Washington State
Wetland Mitigation Evaluation Study

Phase 2: ***Evaluating Success***

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Washington State Wetland Mitigation Evaluation Study
Phase 2: Evaluating Success

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Project Summaries for each of the 24 projects evaluated in this study are available as a separate document entitled:
Washington State Wetland Mitigation Evaluation Study
Phase 2: Evaluating Success
Appendix F
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List of Acronyms and Abbreviations

AO…………………………..Administrative Order

DSL…………………………Division of State Lands

Ecology……………………..Washington State Department of Ecology

EM…………………………..Emergent

FO/SS……………………….Forested and/or scrub-shrub

ft…………………………….feet.

G/O…………………………Goals and/or objectives

GPS…………………………Global Positioning System

HGM………………………..Hydrogeomorphic (see definition p.11)

km…………………………..kilometer

m……………………………meter

NRCS……………………….Natural Resource Conservation Service

NWP………………………...Nationwide Permit

OW/AB……………………...Open water and/or aquatic bed

PS…………………………....Performance Standard

PSWQAT…………………....Puget Sound Water Quality Action Team

USACOE or Corps…………United States Army Corps of Engineers

USEPA or EPA……………...United States Environmental Protection Agency

USFWS……………………...United States Fish and Wildlife Service

WDFW……………………...Washington State Department of Fish and Wildlife

WQC………………………..Water Quality Certification

WSDOT…………………….Washington State Department of Transportation

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Executive Summary

The Washington State Wetland Mitigation Evaluation Study was developed in two phases to evaluate the success of projects intended to compensate (mitigate) for wetlands lost to development activities in the state of Washington. Phase 1 of the study, conducted in the fall of 1999, examined the compliance of 45 randomly selected projects with their permit requirements. Phase 2 examined the ecological success of a subset of the projects from Phase 1. The study did not include any Washington State Department of Transportation mitigation projects.

Over all, 24 compensatory wetland-mitigation projects (at 31 sites) were evaluated in Phase 2. Eighteen projects were located west of the Cascade Mountains, and six projects were located east of the Cascade crest.

The goal of Phase 2 of the Wetland Mitigation Evaluation Study was to determine the success of wetland mitigation projects from an ecological perspective. The overall success of mitigation projects in Phase 2 was evaluated based on two factors, each with its own criteria.

- **Achievement of ecologically relevant measures:**
  - Establishing the required acreage of mitigation.
  - Attaining ecologically significant performance standards.
  - Fulfilling appropriate goals and/or objectives.
- **Adequate compensation for the loss of wetlands:**
  - Contribution of the mitigation activity to the potential performance of functions.
  - Comparison of the type and scale of functions provided by the mitigation project with the type and scale of lost wetland functions.

In addition to evaluating the success of mitigation projects, the Phase 2 study also examined:

- Wetland resource trade-offs (e.g., in-kind/out-of-kind, on-site/off-site, etc.).
- Ecological condition (e.g. surrounding land uses, buffer condition, extent of invasive species, etc.).
- Factors that were associated with project success (or lack of success).

Three projects (13%) were found to be fully successful; eight projects (33%) were moderately successful; eight (33%) were minimally successful; and five (21%) were not successful.

The results of the Phase 2 study indicate that "created wetlands" are more successful than previous studies have shown, since 60 percent of them were at least moderately successful, and only one project (10%) was not successful. However, only 65 percent of the total acreage of wetlands lost was replaced by creating or restoring new wetland area, thereby resulting in a net loss of 24.18 acres of wetland area.

No enhancement projects were fully successful, while eight out of nine (89%) enhanced wetlands were minimally or not successful. Nearly two-thirds of the total acreage of mitigation that was established resulted from enhancement activities.

In addition, mitigation projects designed and implemented by public entities[1] fared worse than projects done by private entities: 71 percent of private mitigation projects were judged to be fully or moderately successful, while 35 percent of public mitigation projects were judged to be fully or moderately successful.

Seventy-nine percent of mitigation projects were at least somewhat achieving their ecologically relevant measures, while 63 percent of projects at least partially compensated for the permitted wetland losses. This implies that, although projects may be doing a better job of achieving ecologically relevant permit requirements, these requirements are not always sufficient indicators of whether mitigation projects adequately compensate for the permitted loss of wetlands.

Phase 2 findings suggest that follow-up by regulatory agencies results in more-successful mitigation projects. Responses to a consultant questionnaire indicated that 75 percent of the fully and moderately successful projects experienced some degree of agency follow-up, while only 27 percent of the minimally and not-successful projects had some follow-up.

It was interesting to note that being out of compliance with permits did not necessarily mean a mitigation project ultimately would be unsuccessful. In fact, 66 percent of the projects that ultimately were fully successful were not in compliance in Phase 1. However, all of the projects that ultimately did not succeed also were not in compliance with their permits. The primary key to success appears to be follow-up, monitoring, and maintenance to make sure the mitigation actions have a chance to work.

Based on these results, the authors recommend that the Department of Ecology improve the follow-up on wetland mitigation projects by developing and implementing a compliance tracking system. Additionally, Ecology should work collaboratively with other regulatory agencies, applicants, and their consultants to come up with new guidance to improve mitigation at every step in the process, from choosing an appropriate site to monitoring and performing site maintenance. By working together, those involved in wetland mitigation can develop solutions and approaches that improve wetland mitigation, and thereby help to protect the state's valuable wetland resources.

[1] Washington State Department of Transportation (WSDOT) projects were not included in this study.

1 Introduction

Wetlands are transitional ecosystems between upland and deep-water areas. Historically, wetlands were viewed as useless wastelands that needed to be "reclaimed" through draining and filling in order to farm or build upon them and, thus, make them useful. However, isolated depressions, estuarine marshes, riparian backwaters, and hillside seeps are all examples of wetland types that can perform functions that benefit society, such as:

- Filtering sediments, nutrients, metals, and toxicants from water;
- Reducing flood and erosion damage by detaining water during high flows;
- Augmenting stream base flows by slowly releasing detained water throughout the season; and
- Providing wildlife habitat for game species as well as an array of diverse and potentially rare animals and plants.

Many of these functions have begun to be understood and appreciated by society at large only within the past 30 years. Scientific studies in the 1960s and 1970s demonstrated the many valuable functions that wetlands provide, and, as a result, they became the subject of increased governmental protection.

Today, federal law protects many wetlands to some degree, while state laws and local regulations may provide additional protection to fill in the gaps. Each of the laws emphasizes protecting and maintaining the valuable ecological and social functions that wetlands perform. In the face of development and growth, federal and state permitting processes use mitigation "sequencing" as the primary mechanism to ensure that wetland functions are protected or replaced.

1.1 Wetland Regulations

The Department of Ecology defines wetland mitigation as a sequential process used to address proposals to fill wetlands in order to ensure that the total adverse impact of a project is reduced to an acceptable level (McMillan, 1998). When wetland losses are permitted, the creation or restoration of new wetland area, or the enhancement of pre-existing wetlands (see step 5 below) is generally required. Ecology's mitigation process is applied in the following sequential order:

1. <u>Avoiding</u> the impact by changing the location or the design of the project to eliminate wetland losses.
2. <u>Minimizing</u> the impact by changing the design of a project to reduce the extent of the wetland loss.
3. <u>Rectifying</u> the impact by restoring the impacted area after the development has taken place.
4. <u>Reducing</u> the impact to the wetland over time (e.g., by using buffer areas and storm water treatment facilities).

5. Compensating for the impact by replacing the lost area and/or functions through wetland creation, restoration, enhancement, and/or preservation.
6. Monitoring the impact over time and taking corrective measures to minimize additional impacts.

On the federal level, discharges into jurisdictional wetlands and the associated wetland losses are regulated by the US Army Corps of Engineers (Corps) through Section 404 of the Federal Water Pollution Control Act (Clean Water Act)(33 USC 1251 et seq.). The Corps authorizes wetland fill by issuing a permit. In the state of Washington, the Department of Ecology (Ecology) regulates projects that affect wetlands under the state's Water Pollution Control Act, Chapter 90.48 RCW. Typically, this is done through issuing a Water Quality Certification (WQC) under Section 401 of the federal Clean Water Act. This certification verifies that the wetland impact will meet state water-quality standards and provisions of all state aquatic-protection laws. In the case of impacts to "isolated" wetlands, Ecology regulates through the issuance of an Administrative Order (AO) under the state Water Pollution Control Act Chapter 90.48 RCW. The Corps permit and Ecology's WQC and/or AO that authorize wetland impacts frequently require implementing compensatory wetland mitigation (hereafter called mitigation).

A Primer on Wetland Mitigation

The process of determining appropriate mitigation actions is usually one that involves a fair amount of negotiation between the project proponent and regulatory agencies. Many factors must be considered in developing an appropriate mitigation approach for a particular project. In most cases, an applicant will hire a professional wetland consultant to work directly with the regulatory agencies in developing a mitigation plan.

The first step in implementing wetland mitigation is to attempt to avoid wetland impacts to the extent practicable. Projects requiring an Individual Permit from the Corps of Engineers must go through an extensive process of demonstrating that wetland impacts cannot be avoided. For most other projects the process involves demonstrating that the project footprint has been designed to avoid most wetland impacts and that the proposed impacts can be adequately replaced with created, restored and/or enhanced wetlands. Agencies typically stress the avoidance of impacts to higher quality wetlands more than impacts to lower quality wetlands.

A similar process is followed to minimize and rectify impacts to the extent possible. Revisions to the project site design can result in further reduction of wetland impacts as can changes in the timing or methods of project construction.

Once it has been determined that wetland impacts have been reduced to the maximum extent feasible, the next step is to determine how best to compensate for the remaining impacts. Typically, agencies require mitigation proposals that create or restore wetlands of an equal or greater acreage than the wetlands lost to the development. The type and amount of mitigation required depends on several factors, including: 1) what type(s) of wetlands are lost; 2) what type(s) of mitigation actions are proposed (creation, restoration, enhancement, etc.) 3) how likely the mitigation plan is to succeed; and 4) how long it will take for the mitigation actions to establish wetland area and functions. In many cases, the enhancement of existing degraded wetlands is allowed to compensate for the loss of wetlands. Although this results in a net loss of wetland area, it has been assumed that the gain in function from the enhancement actions offsets the loss of functions from the filled wetland. In rare instances, the preservation of existing wetlands is permitted as compensation for the loss of wetland area. Most wetland mitigation projects include some combination of creation, restoration, enhancement and preservation.

Once the basic mitigation approach is agreed upon, the next step is to develop a detailed mitigation plan that specifies what will be done and how it will be judged to determine if it is successful. This involves the development of goals and objectives to specify the purpose of the project, performance standards and monitoring provisions to determine if the project is successful, and contingency measures to address potential problems that might arise as the mitigation site evolves. Typically, a mitigation site is monitored for five to ten years to ensure the site is meeting performance standards and to make certain that it has developed to the point where it can continue to evolve without direct human intervention.

Once a detailed compensatory mitigation plan is approved, it becomes a part of the development permit. Typically, an applicant is required to submit an "as-built" report when construction of the mitigation site is completed and a monitoring report every year or two until the site has met its performance standards. It is incumbent upon the regulatory agencies to ensure that monitoring reports are received and that the site is meeting its performance standards. At the end of the monitoring period the regulatory agencies should either verify that the site has met all permit requirements or require contingency measures to correct any problems that occur.

A multi-agency guidance document on mitigation plans was produced in 1994 that outlines the type of information that should be included in a mitigation plan (Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals, Ecology Publication #94-29).

1.2 Background

Recent studies of the effectiveness of wetland regulatory programs (Gwin and Kentula, 1990; Castelle et al., 1992; Storm and Stellini, 1994; Allen and Feddema, 1996; Mockler et al., 1998; and National Research Council, 2001) have raised questions regarding the success of mitigation projects. These studies have indicated that a net loss of wetland area and functions frequently occurs despite requirements for mitigation. A local study, conducted in 1998, evaluated mitigation projects in King County (Mockler et al., 1998). This study found that the majority of projects were not meeting their performance standards and were, in fact, resulting in a net loss of wetland functions in King County.

In light of the King County study, Ecology initiated a two-phased study to determine the effectiveness of mitigation statewide. This report summarizes the results of the second phase that study. A report entitled Washington State Wetland Mitigation Evaluation Study Phase 1: Compliance (Johnson et al., 2000) details the first phase of the study, and is summarized below.

1.2.1 Phase 1

The goal of Phase 1 of the Wetland Mitigation Evaluation Study was to determine the level of compliance with permit requirements for mitigation projects statewide. This was accomplished by examining a representative sample of wetland mitigation projects permitted by the Corps and/or Ecology in Washington.

The site-selection procedure for Phase 1 of the Wetland Mitigation Evaluation Study involved identifying a sub-population of wetland mitigation projects that met selection criteria. Projects permitted by the Corps (through Section 404) and Ecology (through Section 401) were compiled into a database of all projects. Preliminary selection criteria were applied to eliminate those projects that had no wetland impacts or required no wetland mitigation. Projects were selected based on permit application date (1992-97). See Table 1 for a brief summary of the initial selection criteria.

Table 1.1 Summary of Criteria Used to Eliminate Projects for Phase 1

Database field criteria	**Reason for eliminating**
1) a. Permit application date	"Prior to 1992"
b. Permit application date	"Post 1997"
2) Ecology Decision	"Denied," "Expired," or "Withdrawn"
3) Applicant *	"WSDOT" [2]
4) a. Permit Type	"NWP* 03" (maintenance)
b. Permit Type	"NWP 13" (bank stabilization)
c. Permit Type	"NWP 19" (minor dredging)
5) a. Wetland impact	"Wetland impact 0"
b. Wetland impact	"No wetland impact indicated"
c. Mitigation	"Mitigation not required"
Other criteria	
6) Tidal Wetlands	Lacked methodology to effectively evaluate
7) 401 Thresholds on NWP 26**	a. Wetland impact <1 acre prior to 2/1996 b. Wetland impact <0.33 acre after 2/1996

*NWP = Nationwide Permit

**Wetland impacts below thresholds generally did not require mitigation.

[2] The Washington State Department of Transportation (WSDOT) has developed and implemented its own monitoring program to study its overall mitigation success and compliance. WSDOT submits annual monitoring reports to the permitting agencies documenting conditions at its mitigation sites; therefore, WSDOT projects were not included in this study. The Wetland Mitigation Evaluation Study focused on how mitigation projects by other public and private entities were doing.

The projects that met the preliminary criteria were stratified into projects west of the crest of the Cascade Mountains (831) and projects east of the Cascade crest (53). All 53 of the eastern projects were reviewed, and only seven projects had completed the authorized impact and were required to perform wetland mitigation. All seven projects were considered in the Phase 1 study.

The 831 projects in Western Washington that met the initial selection criteria were randomly sorted and numbered. Additional selection criteria were then applied to focus on projects that required freshwater wetland mitigation. See Table 1.1.

The first 400 entries were reviewed, and 54 projects were found to have required freshwater wetland mitigation. Of those 54, 38 were considered in the Phase 1 study. Of the 16 projects that were not selected: two projects had not completed the permitted wetland fill; eight projects were still under construction; five projects did not provide access to the site in time for a field visit; and one project was tidally influenced.

Assuming that the first 400 entries of the randomly numbered Western Washington sites in the database were similar to the next 431 entries, it was estimated that approximately 112 projects that met the initial selection criteria would have required freshwater wetland mitigation west of the Cascades. This would mean that the 38 projects from Western Washington that were considered in the Phase 1 study represented 34 percent of the sub-population of wetland mitigation projects that met all site-selection criteria.

Mitigation projects were evaluated to determine:

1. Were they being implemented?
2. Were they implemented to plan?
3. Were they meeting the required performance standards?

The Phase 1 study found that 29 percent of the 45 projects evaluated were in full compliance with the three questions listed above:

1. 93 percent were implemented,
2. 55 percent were implemented to plan, and
3. 35 percent were meeting the assessed performance standards.

1.2.2 Phase 2

1.2.2.1 Goals and Objectives

The goal of Phase 2 of the Wetland Mitigation Evaluation Study was to determine how successful wetland mitigation projects were ecologically. However, the concept of "ecological success" proved to be difficult to define and measure. It was concluded that no single measure of "ecological success" was feasible, and therefore, overall success in Phase 2 was broken out into two factors, each with its own criteria.

1. How well did mitigation projects achieve their ecologically relevant measures?
   a) Have mitigation efforts established the required acreage of mitigation?

   b) How well did projects attain their ecologically significant performance standards?
   c) How well did projects fulfill their goals/objectives?

2. How effective were mitigation projects at compensating for their authorized wetland impacts?
   a) How much of a contribution to wetland functions did the mitigation project provide?
   b) Did the mitigation project provide the same functions as those lost or did it exchange functions?

Based on the results obtained for the questions above, the authors were able to evaluate:

3. Overall, how successful were the wetland mitigation projects?

The Phase 2 study examined what kinds of trade-off's were occurring in wetland resource types and locations. For example:

- Was the mitigation in-kind?
  - Is the state of Washington losing certain Cowardin classes and mitigating for them with other Cowardin classes (Cowardin et al., 1979)?
  - Is the state losing certain hydrogeomorphic (HGM) subclasses and mitigating for them with other HGM classes (see definition on p. 11)
- Was the mitigation on-site?

The Phase 2 study also answered questions relating to the ecological condition of mitigation projects, such as:

- What land uses were within one kilometer of mitigation projects?
- What kind of buffers did mitigation projects have?
- What kind of corridors/connectivity did mitigation projects have?
- What water regimes were present on mitigation sites?
- What was the extent of invasive, non-native plant species on mitigation sites?

The answers to the preceding bulleted questions did not affect the overall success of a mitigation project. Rather, they were included to stimulate discussion and provide more information on what conditions were generally found on mitigation sites.

Finally, this study asked:

- What are the main factors that contributed to the success (or lack of success) of mitigation projects?

1.2.2.2 Limitations of this Study

The Wetland Mitigation Evaluation Study was designed as a way to check the status of mitigation in the state of Washington by looking at a sample of mitigation projects. It was not intended to specifically identify failed projects. Rather, the Phase 2 study provided an opportunity to review past regulatory decisions and understand the rationale behind them.

Furthermore, the results of this study are a snapshot in time. The 24 projects were each evaluated based on a one to two-day site visit, and the conditions observed at the time of the site visit are reflected in the evaluation of a project's success. It is acknowledged that all of the projects are still developing and site conditions will change for the better or worse. The results of this study, therefore, represent a moment in the life of the projects evaluated.

2 Methods

2.1 Technical Assistance Groups

2.1.1 Advisory Committee

The Phase 2 Advisory Committee was a group of wetland professionals and regulators that were assembled from private business, federal, and state agencies to provide guidance on the goals and methods for the Phase 2 study. Some advisory committee members also accompanied the site assessment team and participated in the site assessment on some sites. In addition, committee members reviewed and provided comments on this report. For a list of advisory committee members refer to Appendix E.

2.1.2 Site Assessment Teams

The site assessment teams collected field data for the mitigation projects evaluated in Phase 2. An assessment team was composed of up to six members with backgrounds in wetland science, soil science, plant identification, data collection, mitigation design and construction, and wetland policy and regulation. For the majority of sites, the assessment team was composed of at least three people.

Each assessment team was responsible for collecting data to:

- Determine wetland area,
- Complete a function assessment data form,
- Categorize the wetland,
- Determine if performance standards were attained, and
- Make general site observations.

For a list of assessment team members, refer to Appendix E.

2.1.3 Site Evaluation Teams

The site evaluation teams evaluated the achievement of ecologically relevant measures, compensation for impacts, and the level of overall success for each project based on background information and the data collected by the assessment teams.

An evaluation team included all members of the assessment team for that particular site, as well as Ecology's senior wetland ecologist, senior wetland policy analyst, and wetland mitigation banking specialist. A minimum of five people evaluated each site, and at least four of those people were common to the majority of evaluation teams for consistency. For a list of evaluation team members refer to Appendix E.

2.2 Office Preparation

2.2.1 Site Selection

The projects selected for the Phase 2 study were a sub-set of the 45 projects evaluated in Phase 1 (section 1.2.1, p.2). The following selection criteria were applied to eliminate projects that would be unproductive to evaluate for Phase 2:

1. Post-implementation Age of Project.
   Projects that were less than two years post-implementation were eliminated. The Phase 2 study focused on determining how successful wetland mitigation projects are at performing certain functions, and how well the wetland losses were being compensated for. Mitigation projects that were less than two years old were judged to be too immature to evaluate their ecological success or contribution to functions. Wetland mitigation projects from Phase 1 that were not implemented also were eliminated.

2. Preservation Projects
   Projects that consisted solely of preserving existing wetlands were excluded. This study focused on determining how well creation, restoration, and enhancement mitigation activities replaced lost wetland functions. Two projects evaluated in Phase 2 (#9 & #294) had a preservation component, but the preservation areas were not assessed in this study. However, the preservation areas were considered when evaluating compensation for impacts and overall project success.

3. Buffer Enhancement Projects
   One of the projects examined in Phase 1 consisted solely of wetland buffer enhancement. This project was eliminated from consideration for Phase 2 because buffers were assessed only as a component of a wetland's ability to perform certain functions.

4. Projects Impossible to Assess
   One of the projects evaluated in Phase 1 consisted of excavating additional acreage adjacent to an existing cattail marsh. The created mitigation area was indistinguishable from the surrounding existing wetland. As a result, it was determined that it would be impossible to assess this site.

Twenty-four projects were evaluated for the Phase 2 study. Eighteen were located west of the crest of the Cascade Mountains, and six were located east of the Cascade crest. The six projects from the east side represent 86 percent of the sub-population of eastern projects that required wetland mitigation and met the initial selection criteria. The 18 projects from Western Washington are estimated to represent 16 percent of the sub-population of freshwater west side projects that required wetland mitigation and met the initial selection criteria from Table 1.1. Refer to Figure 3.2 on p.24 for approximate locations of the projects evaluated in Phase 2.

*NOTE: The Phase 2 study did not include any WSDOT projects (see footnote 2, p.3).

2.2.2 Obtaining Site Access

Since all mitigation projects selected for evaluation in Phase 2 were also part of the Phase 1 study, the site assessment team was granted access by the property owner or manager to all sites without difficulty.

Permission to visit all sites was granted based on the fact that the Phase 2 study, like the Phase 1 study, is academic in nature. Applicants and property owners were informed that no enforcement actions would be triggered as a result of this study's evaluation of their projects. The results of the Phase 2 study are, therefore, reported anonymously. An individual project is identified by a randomly selected number and by the county in which the project is located.

2.2.3 Background Information

Since a primary focus of the Phase 2 study was determining how well the mitigation project compensated for the impacts to wetlands, the following information was necessary:

- Delineation reports and any other information concerning the impacts to wetlands,
- The Corps permit and Section 401 WQC,
- Final wetland mitigation plans and project maps,
- Public notices and applicable agency and public comments,
- As-built reports and/or drawings,
- Monitoring reports and site photos,
- Decision documents or notes to the file,
- Correspondences and memorandums,
- NRCS soil surveys,
- Aerial photographs,
- National Wetland Inventory maps from USFWS,
- Topographic maps, and
- Priority habitats and species information from WDFW.

Information was obtained from the Corps, applicants, consultants, and/or Ecology. Aerial photos were obtained from either the Department of Natural Resources or WSDOT.

2.3 Site Assessment

The Phase 2 site assessment team conducted field visits for 24 wetland mitigation projects (at 31 sites) from May through August 2000. Six of the projects were located east of the Cascade crest while 18 were located west of the Cascade crest. See Figure 3.2 on p. 24 for the approximate locations of the projects evaluated in this study.

2.3.1 Mitigation Activity

There are three main mitigation activities currently in common use: restoration, creation, and enhancement. For the purposes of the Phase 2 study, definitions for each type of mitigation activity were taken from the DRAFT Mitigation Banking Rule (WAC 173-700-100):

- "Creation" means the establishment of wetland area, functions, and values in an area where none previously existed.
- "Restoration" means actions taken to intentionally re-establish wetland area, functions, and values at a site where wetlands previously existed, but are no longer present because of the lack of water or hydric soils. Restoration can also include the re-establishment of historic wetland HGM classes (see definition on p. 11) on sites that have been altered due to human activities to a different HGM class, and which are significantly degraded with low levels of functions and values.
- "Enhancement" means actions taken within an existing degraded wetland or other aquatic resource to increase or augment one or more functions or values.

2.3.2 Determination of Wetland Area

The assessment team determined wetland boundaries using the Washington State Wetland Identification and Delineation Manual (Washington State Dept. of Ecology, 1997), which is consistent with the Corps 1987 Wetland Delineation Manual. Since site visits were conducted between May and August 2000, the assessment team focused on hydrologic indicators (e.g., water marks, drainage patterns, sediment deposits, etc.) to determine the presence of wetland hydrology. In the absence of hydrologic indicators, vegetation and soil parameters were relied upon more heavily than the hydrology parameter. Thus, the absence of hydrologic indicators did not necessarily result in a determination that the area was non-wetland. Similarly, hydric soil indicators were not relied upon for created wetlands, which may not have had sufficient time to develop such indicators. In general, the assessment team gave the project proponents the benefit of the doubt when determining wetland boundaries.

Once determined, positions along the wetland boundary were collected using a Trimble ProXR Global Positioning System (GPS). Trimble reports that the ProXR equipment has

0.5 meter accuracy (Trimble, 1998). GPS data was downloaded into Pathfinder Office 2.51 and differentially corrected using the nearest base station with accessible data[3]. Pathfinder Office 2.51 automatically calculated the area of the wetlands from the position data collected.

Wetland determinations focused on the area of mitigation activity. If the compensatory wetland mitigation project site encompassed a large area, but it appeared that mitigation activities were conducted only on a portion of this area, then only the "active" mitigation area was considered in the wetland determination and subsequent site assessments.

For example:
A project proposed to:
1. Remove fill to restore 2 acres of wetland; and
2. Plant trees and shrubs to enhance 5 acres of existing degraded wetland.

The assessment team observed that the proposed activities to enhance the 5 acres had not been conducted or had failed. The wetland determination, therefore, focused on the 2 acres of restoration that had been implemented.

A 10 percent margin of error was used to provide applicants with the benefit of any doubt. This accommodated potential error from the GPS, as well as error associated with determining the limits of the required mitigation area (within unmarked property boundaries). The margin of error was applied to each site to determine if an individual site met its acreage requirement. However, total reported wetland area established does not reflect this margin of error, because calculated areas of established acreage are just as likely to be 10 percent larger than the actual acreage as 10 percent smaller than the actual acreage.

For example:
A site with a calculated wetland area of 1.82 acres would be given a 10 percent margin of error,

$$1.82 + 0.182 = 2.02$$

thereby resulting in a maximum established wetland acreage of 2 acres.

If the wetland acreage requirement for this site were 2 acres, then this study would have determined that the site "met its wetland acreage requirement," but the reported wetland area established for the site would be 1.82 acres.

[3] In some cases data from the closest base station could not be downloaded properly.

2.3.3 Attaining Performance Standards

Performance standards for the projects evaluated in the Phase 2 study were defined as:

- The performance standards identified in a project's wetland mitigation plan,
- Any Corps permit requirements and/or WQC conditions, and
- Performance standards identified in the monitoring section of a mitigation plan.

Attainment of performance standards was assessed based on field conditions observed during the site visit. If a monitoring report was available, then on-the-ground conditions were compared to the results of the most recent monitoring event.

Some performance standards could not be assessed, such as:

- Year-based standards that were outside the timeframe of the site visit, and
- Some water-regime performance standards that required evidence of inundation or saturation during the early part of the growing season, since site visits were conducted primarily in June through August.

For a list of the performance standards that could not be assessed refer to Appendix B

2.3.4 Wetland Categorization

A wetland category was determined for each site by applying the Washington State Wetlands Rating System for either Eastern Washington or Western Washington (Washington State Dept. of Ecology, 1991 and 1993).

2.3.5 Function Assessment

During the field visit at each site, the assessment team collected data on wetland functions using Methods for Assessing Wetland Functions (Hruby et al., 1999 and 2000). First, the HGM subclass was determined for each wetland. Then, the most appropriate data collection form was used (riverine flow-through, riverine impounding, depressional closed, or depressional outflow for lowland Western Washington wetlands; and depressional long duration or depressional short duration for wetlands in the Columbia Basin of Eastern Washington). Data were collected only within the mitigation area, even where the mitigation site was a portion of an existing larger wetland.

> **Hydrogeomorphic (HGM)** refers to a categorization of wetlands based upon geomorphic setting, water source and transport, and hydrodynamics. It is designed to group wetlands that function in similar ways. Examples include Riverine, Depressional, Slope, and Lacustrine Fringe.

In some cases Ecology had not developed an appropriate function assessment method for either the exact HGM subclass of the mitigation project or the region of the state where the project was located. In those cases the assessment team chose the most applicable function assessment method and associated data form.

Once the data forms were complete, the information from each site was entered into an Excel spreadsheet specific to each of the above mentioned HGM subclasses and a numeric score for each of the functions assessed was automatically calculated. However, numeric scores were only used to stimulate discussion and begin the evaluation process. The completed data forms, which contained pertinent information about each mitigation area and its structural characteristics, formed the primary basis for site evaluations.

Two other function assessment methods, Wetland and Buffer Functions Semi-Quantitative Assessment Methodology (SAM) (Cooke, 2000) and WSDOT's Wetland Functions Characterization Tool for Linear Projects (Null et al., 2000), were performed on each site for comparison and to provide additional information. Data collected during the field visits was used to complete these two methods in the office.

2.3.6 Consultant/Applicant Questionnaire

For each project, at least one questionnaire was sent to the consultant and/or the applicant. The primary purpose of the questionnaire was to find out what type of activities (e.g., excavation, soil ripping, soil amendments, plantings, hydroseeding, irrigation, weed control, etc.) were performed at each of the mitigation projects. In addition, the questionnaire asked whether monitoring and/or maintenance had occurred, and if any agencies had followed up on the project.

The information was used to help determine what factors contributed to the success or the lack of success of a project.

For the complete Consultant/Applicant Questionnaire refer to Appendix D.

2.4 Site Evaluation

After completing all field work and data forms, each site (some projects had multiple mitigation sites) was evaluated by an evaluation team, and the results were tabulated on a standardized form (the site evaluation form).

Site evaluations began with a visual orientation to the site. This included using topographic maps and aerial photos to illustrate the landscape position of the mitigation site. Then, slides and/or photos taken during field visits for Phase 1 and Phase 2 were shown to illustrate site conditions (extent of shrubs and percent cover, types of plant species present, extent of inundation, water inlet or outlet, etc.).

Following the visual orientation, the evaluation team reviewed background information describing the impact site and the goals, objectives, and construction actions of the mitigation project.

2.4.1 Site Evaluation Form

The site evaluation form summarized background information, data collected on-site, and the judgments of the evaluation team. The form entailed a series of questions meant to determine the following:

- The potential of the site to perform functions (see definition and example below),
- The opportunity of the site to perform functions (see p.14 for definition and example),
- The contribution of the mitigation activities to the potential performance of functions on a site (see p.15 for definition and example),
- The degree to which the project achieved ecologically relevant measures, and
- The degree to which the project compensated for the authorized wetland losses.

Answers to the questions on the evaluation form were obtained either directly from data collected during the site visits or as a result of a consensus judgment by the evaluation team. A model for decision-making (Hruby, 1999), which relied on data and the expert knowledge of the evaluation team, was used to arrive at consensus judgments. For a blank copy of the site evaluation form, see Appendix C.

2.4.2 Potential to Perform Functions and Opportunity

The evaluation team reviewed the numeric scores and data forms obtained from the application of the Methods for Assessing Wetland Functions (Hruby et al., 1999 and 2000) to rate the potential and opportunity to perform functions at each site. Numeric scores from the Methods for Assessing Wetland Functions were not used, because: valid quantitative function models did not exist for the HGM subclasses of some sites, or only the mitigation area of a wetland was assessed when sites were part of a larger wetland system. The data obtained from the Semi-Quantitative Assessment Methodology (SAM) (Cooke, 2000) and the Wetland Functions Characterization Tool for Linear Projects (Null et al., 2000) were also used as supplemental information.

Since numeric scores were not used verbatim, the evaluation team evaluated the potential of each mitigation site to perform certain functions using a consensus of its best professional judgment, which was based on all of the available function assessment data. The potential to perform each function was rated by assigning one of the following qualitative scores:

- High,
- Moderately High,
- Moderate,
- Moderately Low,

- Low,
- Not Applicable (does not perform), or
- Unable to Assess (for functions that the evaluation team did not have enough information about to assign a rating).

Definition:
If a wetland has the **potential** to perform a function, it means that a wetland possesses physical characteristics that indicate the environmental processes necessary to perform a function are present (i.e., the wetland has the capability to perform a function).

For example, the function of removing sediments involves the processes of reducing water velocities and filtering sediments. Determining the actual level of performance of this function is difficult and time consuming to measure (e.g., sediment loads coming into a wetland compared to sediment loads leaving the wetland, or variation in water velocities and rates of filtration). However, determining the **potential to remove sediments** involves readily observable characteristics, such as the presence of a pond and/or a constricted outlet that may indicate that water velocities are being reduced. Likewise, the presence of dense, tall, emergent vegetation is a physical characteristic that indicates water filtration may be occurring.

Some functions also were assigned a qualitative rating representing the site's opportunity to perform that function. Opportunity was rated as:

- High,
- Moderate, or
- Low.

Opportunity refers to whether conditions in the contributing basin (area draining into the wetland) provide the wetland with the possibility to perform a function.

For example, if a wetland has a wide, well-vegetated buffer and the contributing basin is mostly undeveloped (e.g., undisturbed forest), then the wetland would have a **low opportunity** to remove sediments. In that case, there would be a low sediment load coming into the wetland. Regardless of the wetland's physical characteristics, if there are no sediments coming in, then there is no possibility for the wetland to remove sediments.

On the other hand, if the wetland did not have a buffer and the contributing basin was either agricultural or highly urbanized, then the wetland would have a **high opportunity** to remove sediments. In this case, there would be a high sediment load coming into the wetland, and there would be a possibility for the wetland to remove sediments.

Refer to Table 2.1 on the next page for a list of the functions that were assessed.

Table 2.1 List of Functions Evaluated

Functions Assessed[4]
Removing Sediment
Removing Nutrients
Removing Metals and Toxic Organics
Reducing Peak Flows
Decreasing Downstream Erosion
General Habitat Suitability
*Invertebrate Habitat Suitability
*Amphibian Habitat Suitability
Anadromous Fish Habitat Suitability
*Resident Fish Habitat Suitability
*Habitat Suitability for Wetland Associated Birds
*Habitat Suitability for Wetland Associated Mammals
*Native Plant Richness
*Primary Production and Organic Export

* The Methods for Assessing Wetland Functions (Hruby et al., 1999) does not rate the opportunity for these functions; therefore, opportunity for the functions was not rated.

2.4.3 Contribution to Performance of Function

The evaluation team also assigned a qualitative rating to represent how much the mitigation activity contributed to the potential of a site to perform functions. The rating of contribution resulted from a comparison of a site's potential to perform wetland functions prior to any mitigation with the site's current potential to perform functions.

The contribution of a mitigation activity to wetland functions was judged based on one of the following six ratings:

- High,
- Moderate,
- Minimal,
- Not At All,
- Negative, or
- Unable to Assess.

Contribution refers to how much the mitigation activity increased or affected the potential of the site to perform wetland functions.

[4]The function assessment methods for the Columbia Basin assessed slightly different functions. For example, "removing nutrients" was broken into "removing nitrogen" and "removing phosphorus." Despite this minor variation, the above list of functions was used to evaluate all sites for consistency.

For the purposes of this study, upland sites that were used for creation and restoration were assumed to have no wetland functions and were rated as "not applicable" for the "before/after" comparisons. (It is acknowledged, however, that upland areas do have the potential to perform some functions that are the same or similar to the wetland functions, but it was not possible to rate these.) For enhancement projects, the potential level of function prior to mitigation activities was determined by the evaluation team, based on available background information. Such information included:

- Descriptions of the enhancement site prior to mitigation,
- Any information on pre-mitigation potential level of functions (generally based on the Wetland Evaluation Technique - WET),
- Conversations with the project consultant, and
- Descriptions of the activities that were to be used to "enhance" the site.

The contribution of a mitigation activity to wetland functions was rated by scoring the increase, or decrease, in the ratings for each individual function. The rating for contribution was based on the increase or decrease in the number of rating levels. If the potential performance went up one level the contribution was rated as "minimal;" if the rating went up two levels, the contribution was rated as "moderate;" and if the rating of function went up three or more levels, the contribution was rated as "high." Some examples are given in Table 2.2 below.

Table 2.2. Understanding Contribution.

FUNCTION **Removing Sediment**	**Potential to perform (before)**	**Potential to perform (current)**	**Contribution**
Example 1 – Enhancement	Moderately low	Moderate (rating of function increased 1 level)	**Minimal**
Example 2 – Creation	Not applicable (Does not perform)	Moderate (rating of function increased 3 levels)	**High**
Example 3 – Enhancement	Moderately high	Moderately high (no change in rating of function)	**Not at all**
Example 4 – Creation	Not applicable (Does not perform)	Moderately low (rating of function increased 2 levels)	**Moderate**

- Example 1 is an enhancement site that performed sediment removal at a moderately low level before mitigation. It was judged to have the potential to perform sediment removal at a moderate level after enhancement activities were implemented. This is judged to be a "minimal" contribution (a one-level increase).
- Example 2 is a creation site that previously did not perform sediment removal. It was judged to have the potential to perform sediment removal at a moderate level after creation activities were implemented. This is judged to be a high contribution (a three-level increase).
- Example 3 is an enhancement site that performed sediment removal at a moderately high level before mitigation and after enhancement activities were implemented.

Mitigation activities, therefore, provided no contribution (not at all) to the performance of functions (no increase).

- Example 4 is a creation site that did not perform sediment removal prior to mitigation. It was judged to have the potential to perform sediment removal at a moderately low level after creation activities were implemented. This is judged to be a moderate contribution (a two-level increase).

The rating of opportunity (see definition on p.14) was used to modify the initial rating of contribution (see explanation on p.16) to derive an overall rating for the contribution a mitigation project provided to the performance of wetland functions. If the wetland had a "high" opportunity to perform a wetland function, the initial rating was increased by one level. If the wetland had a "low" opportunity the initial rating was decreased by one level. A moderate opportunity did not change the rating of contribution. The opportunity rating did not change the rating of contribution if it originally was "negative" or "not at all." Some examples are given in Table 2.3 below.

Table 2.3. Understanding How Opportunity Affects Contribution.

FUNCTION Removing Sediment	**Potential to perform (before)**	**Potential to perform (current)**	**Contribution to potential**	**Opportunity to perform (current)**	**Overall Rating of Contribution**
Example 1 - Enhancement	Moderately low	Moderate	Minimal	*High* →	**Moderate**
Example 2 - Creation	Not applicable	Moderate	High	*Low* →	**Moderate**
Example 3 - Enhancement	Moderately high	Moderately high	Not at all	*High* →	**Not at all**
Example 4 - Creation	Not applicable	Moderately low	Moderate	*Moderate* →	**Moderate**
Example 5 - Enhancement	Low	Moderately low	Minimal	*Low* →	**Not at all**

- Example 1 is an enhancement site which provided a minimal contribution to the potential for sediment removal. It was judged to have a high opportunity to remove sediment, and therefore, its overall contribution to sediment removal has been boosted to moderate.
- Example 2 is a creation site that provided a high contribution to the potential for sediment removal. It was judged to have a low opportunity to remove sediment, and therefore, its overall contribution decreased to moderate.
- Example 3 is an enhancement site that did not provide a contribution to the potential for sediment removal. It was judged to have a high opportunity to remove sediment, but the enhancement activities have not provided a contribution to sediment removal, and therefore, its overall contribution remains not at all.
- Example 4 is a creation site that provided a moderate contribution to the potential for sediment removal. It was judged to have a moderate opportunity to remove sediment, and therefore, its overall contribution remains moderate.

- Example 5 is an enhancement site that performed sediment removal at a low level prior to mitigation. After enhancement activities were implemented it was judged to perform sediment removal at a moderately low level. This would be a minimal contribution (a one-level increase). The site was judged to have a low opportunity to remove sediment, and therefore, its overall contribution decreased to not at all.

For a few sites in which the enhancement activities failed, contribution was the only rating given. It did not matter how well the wetland had the potential to perform a function if it had the same potential before the mitigation activity was implemented.

2.4.4 Evaluation Questions

The site evaluation form included a series of questions that examined the achievement of ecologically relevant measures, compensation for wetland losses, and ecological appropriateness. The evaluation team answered the questions based on available data and a consensus of their best professional judgment. See Appendix C for a copy of the Site Evaluation Form.

Performance Standards (PS)

The evaluation team determined to what extent performance standards were attained for all performance standards assessed. However, only the attainment of significant performance standards (e.g., standards that best reflected how the site was progressing ecologically) was considered an ecologically relevant measure. Determining whether a performance standard was significant was based on:

- Clarity and specificity: was the performance standard measurable and meaningful or was it confusing or vague.
- Feasibility: was the PS so specific and/or rigorous that it could never be met, thereby setting sites up for failure (e.g., requiring 100% areal cover of wetland vegetation at a site with large areas of permanent or extended inundation).
- Whether the PS related to attaining wetland functions - not signage or fencing.

The following is an example of a performance standard that was judged to be not significant, because it was not measurable or specific:

> "After 3 years, wildlife habitat support will be measured by documentation of the areal cover of woody vegetation. This measurement will be used as an indicator of an increase in habitat structure and complexity. The initial establishment and survival of either planted or colonizing tree and shrub species should begin to determine the future habitat structure of the wetland and decisions on possible restructuring of the installed plant community, if needed."

This performance standard was not significant, because it provided no benchmark for what percentage of area would have to be covered by woody vegetation thus, it was not measurable. In addition the standard does not specify native, wetland, or woody vegetation. This standard could be met by simply documenting that the site has some areal coverage by any shrub, such as *Cytisus scoparius* (Scot's broom), an invasive upland shrub.

The following is an example of a performance standard that was judged to be significant:

> "The emergent vegetation will cover at least 0.65 acre of the mitigation area, and native emergent species will have at least 80% areal cover in this area"

This performance standard provides a significant measure of how the site is developing. The standard sets measurable benchmarks for native vegetation in a specific Cowardin class.

For a list of significant, non-significant, and other PS encountered refer to Appendix B.

<u>Goals and Objectives</u>
The evaluation team likewise assessed whether goals and objectives were fulfilled and whether the goals and objectives were appropriate to the project. For example, an enhancement project had an objective to provide aquatic diversity/abundance, but the mitigation plan did not include any aquatic areas and no open water or aquatic bed areas were found on the site. This objective was judged to be inappropriate for this project. However, this same project had another objective to provide sediment/toxicant retention. This objective was judged to be appropriate.

<u>Compensating for the Impact</u>
When assessing how well the project compensated for the impacts to wetlands, the evaluation team considered the rating of potential to perform functions and how much the mitigation actions contributed to those functions. First, the evaluation team determined what functions were likely to have been lost, based on wetland impact assessments, delineation reports, and/or permit records. Then, the evaluation team determined whether the same functions were provided by the mitigation. For example, if a wetland impact resulted primarily in a loss of water quality functions, and the mitigation provided a moderately high level of water quality functions, then the mitigation project provided the same functions that were lost.

<u>Exchanged/Additional Functions</u>
The evaluation team also determined whether the mitigation project provided additional functions or new functions in exchange for the functions lost. If an exchange of functions occurred, the evaluation team determined whether the exchange constituted appropriate compensation for the impacts to wetlands. Criteria used to judge an appropriate exchange of functions included:

- Whether the mitigation project provided a high contribution to the exchanged functions;
- Whether the exchanged functions were limiting in the basin[5]; and

[5] Area that drains into a particular river, stream, or creek.

- Whether the exchanged functions were provided over a sufficient enough area to compensate for the impact (see footnote 10 on p.39).

For example, one mitigation project provided water quantity functions (reduced peak flows and downstream erosion) in a basin that had flooding problems, but wildlife habitat, not water quantity functions, were the primary functions lost as a result of the wetland impact. This was an exchange of functions, and it was judged to be appropriate, since the mitigation provided a high contribution to functions that were limiting in that basin. However, the evaluation team judged another project exchanging wildlife habitat functions for lost water quality functions to be inappropriate because the mitigation activities provided a minimal contribution to the wildlife habitat functions, and these functions were not provided over a sufficient enough area to compensate for the impact.

Ecological Appropriateness

The site evaluation form also included questions pertaining to the ecological appropriateness of a mitigation project. The questions focused on assessing the appropriateness of the mitigation plan, as well as whether the mitigation project fulfilled the potential of the site. However, the questions proved to be highly subjective, making it difficult to maintain consistency from one project to the next. Therefore, the answers to the questions were not evaluated and did not affect the evaluation of a project's success.

NOTE: Results/Discussion section contains further explanations of the methods used in this study.

3 Results/Discussion

The Wetland Mitigation Evaluation Study was developed as a two-phase study to evaluate the success of wetland mitigation in the state of Washington. Phase 1 of this study, conducted in the fall of 1999, examined compliance with permit requirements, which was essentially an objective evaluation (Johnson et al., 2000). Phase 2 of the study set out to evaluate ecological success. However, defining and measuring ecological success proved to be more difficult, and the evaluation process was more subjective.

To address this subjectivity, the evaluation team employed an approach for decision-making that combined the data collected during field visits with the expert knowledge of the evaluation team. Using this approach, the evaluation team obtained consensus judgments on all factors being evaluated. The consensus judgments were documented and quantified, thereby forming the basis for the following results[6]. The authors of this report have confidence in the results obtained using the approach for decision-making as it "has a history of successful application in complex situations that require the combination of judgment, expertise from many disciplines, and both qualitative and quantitative data" (Hruby, 1999). Refer to the project summaries in Appendix F for documentation of the evaluation decisions and rationale.

Discussions about how success should be determined for the projects in the Phase 2 study led to an eventual agreement that no single measure of "ecological success" was feasible. Instead, following a preliminary analysis of the data collected, **overall mitigation project success** was broken out into the following two categories, each with its own criteria.

- **Achievement of ecologically relevant measures**
  - Establishing required acreage of mitigation,
  - Attaining significant performance standards,
  - Fulfilling appropriate goals and/or objectives.
- **Adequate compensation for the impacts to wetlands**
  - Contribution of the mitigation activity to the potential performance of functions,
  - Providing the same functions or exchanging the functions lost,
  - Type and scale of impacts.

In addition, the Phase 2 study also evaluated:

- **Wetland resource trade-offs;**
  - In-kind;
  - Wetland category; and
  - On-site vs. off-site.
- **Ecological condition**
  - Land uses around the mitigation site,

[6] Results for the acreage analysis were based on GPS data collected in the field and did not utilize a decision-making approach.

  - Quality of buffers and corridors,
  - Types of water regimes, and
  - Dominance by non-native plant species.
- **Factors that correlate with success**
  - Role of follow-up by regulatory agencies, and
  - Comparison of Phase 1 compliance with Phase 2 success.

Twenty-four compensatory wetland mitigation projects (at 31 sites) were evaluated in the Phase 2 study. All were selected from the 45 randomly selected projects evaluated in the Phase 1 study. Eighteen projects were located west of the Cascade crest, and six projects were located east of the Cascade crest. Figure 3.2 (p.24) shows the approximate locations of the 24 compensatory mitigation projects evaluated in Phase 2.

3.1 Achievement of Ecologically Relevant Measures

Ecologically relevant measures are those regulatory requirements that relate to achieving the proposed ecological development (target ecosystem) and/or level of function of a wetland mitigation project.

For example:
The requirement to establish a specific acreage of mitigation relates to achieving a specific level of wetland function, such that if a project falls short of establishing the required acreage, then many wetland functions may not be performed at the expected or proposed level.

On the other hand, the requirements to submit monitoring reports or construct interpretive signs, though important, do not directly relate to or provide a measure of the ecological development of a site.

Phase 2 evaluated three measures, related to regulatory compliance, that were considered relevant to a project's ecological success.

1. Establishment of the required acreage of mitigation. This was rated as:
   - Yes, establishing required acreage, or
   - No, not establishing required acreage.
2. Attainment of significant performance standards (PS). This was rated as:
   - Yes, attaining all PS,
   - No, attaining no PS,
   - Somewhat, attaining some PS, or
   - Not Applicable, if a project did not have any significant PS.
3. Fulfillment of appropriate goals/objectives (G/O). This was rated as:
   - Yes, fulfilling G/O,
   - No, fulfilling no G/O,
   - Somewhat, fulfilling some G/O, or
   - Not Applicable, if the project did not have any appropriate G/O.

The overall achievement of measures was rated as:

- Yes, achieving all measures,
- No, achieving no measures, or
- Somewhat, achieving some measures.

Table 3.1 Achievement of Ecologically Relevant Measures.

	Yes	Somewhat	No	Not applicable (NA)
Did the project establish the required acreage of mitigation?	14	-	10	-
Did the project attain significant performance standards (P.S.)?	5	4	6	9
Did the project fulfill appropriate goals/objectives?	8	9	4	3
Did the Project Achieve All Ecologically Relevant Measures?	**7***	**12**	**5**	**0**

*The rating for overall achievement of ecologically relevant measures was based on applicable measures only. Projects without significant performance standards or appropriate goals/objectives were not penalized. For example, a project without any significant performance standards could still receive a "yes" rating for overall achievement of measures if it achieved the other two applicable measures (establishing required mitigation acreage and fulfilling appropriate G/O).

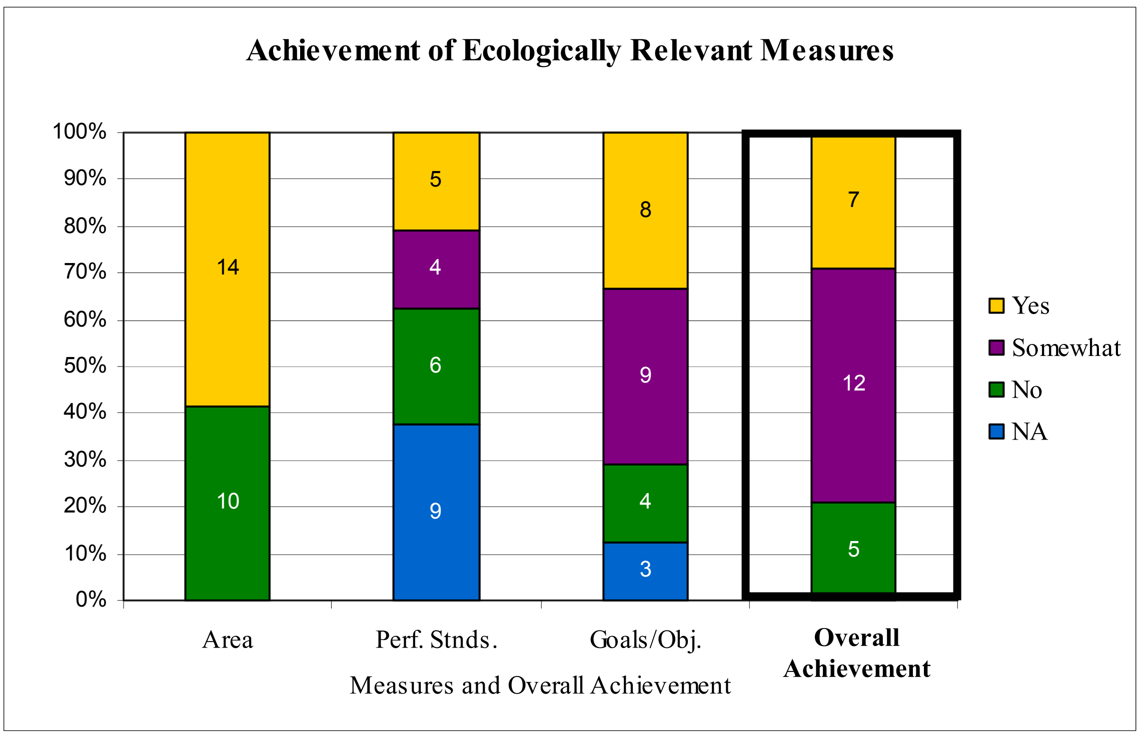

Figure 3.1. Percentage of projects achieving each measure: 1) establishing required acreage of mitigation; 2) attaining significant PS; 3) fulfilling appropriate G/O; and 4) overall achievement of measures. This analysis included all 24 projects.

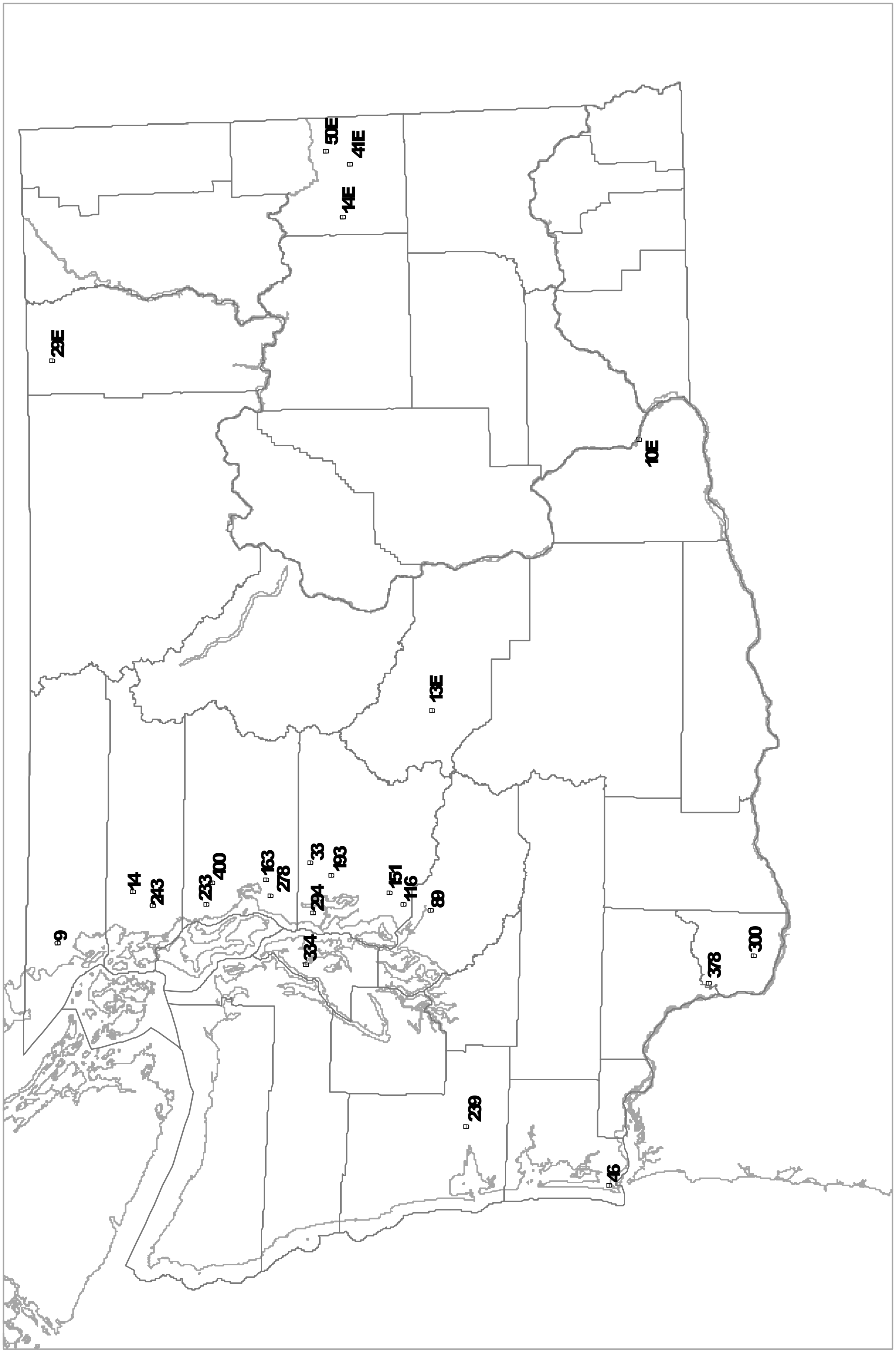

Figure 3.2. Approximate locations of the 24 projects evaluated in the Phase 2 study.

Seven projects achieved all measures; 12 projects achieved some measures, and five projects did not achieve any measures. This means that only 29 percent of the projects evaluated in this study achieved all of the ecologically relevant measures required by their permits. This rate is comparable with other studies that have examined compliance with permit requirements. Compliance in those studies has ranged from 12 percent to 50 percent (Allen and Feddema, 1996; Brown and Veneman, 2001; Castelle et al., 1992; Holland and Bossert, 1994; Johnson et al., 2000; Michigan Dept. of Environmental Quality, 2000; Mockler et al., 1998; Morgan and Roberts, 1999; Redmond, 1992; Storm and Stellini, 1994; Wilson and Mitsch, 1996). See Table 2 in Appendix A for site-specific results.

3.1.1 Establishing the Required Acreage of Mitigation

Perhaps the primary ecologically relevant measure of a mitigation project is whether the project established the required amount of acreage of the proposed mitigation activity(ies). The agencies that permitted the original wetland impacts decided how much acreage of a given mitigation activity would be required to adequately compensate for the impacts. Determining the established acreage of mitigation was, therefore, a primary focus of the Phase 2 study.

Methods

The assessment team determined the wetland boundaries during field visits. If creation/restoration was required then the assessment team focused on determining the wetland acreage of the site. If enhancement was required then the assessment team focused on determining whether the proposed enhancement activities were effectively accomplished, and on confirming that the site was wetland of the required acreage.

Site visits were conducted from May to August 2000. Precipitation for the period from October 1999 to October 2000 was approximately 99 percent of average for the state in general.[7]

Results

The table below summarizes the results of the wetland determination for all 24 of the mitigation projects evaluated in Phase 2.

Table 3.2 Comparing Impacts, Required Mitigation, and Established Mitigation.

	Acreage of Wetland Impacts	Required Wetland Mitigation Acreage	Established Acreage of Mitigation
Westside Totals	54.63	114.56	105.83
Eastside Totals	4.16	16.24	4.03
Statewide Totals	**58.79**	**130.80**	**109.86**

[7] Data taken from http://www.or.blm.gov/nwcc/nwcc-reports/climateprecip/climateprecip.htm

- Statewide, mitigation projects established 84 percent of the mitigation acreage.
- On the west side, mitigation projects established 92 percent of the mitigation acreage.
- On the east side, mitigation projects established 25 percent of the mitigation acreage.

Refer to Table 1 in Appendix A for site-specific information on acreage (impact acreage, required wetland mitigation acreage, and established wetland mitigation acreage).

Discussion

Five of the mitigation projects established more wetland area than was required. The Phase 2 site assessment included a determination of the wetland boundary. It did not, however, include a determination of buffer area. Several projects required a specific acreage or width of buffer around the site, but this was not assessed. If the required buffer was wetland and was adjacent to the mitigation, then it was included as wetland area. A separate study to confirm that mitigation projects have the width or acreage of buffer required by their permits would be valuable.

As the results indicate, the projects evaluated in the Phase 2 study established 84 percent of the total mitigation acreage that was required. Individually, 14 projects (58%) established their required acreage (see Figure 3.1, pg.23). Though this is not perfect, other studies of mitigation projects have generally revealed that an even lower percentage of the required acreage was actually established. An Indiana study of compensatory wetland mitigation found that 44 percent of the required acreage of mitigation had actually been established (Robb, 2001). A study of Ohio wetlands revealed that only 38 percent of the required acreage of mitigation had been established (Wilson and Mitsch, 1996). Studies in Massachusetts and Michigan both found that 50 percent of projects established the required acreage (Brown and Veneman, 2001; Michigan Dept. of Environmental Quality, 2000). A Tennessee study found that 68 percent of the required acreage was actually established and that only 28 percent of the projects were of the required size (Morgan and Roberts, 1999). However, a study of wetland replacement in Oregon found that 91 percent of the required wetland area was established (Gwin and Kentula, 1990).

3.1.1.1 Establishment of Required Acreage by Mitigation Activity

By comparing the numbers in Table 3.2, on the previous page it would appear that the acreage of wetland losses was effectively replaced at a ratio of 1.87:1 even though the required acreage was not established. However, much of the acreage that was established involved enhancing pre-existing wetland areas, which does not result in a net gain in wetland acreage. Therefore, it is important to examine the established acreage of mitigation by type of mitigation activity.

Methods

Table 3.3 compares the total amount of mitigation acreage required versus acreage of mitigation that was established for the three types of mitigation activities. Data also were analyzed to determine whether individual projects established the required amount of acreage of a mitigation activity (see Figure 3.3, p.28).

The 24 mitigation projects were assigned to one of four mitigation activity categories: creation, restoration, enhancement, or mixed. Ten projects involving a mixture of mitigation activities were assigned to an activity category based on which activity had the predominant amount of acreage required. If no single activity accounted for greater than 75 percent of the required mitigation acreage, then the project was placed into the "mixed activity" category.

For example:

- A project that required 1.0 acre of restoration and 5.0 acres of enhancement was assigned to the "**enhancement**" category;
- A project that required 2.0 acres of restoration and 2.0 acres of enhancement was assigned to the "**mixed activity**" category.

Results

For project-specific information, see Appendix A, Table 1.

Table 3.3 Acreage of Mitigation by Activity: Required Vs. Established

		Creation/Restoration Acreage		Enhancement Acreage	
	Impact Acreage	Required	Established	Required	Established
West Total	54.63	36.36	34.38	78.30	71.45
East Total	4.16	6.60	3.83	9.64	0.20
State Total	**58.79**	42.96	**38.21**	87.94	**71.65**

For the 24 projects considered in Phase 2:

- **Only 65 percent of the total acreage of wetland losses was replaced by creating or restoring new wetland area, thereby resulting in a net loss of 24.18[8] acres of wetland area.**

More specifically:

- 89 percent of the acreage required to be **created or restored** was established:
  - 87 percent of the acreage required to be **created** was established, and
  - 93 percent of the acreage required to be **restored** was established.
- 81 percent of the acreage required to be **enhanced** was established. This means that on 16.29 acres, enhancement actions failed either because none of the required

[8] One enhancement project (#378) appeared to have resulted in a loss of 3.6 acres of previously existing wetland due to re-contouring of the site. This acreage was not included in the "Impact Acreage."

plantings were established, or wetland acreage was actually lost as a result of the enhancement actions (refer to footnote 8 on p. 27).

- Nearly two-thirds (65%) of the total established acreage of mitigation resulted from enhancement activities.
- Two projects (#9 and #294), with a combined total of 21.3 acres of impacts to wetlands, were required to preserve an additional 77.5 acres of existing wetland. The site assessment team did not assess preservation areas. Thus, for the purposes of this study, the acreage of preservation was not included in either the required mitigation acreage for the projects nor in the established acreage. However, preservation areas were taken into consideration when the projects were evaluated for compensation of impacts and overall project success.

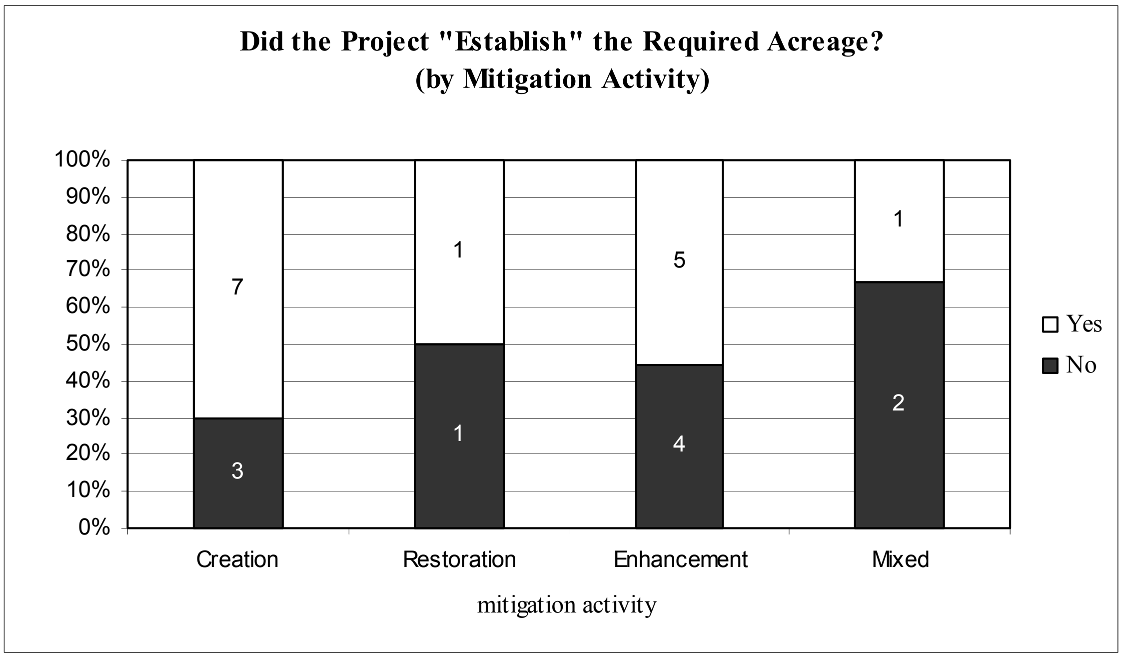

Figure 3.3 Distribution of projects in each category of mitigation activity that either did or did not establish the required acreage of mitigation.

Of the 24 projects considered, 14 projects (58%) established the acreage required in the permit, while 10 projects (42%) did not.

In addition, of the 24 projects:

- 10 involved creating new wetlands – seven (70%) established the acreage required, while three (30%) did not.
- Two were restoration projects – one (50%) established the acreage required, while one (50%) did not.
- Nine involved enhancing pre-existing wetlands – five (56%) established the acreage required, while four (44%) did not.
- Three were mixed activity projects – one (33%) established the acreage required, while two (66%) did not.

Discussion

Several conclusions can be drawn from the results of the established acreage of mitigation analysis.

- There was not a statistically significant difference between the four categories of mitigation activity (creation, restoration, enhancement, mixed) in establishing their required acreage of mitigation.
- Created wetlands did a relatively good job of establishing the required acreage (87% of acreage and 70% of projects). One of the biggest concerns regarding the use of creation is its purported high risk of failure. However, only one of the created wetlands considered in this study (#50E) failed to create wetland conditions.
- Restoration was a dominant activity in only two of the 24 projects (8%). Despite the regulatory agencies' stated preference for restoration as the mitigation activity of choice, this study did not find restoration to be a common form of mitigation. This could be due to the fact that the projects selected for this study were permitted before restoration was as rigorously promoted. Also, restoration activities are generally not suitable for small-scale projects like most of those evaluated.
- Four enhancement projects (44%) did not establish the required acreage of mitigation. Since enhancement activities occurred in an existing wetland, the site to be enhanced should have had the same wetland acreage after enhancement activities were performed, but four of the nine enhancement projects did not establish the required acreage of mitigation. There are two main reasons for this:

    1. The enhancement actions failed.

A wet pasture was to be enhanced by planting shrubs and trees and controlling *Phalaris arundinacea*. During the site visit, it was determined that few if any shrubs or trees were present and the area was still dominated by *P. arundinacea*. It was concluded that the site did not establish the required acreage of enhanced wetland.

    2. The enhancement involved re-grading.

A wet pasture was to be enhanced by significantly re-grading (excavating two large ponds and a channel between them, and re-contouring the remaining soil). During the site visit, which occurred later in the growing season, no evidence of hydrology or hydric soils was observed in the re-contoured mounds. It was concluded that re-grading resulted in an apparent loss of about half of the previously existing wetland area.

3.1.1.2 Establishment of Acreage by Age and Size of the Project

Age

It is logical to assume that older mitigation projects would be more developed ecologically than younger mitigation projects. Phase 2 data were analyzed to determine whether age was a factor in establishing the required acreage of mitigation. Projects were divided into two age categories: less than five years old, and equal to or greater than five years old.

For site-specific information on required and established mitigation acreage by and age, refer to Table 1 in Appendix A.

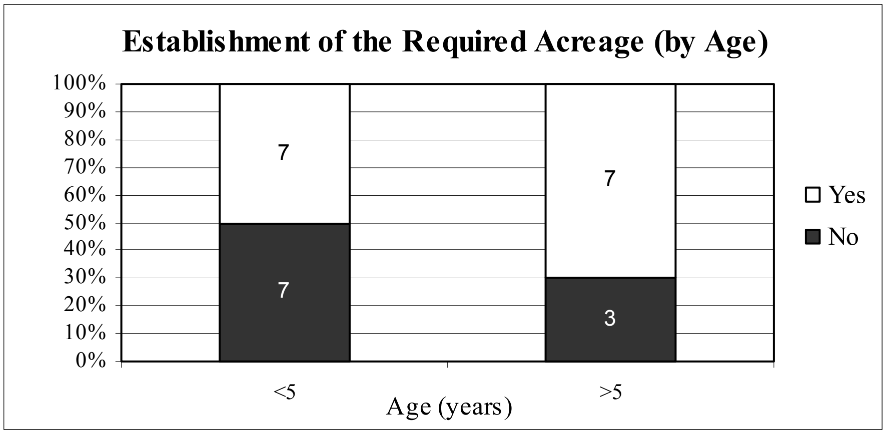

Figure 3.4 Comparison of the establishment of acreage for projects in two age categories (less than 5 years, and greater than or equal to 5 years old). Projects either did or did not establish the required acreage (n=24).

<u>Size</u>
Small wetland mitigation projects or "postage stamps wetlands" often are believed to do poorly at establishing wetland area and function. Phase 2 data were analyzed to determine whether size was a factor in successfully meeting the acreage requirement. Mitigation projects were divided into three size categories: less than one acre, one to five acres, and greater than five acres.

See Figure 3.5 below. Refer to Table 1 in Appendix A for site-specific information.

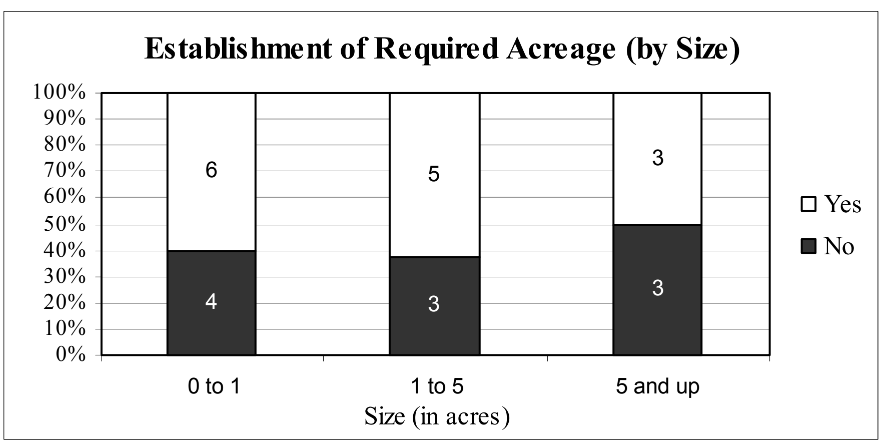

Figure 3.5 Comparison of the establishment of required mitigation acreage for projects in three size categories (less than 1 acre, 1 to 5 acres, and equal to or greater than 5 acres). Individual projects were categorized as either establishing the required wetland mitigation acreage or not (n=24).

Discussion

Figure 3.4 appears to suggest that projects five years and older did a better job of establishing wetland area than projects less than five years old. This slight difference in the establishment of acreage appears logical, because sites less than five years old are still developing, particularly if they have been graded. As a result, most wetland mitigation projects have requirements to monitor mitigation sites for a minimum of five years. During this five-year monitoring period, problems, such as plant mortality and insufficient water supplies, could be addressed with contingency actions.

Figure 3.5 indicates that of the three size categories of mitigation projects, those five acres and greater did not do as well at establishing the required acreage as the other two size categories. However, the differences observed in the results for both the age and size analyses were not statistically significant (most likely due to a small sample size). Therefore, it appears that neither the age nor the size of the wetland mitigation project had an influence on whether a project established the required acreage of mitigation.

3.1.1.3 Establishment of Acreage: West vs. East

Twenty-four projects were evaluated.

- 18 projects were located west of the Cascade crest.
  - West side projects established 92 percent of the required wetland mitigation acreage (106 acres established out of 115 acres required),
  - 12 projects established the required wetland mitigation acreage, and
  - Six projects did not establish the required acreage.
- Six projects were located east of the Cascade crest.
  - East side projects established 25 percent of the required wetland mitigation acreage (4 acres established out of 16 acres required),
  - Two projects established the required wetland mitigation acreage, and
  - Four projects did not establish the required acreage.

Projects on the east side appeared to have difficulty establishing mitigation acreage (Figure 3.6). Due to a small sample size, it is not clear whether this is a trend for the east side, or whether problems with establishment of acreage were strictly project-specific. Refer to Table 1 in Appendix A for project-specific acreage information and Appendix F for project summaries.

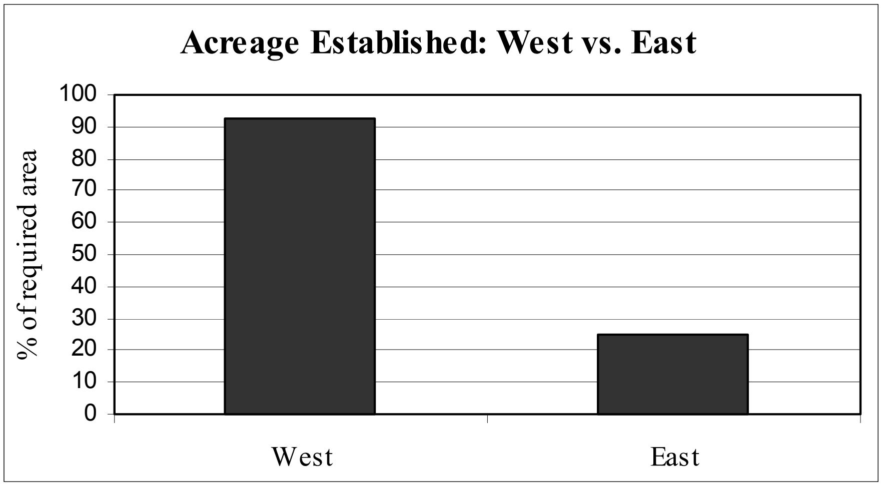

Figure 3.6 Established acreage as a percentage of the acreage required for projects west of the crest of the Cascade Range and east of the Cascade Range (n=24).

3.1.2 Attainment of Performance Standards (PS)

Methods

Another ecologically relevant measure that was evaluated was whether performance standards were attained. However, many of the performance standards that were assessed did not reflect how the site was functioning or progressing ecologically. Therefore, the evaluation team determined which of the assessed performance standards were significant for each project. This determination was based on the following three criteria:

- Whether the PS related to attainment of wetland functions.

Significant

"Grades of 60-61+ feet on existing upland areas reduced by 0.5-1.5 feet." This standard relates to increasing flood storage capacity.

Not Significant

"Establish a permanent interpretive sign for the mitigation area." This standard does not relate to a wetland function.

- Whether the PS was measurable and specific – not confusing or vague.

Significant
"Non-native blackberries, reed canary grass, and purple loosestrife may not account for more than 10% of total cover at any monitoring occasion." This standard specifies which plant species are of concern sets a specific, measurable percent cover, and it specifies that the standard is for total (or cumulative) cover.
Non Significant
"By the end of the fifth year, there will be 95-100% coverage." This standard does not specify what type of coverage (cumulative or relative), nor what should be providing the cover – it could be Scot's broom or Canada thistle.

- Whether the PS was feasible (realistic) and not so rigorous that it could never be met, thereby setting sites up for failure.

Significant
"After five growing seasons, there shall be least 65% combined cover for trees and shrubs." With adequate site conditions, this standard is realistic and attainable.
Non Significant
"7-9 acres dominated by native forested wetland vegetation in the *Alnus rubra*/*Rubus spectabilis*, *Alnus rubra*/*Lysichitum americanum*, and *Fraxinus latifolia*/*Carex obnupta* community types." This standard provides a range for acreage, which is good. However, specifying the exact plants that need to dominate these areas could be setting this site up for failure by not allowing natural colonization and site conditions to influence plant community composition. A more feasible standard would be, "7-9 acres dominated (or co-dominated) by at least three, native, wetland, tree species with a shrub layer dominated (or co-dominated) by at least three, native, wetland, shrub species, and an herbaceous layer dominated (co-dominated) by at least three, native, wetland, emergent species."

<u>Results</u>

Refer to Figures 3.7, and 3.8. For project specific results of performance standard analysis, see Tables 2 and 8 in Appendix A.

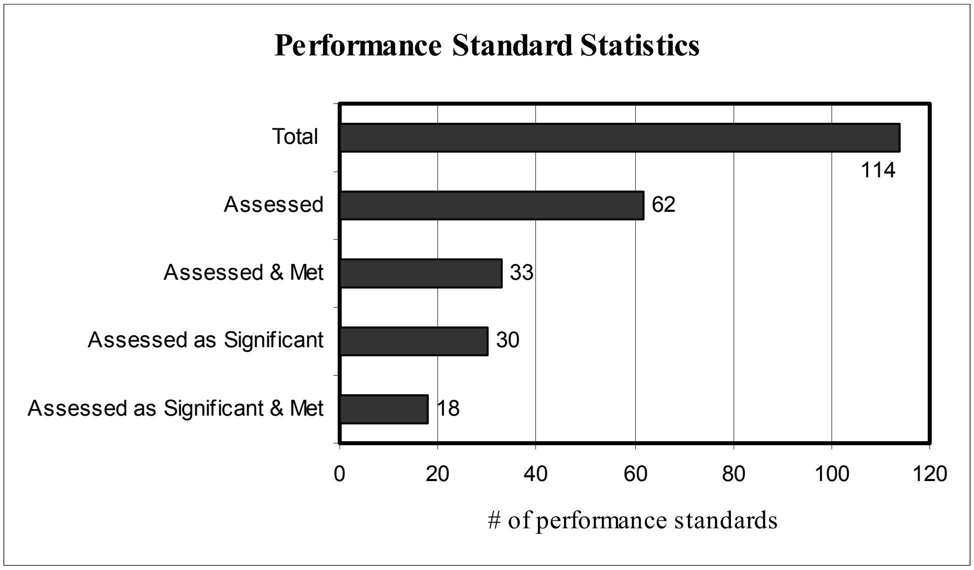

Figure 3.7 Comparison of the total number of performance standards encountered, the total number assessed, the total number attained of those assessed, then the number of performance standards that were considered significant of the total number that were assessed, and the number of significant assessed performance standards that were met.

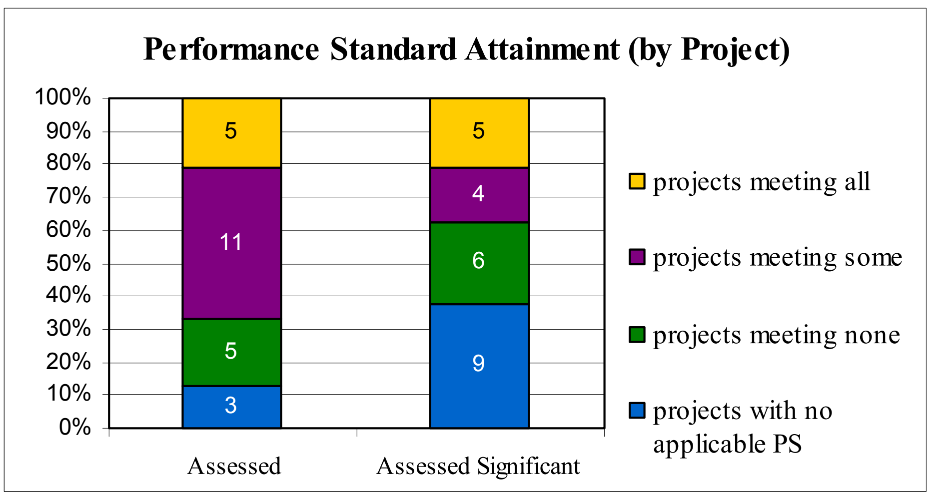

Figure 3.8 Performance standard (PS) attainment by relative percentage of projects for two categories: all assessed PS, and assessed PS that were determined to be significant (n=24 projects).

Discussion

The results of the performance standards analysis (Figure 3.7) show that of the 114 performance standards encountered, 62 (54%) were assessed with the methods and timing of this study (see section 2.2.3, p.10-11, for a description of the PS that could not be assessed by the Phase 2 study). The Phase 2 study, however, focused on attainment of "significant" performance standards. Figure 3.7 shows that of the total number of performance standards, only 30 (26%) were both assessable and significant.

Focusing on the significant standards resulted in an increase in the number of projects without applicable performance standards. Figure 3.8 indicates that three projects (13%) had no assessable performance standards, while nine projects (38%) had no significant performance standards.

Projects without significant performance standards were not penalized in regard to achieving all ecologically relevant measures. The projects without significant performance standards were evaluated based on the other two measures, establishing the required acreage of mitigation and fulfilling goals/objectives.

Though it was discouraging that nine projects had no significant performance standards and, therefore, no significant benchmarks for the ecological progression of the desired wetland characteristics and functions, it was even more discouraging that most of the projects that had significant performance standards were still lacking many basic standards, such as:

- Wetland area,
- Water regime – permanently ponded, seasonally inundated, seasonally saturated, or a combination of these,
- Area of Cowardin class(es),
- Percent cover (relative or cumulative) of native wetland vegetation species desired,
- Maximum percent cover (relative or cumulative) of invasive vegetation species tolerated.

Since performance standards are the primary benchmark for determining mitigation compliance and success, it is disconcerting that most projects had incomplete and poorly developed standards. This will be discussed further in Recommendations.

Appendix B contains a list of performance standards that were assessed and significant, assessed but not significant, and those that were not assessed in the Phase 2 study.

3.1.3 Fulfilling Goals/Objectives

Goals and objectives are an integral part of a mitigation plan because they provide a description, in general terms, of what the mitigation project is trying to achieve. Therefore, fulfilling appropriate goals and objectives was the third ecologically relevant measure that a project needed to achieve as part of the evaluation of success.

A goal is a broad statement of what the mitigation project intends to accomplish, while an objective is a specific element or subset of a goal defining specifically what is necessary to fulfill that goal. An objective is typically stated in terms of wetland functions or values. Objectives should lead directly to performance standards, which provide a measurable benchmark to determine if an objective has been accomplished (McCabe and Devroy, 2001; Hruby et al., 1994; Ossinger, 1999).

EXAMPLE:
Goal: Create 2.0 acres of emergent and scrub-shrub wetland, which will improve water quality and provide habitat for amphibians.
Objective#1: Create at least 1.5 acres of seasonally inundated wetland.
Objective#2: Provide sediment retention and nutrient removal.
Objective#3: Provide breeding habitat for red-legged frogs.

Methods

Goals and/or objectives were evaluated for all 24 projects. Goals and objectives were lumped, because several projects had either one or the other but not both. Also, the terms "goal" and "objective" often are used interchangeably. There appears to be some confusion about what, specifically, each term pertains to despite guidance documents that define each term and explain how each should be applied.

The evaluation team determined which goals and/or objectives were appropriate for each project using the same criteria that were applied to performance standards, such as, the clarity of the goal/objective (not confusing or vague) and the feasibility of the goal/objective (for example, proposing to create anadromous fish habitat in an isolated depression is not feasible). Only the fulfillment of appropriate goals/objectives was considered in the overall achievement of ecologically relevant measures.

Results

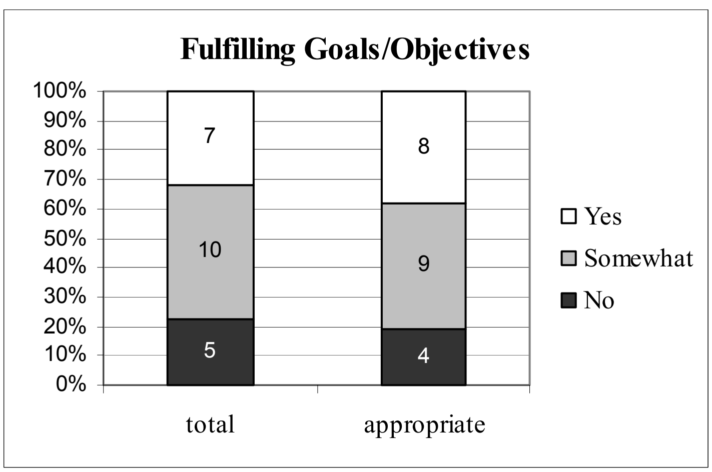

Figure 3.9 Comparison of the relative percent of projects fulfilling all goals and objectives versus the percent of projects fulfilling those goals and objectives judged to be appropriate. Yes = fulfilling all goals/objectives; Somewhat = fulfilling some but not all; and No = not fulfilling any.

Twenty-two projects[9] were evaluated to determine if they fulfilled all of their goals/objectives, while only 21 projects were judged to have had appropriate goals/objectives.

[9] Two projects (#334 and 10E) did not have any G/O and, therefore, were not included in this analysis.

See Table 2 in Appendix A for project-specific results of the goals/objectives analysis.

Discussion

In general, projects did a better job of fulfilling appropriate goals and objectives than attaining significant performance standards. This could be due to the fact that performance standards frequently did not represent the goals and objectives of a mitigation project. For example, a project could fulfill its goals/objectives to create a scrub/shrub wetland and provide habitat for passerine birds, and either not have significant performance standards or not attain any of them. In addition, there is a wide range of on-the-ground scenarios that could fulfill the same goal or objective. The example of a goal to establish scrub/shrub wetland and provide habitat for passerine birds would be fulfilled by any mitigation site that had scrub/shrub vegetation covering greater than 30 percent of the wetland.

3.2 Compensating for the Impact

Methods

In addition to achieving ecologically relevant measures, the second factor used to determine the overall success of a mitigation project was whether the project adequately compensated for the wetland loss. However, this evaluation was more subjective than evaluating the achievement of measures. To minimize subjectivity, the evaluation of whether a mitigation project adequately compensated for impacts was based on available data and the consensus judgment of the evaluation team, following a decision-making approach (Hruby, 1999). Four criteria were used to guide the team's judgment:

- How much did the mitigation activity contribute to the potential of the site to perform wetland functions? This was the most important criterion considered.
- Did the mitigation project provide the same functions as the lost wetland and over a sufficient enough area[10] to compensate for the lost functions?
- If the mitigation project did not provide the same functions, did the project provide an appropriate exchange of functions (e.g., water quality functions were lost and the mitigation project provided wildlife habitat functions)? An exchange was considered appropriate if the functions provided in exchange were implemented over a sufficient enough area, and were limiting in that basin, and/or represented a high contribution to the performance of functions.
- The type and scale of the authorized wetland impact. For example, a mitigation project compensating for impacts to 0.25 acre *Phalaris arundinacea* dominated wetland would not be held to as high a standard as a project compensating for impacts to 5 acres of a forested wetland.

Projects were rated as "Yes," adequately compensating for the impact; "Somewhat," somewhat compensating for the impact; and "No," not adequately compensating for the impact.

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[10] A sufficient enough area was a judgment made by the evaluation team, which was made independently of the replacement ratios that were required.

Results

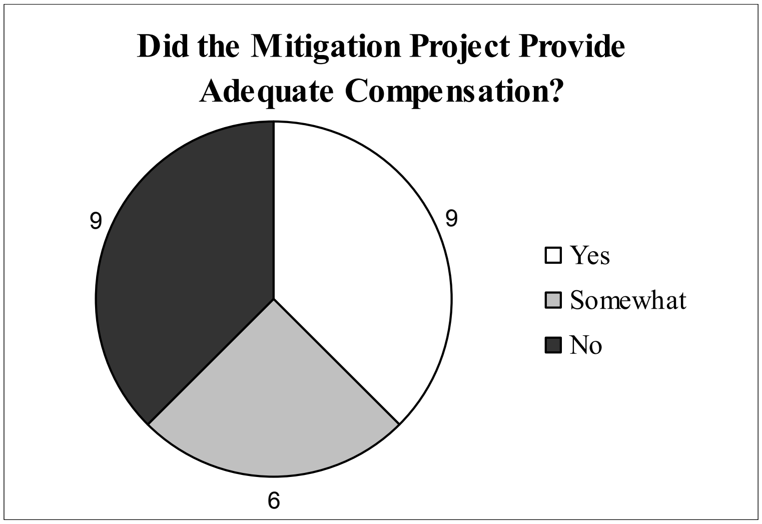


Figure 3.10 Distribution of the 24 projects into one of the three categories of compensation for the impact (n=24 projects).

See Table 3 in Appendix A for results specific to each project.

Discussion
In general, the projects evaluated in the Phase 2 study did better achieving ecologically relevant measures than compensating for impacts. **Only 63 percent of mitigation projects were even partially compensating for impacts** (Figure 3.10) **while 79 percent of projects at least partially achieved their measures** (Figure 3.1). This implies that though projects may be doing a better job of achieving measures, these measures may not indicate whether mitigation projects adequately compensate for the wetland impacts.

3.2.1 Contribution of the Mitigation by Function

Evaluating a site's contribution to the performance of functions was an essential component of determining whether a project adequately compensated for the impact. Evaluating contribution was also crucial to understanding whether enhancement actions provided the necessary gain in wetland functions to make up for the resulting net loss of wetland area. (Contribution to wetland functions was determined for each site. Since some projects had more than one mitigation site, for the 24 projects evaluated, there were 31 sites visited and assessed.)

Methods
Contribution refers to how much the mitigation actions increased or affected the potential of the site to perform wetland functions. The contribution to the performance of functions by a mitigation site was determined for three general categories of functions:

- **Water Quality**. The rating for the Water Quality category was an average of the ratings for the potential to remove:
  1) Sediment;
  2) Nutrients; and
  3) Metals and toxic organics.
- **Water Quantity**. The rating for the Water Quantity category was an average of the ratings for the potential to:
  1) Reduce peak flows; and
  2) Decrease downstream erosion.
- **General Habitat**. The rating of General Habitat addressed the suitability of a wetland for all species. The potential to perform this function was based on surrounding land uses, buffer condition, number of habitat niches, and structural complexity and diversity within the wetland.

The individual functions were defined to be consistent with Methods for Assessing Wetland Functions Volume 1 (Hruby et al., 1999). Groundwater-recharge functions were not considered, because many upland sites perform this function and there is still much that needs to be understood about groundwater interactions in many HGM subclasses.

Determining the contribution of the mitigation activity to the performance of functions was particularly important for enhancement projects. Created and restored wetlands either produced wetland conditions and functions where none previously existed or, if the mitigation activity did not produce wetland conditions, then the mitigation project was judged to have no contribution to functions (as in #50E). However, enhancement projects were wetlands with existing functions prior to mitigation actions. Thus, the level of success of an enhancement project depended on determining how much the enhancement actions increased the potential of the site to perform specific functions.

Thirty-one mitigation sites (for the 24 projects) were visited and assessed. Contribution and potential to perform wetland functions were assessed for 30 sites. One project/site (#46) was established in a coastal dune ecosystem. Little is known about how these systems function in general, and no function assessment methods have been developed for interdunal wetlands. Without information on potential to perform functions, the evaluation team could not determine the level of contribution by this mitigation project.

Results

For the 30 sites considered, Figure 3.11, Figure 3.12, and Figure 3.13 illustrate the level of contribution made by each of the four mitigation activities for each of the three major function categories: water quality, water quantity, and general habitat.

3.2.1.1 Contribution to Water Quality Functions

Sediment, nutrient, metals, and toxic organics removal.

30 sites were considered.

- 11 sites predominantly involved creating wetlands:

- 6 sites (55%) had a high contribution toward water quality functions,
- 2 sites (18%) had a moderate contribution toward water quality functions,
- 1 site (9%) did not contribute at all toward water quality functions, and
- 2 sites (18%) do not perform water quality functions because of wetland type (flat) and location in the landscape (top of the watershed).

- 3 sites predominantly involved restoring wetlands and all three (100%) had a high contribution toward water quality functions.
- 12 sites predominantly involved enhancing pre-existing wetlands,
  - 1 site (8%) had a high contribution toward water quality functions,
  - 4 sites (33%) had a moderate contribution toward water quality functions,
  - 4 sites (33%) had a minimal contribution toward water quality functions, and
  - 3 sites (25%) did not contribute at all to water quality functions.
- 4 sites involved a mixture of activities:
  - 2 sites (50%) had a high contribution toward water quality functions,
  - 2 sites (50%) had a moderate contribution toward water quality functions.

For site-specific information, refer to Table 3 in Appendix A.

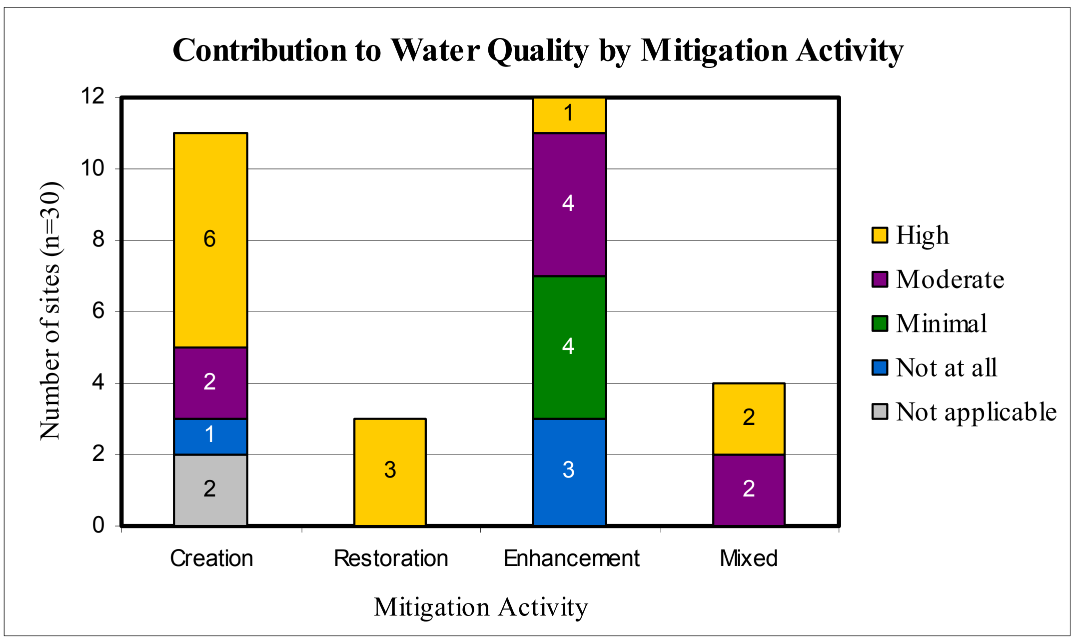


Figure 3.11 Comparison of the level of contribution to water quality functions for each mitigation activity.

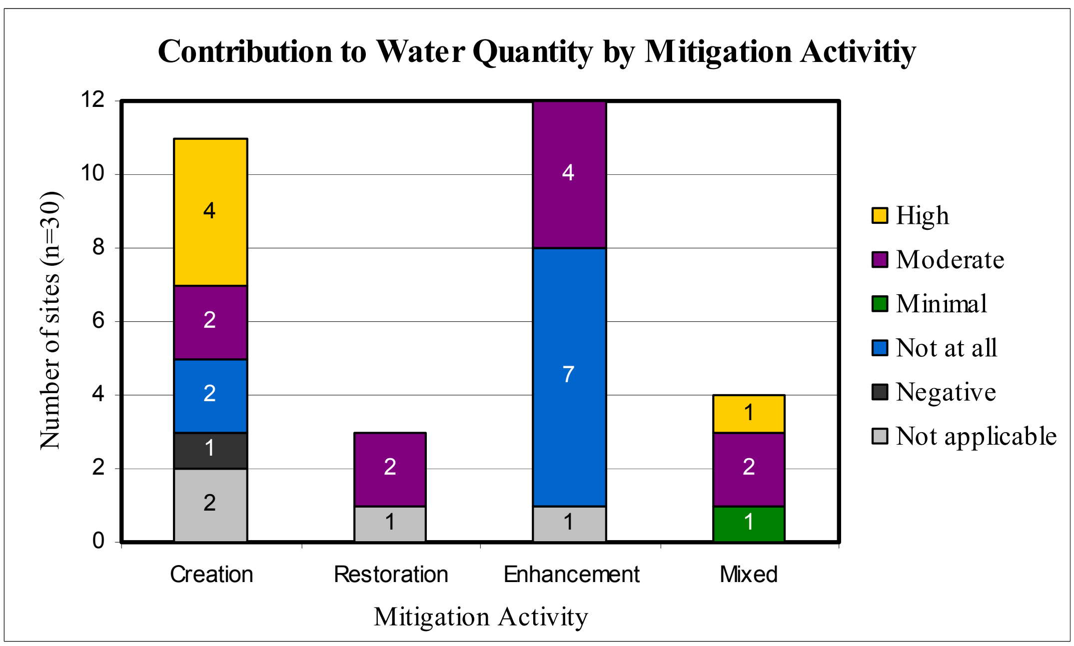
According to the Mann-Whitney U test (Sokal and Rohlf 1969), the sites that involved creating wetlands provided a significantly higher contribution to water quality functions than enhancement sites ($p<0.05$).

3.2.1.2 Contribution to Water Quantity Functions
Reducing peak flows and decreasing downstream erosion.

30 sites considered.

- 11 sites predominantly involved creating wetlands:
  - 4 sites (36%) had a high contribution toward water quantity functions,
  - 2 sites (18%) had a moderate contribution toward water quantity functions,
  - 2 sites (18%) did not contribute at all to water quantity functions,
  - 1 site (9%) had a negative contribution[11] (i.e., the project increased downstream erosion and peak flows), and
  - 2 sites (18%) were not applicable to assess water quantity functions due to the presence of a tidal influence (#239) and a controlled water source (#13E).
- 3 sites predominantly involved restoring wetlands:
  - 2 sites (66%) had a moderate contribution toward water quantity functions,
  - 1 site (33%) was not applicable to assess water quantity functions due to the presence of a water control structure (#163 – tide gate).
- 12 sites predominantly involved enhancing pre-existing wetlands:
  - 4 sites (33%) had a moderate contribution toward water quantity functions,
  - 7 sites (58%) did not contribute at all to water quantity functions, and
  - 1 site (8%) was not applicable to assess water quantity functions due to our limited knowledge of this function for slope wetlands (#300).
- 4 sites involved a mixture of activities:
  - 1 site (25%) had a high contribution toward water quantity functions,
  - 2 sites (50%) had a moderate contribution toward water quantity functions,
  - 1 site (25%) had a minimal contribution toward water quantity functions.

For site-specific information, refer to Table 3 in Appendix A.



[11] The purpose of this project (#41E) was to deepen and widen a creek channel so that more water could move through it more quickly.

Figure 3.12 Comparison of the level of contribution to water quantity functions for each mitigation activity.

3.2.1.3 Contribution to the General Habitat Function

30 sites were considered.

- 11 sites involved creating wetlands:
  - 1 sites (9%) had a high contribution toward general habitat,
  - 5 sites (45%) had a moderate contribution toward general habitat,
  - 3 sites (27%) had a minimal contribution toward general habitat, and
  - 2 sites (18%) did not contribute at all to general habitat.
- 3 sites involved restoring wetlands:
  - 2 sites (67%) had a high contribution toward general habitat,
  - 1 site (33%) had a moderate contribution toward general habitat.
- 12 sites involved enhancing wetlands:
  - 1 site (8%) had a high contribution toward general habitat,
  - 2 sites (17%) had a moderate contribution toward general habitat,
  - 6 sites (50%) had a minimal contribution toward general habitat, and
  - 3 sites (25%) did not contribute at all to general habitat.
- 4 sites involved a mixture of activities:
  - 1 site (25%) had a high contribution toward general habitat,
  - 1 site (25%) had a moderate contribution toward general habitat, and
  - 2 sites (50%) had a minimal contribution toward general habitat.

For site-specific information, refer to Table 3 in Appendix A.

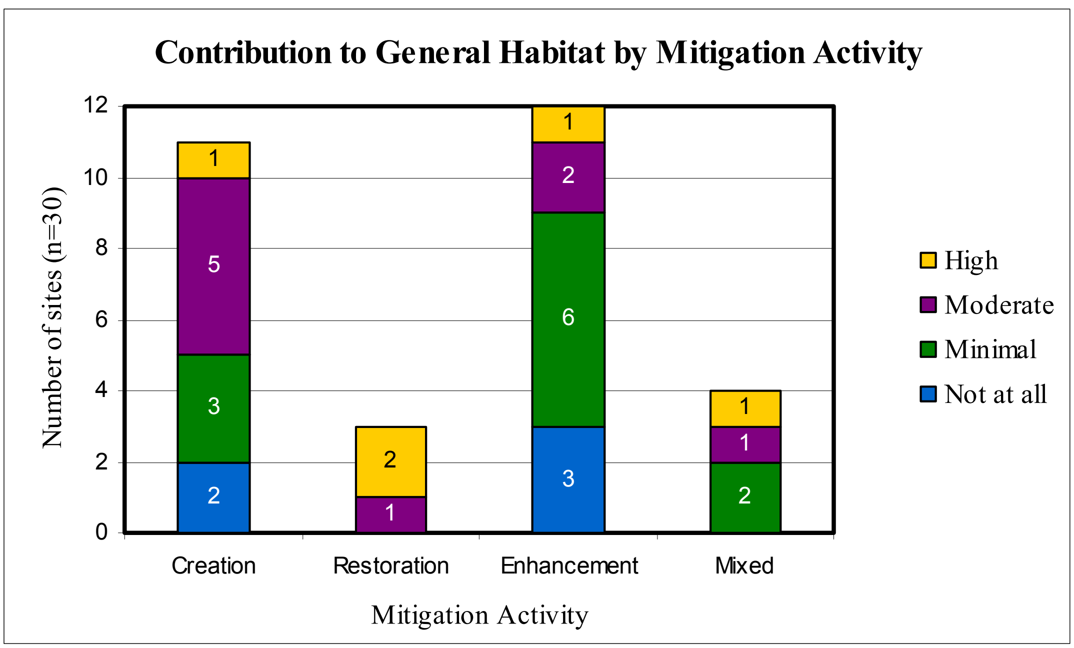


Figure 3.13 Comparison of the level of contribution to the general habitat function for each mitigation activity.

3.2.2 Contribution by Mitigation Activity

Contribution data was also compared within the same mitigation activity across the three functions. This illustrates more clearly how much a given mitigation activity contributes to the major wetland functions assessed. Figure 3.14 and Figure 3.15 illustrate contribution levels for creation and enhancement respectively.

3.2.2.1 Contribution to Functions by Created Wetlands

Results

Eleven sites involved predominantly creation activities (#46 is not included. The evaluation team was unable to assess its potential to perform functions and its contribution.).

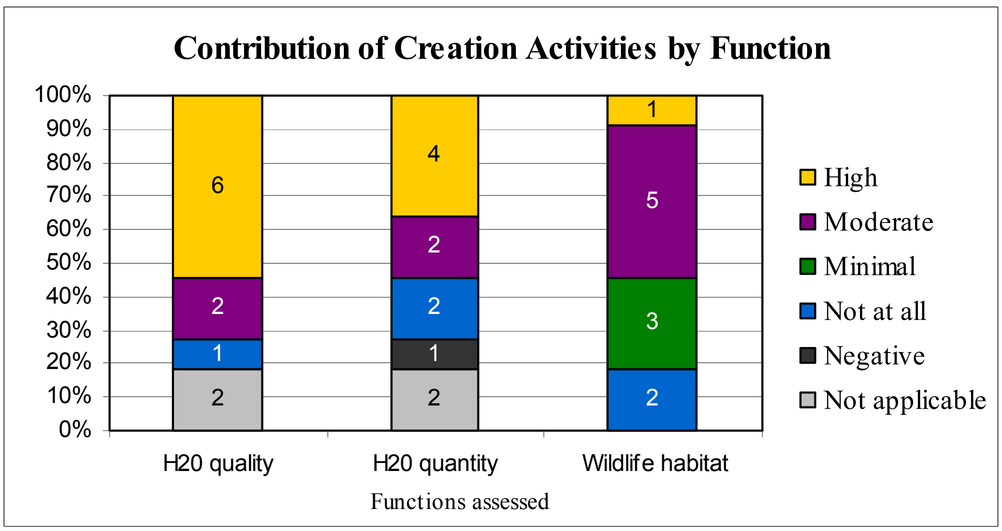


Figure 3.14 Comparison of the level of contribution to each of the three functions by percentage of sites that performed predominantly creation activities (n=11sites).

Discussion

Over half of the created wetland projects (54-73%) provided at least a moderate contribution to each of the three function categories assessed. However, nine to 27 percent of creation sites provided no contribution or a negative contribution to wetland functions.

3.2.2.2 Contribution to Functions by Enhanced Wetlands

Results

Twelve sites involved predominantly enhancement activities.

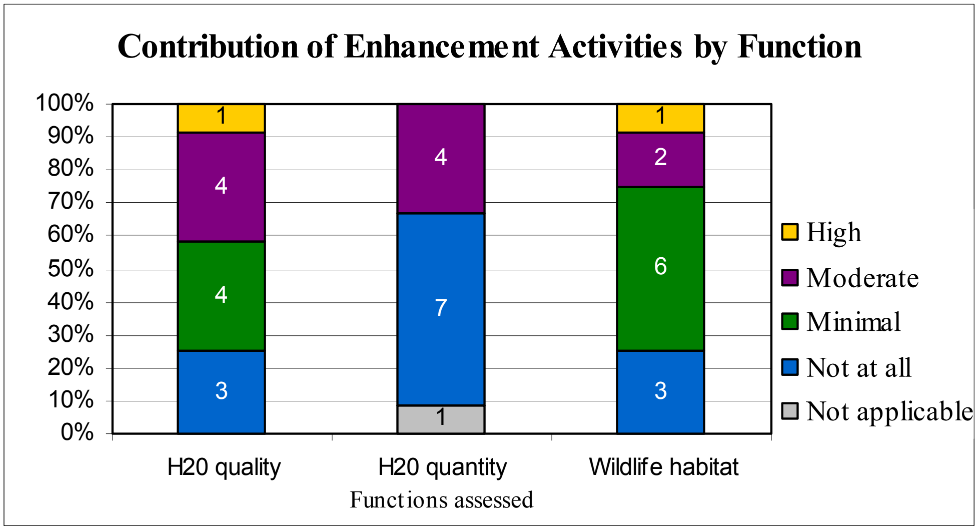


Figure 3.15 Comparison of the level of contribution to each of the wetland functions by percentage of sites that performed predominantly enhancement activities (n=12 sites).

Discussion

Over half of the enhanced wetland sites (58-75%) provided no more than a minimal contribution to the wetland functions assessed, and at least 25 percent of projects provided no contribution. Less than half of the enhancement sites (25-42%) provided no more than a moderate contribution to functions, with only one project providing a high contribution (for two of the function categories).

3.2.2.3 Discussion of Contribution to Functions

Restoration and mixed activity projects were too few in number to draw any relevant conclusions. However, all restoration and mixed activity areas provided at least a minimal contribution to all wetland function categories.

The results of the analysis of Contribution to Function (see Figure 3.11 on p. 40) indicate that the creation areas evaluated in Phase 2 provided a significantly higher contribution to water quality functions than enhancement projects. Though created wetlands were most effective at providing water quality improvement, they also provided a high contribution to water quantity functions (36% of sites) and at least a moderate contribution to wildlife habitat (55% of sites). Since creation areas were not wetlands prior to mitigation actions, it is not surprising that these projects could do a relatively good job of contributing to wetland functions.

Phase 2 results also show that less than 10 percent of the enhancement areas provided a high contribution to the potential performance of functions, while 25 percent of enhancement areas (Figure 3.15) provided no contribution to any functions. It is particularly noteworthy that enhancement areas generally provided little or no contribution to the General Habitat function (75% were minimal to no contribution).

When the enhancement of existing wetlands was approved as mitigation for wetland impacts it was understood that this would result in a net loss of wetland area, but it was believed that enhancement would, instead, result in a net gain of wetland functions, particularly to wildlife habitat. However, as the results indicate (Figure 3.15), at least half of the enhancement sites provided, at best, a minimal contribution to function performance. **The results indicate that, in general, the enhancement projects evaluated in the Phase 2 study did not result in a significant net gain of wetland functions.**

The highest contribution from all the mitigation activities was to water quality functions. Although these functions are often not targeted in the goals or objectives of a mitigation project, they are crucial functions to provide since they are generally the most common and important functions lost as a result of impacts to wetlands (based on available delineation reports and function assessment information in mitigation plans). Wildlife functions are generally the most common functions targeted in the goals/objectives of mitigation projects. However, the Phase 2 results suggest that mitigation sites did not do as well at providing a contribution to wildlife functions (Figure 3.13).

The relatively low contribution to the general habitat function and the high contribution to water quality functions is greatly influenced by the opportunity that a project has to actually provide the function. As mentioned in section 2.3.3 (p.15), a project's opportunity to provide a function affected the project's contribution to the function. With this in mind, it appears that, in general, the projects evaluated in this study had a higher opportunity to provide water quality functions than to provide wildlife habitat functions, largely as a result of their location in urban or urbanizing areas.

Similar results were obtained in a recent Massachusetts study. Function assessments results indicated that wetland mitigation projects provided a high level of water quality functions, but mitigation projects did not do as well at providing wildlife habitat functions (Brown and Veneman, 2001).

3.2.3 Provide the Same/Exchange Functions

<u>Methods</u>
Another factor used to determine if a mitigation project adequately compensated for the authorized impacts to wetlands was whether the mitigation project provided the same functions as the lost wetland. For example, if water quality functions were lost as a result of wetland impacts, did the mitigation project provide water quality functions over a sufficient enough area to compensate for the loss?

In some cases, the mitigation project exchanged wetland functions rather than providing the same functions that were lost. In those cases, the evaluation team determined whether the exchange was appropriate based on: 1) whether the exchanged functions were provided over a sufficient enough area; 2) if the mitigation provided a high contribution to the functions; 3) if the functions provided were limiting in the area; and 4) the landscape position of the site.

Example 1:
Water quality functions were lost. In exchange, the mitigation project provided a minimal contribution to wildlife habitat functions. However, the mitigation area was surrounded by roads and, thus, provided little opportunity for wildlife to successfully use the site. This was considered an inappropriate exchange of functions.

Example 2:
Water quality functions were lost. In exchange, the mitigation project provided a high contribution to water quantity functions in an area that experienced flooding. This was considered an appropriate exchange of functions.

Several projects also provided functions in addition to those that were lost.

<u>Results</u>
Twenty-four projects were considered.

- 12 projects (50%) provided functions that were lost (9 projects provided the same functions that were lost, while 3 projects provided some of the same functions that were lost), and 10 of the 12 provided functions in addition to those lost.
  - 8 projects (67%) were judged to have adequately compensated for the impacts,
  - 3 projects (25%) somewhat compensated for their impacts,
  - 1 project (8%) did not compensate for the impact.[12]
- 8 projects (33%) exchanged functions.
  - 1 project (13%) was judged to have adequately compensated for the impact,
  - 3 projects (37%) somewhat compensated for the impact,
  - 4 projects (50%) did not adequately compensate for impacts.
- 4 projects (17%) neither provided lost functions nor exchanged functions and, therefore, did not compensate for impacts.

<u>Discussion</u>
The results suggest that projects replacing or somewhat replacing the functions lost were better at compensating for impacts than projects exchanging functions. Of the five projects that exchanged functions but did not compensate for the impact, four were enhancement projects that either did not provide a high contribution to the exchanged functions and/or did not provide the functions over a sufficient enough area.

See Table 3 in Appendix A for project-specific information.

[12] During construction of #278, soils contaminated with toxic organic compounds were exposed and potentially mobilized. As a result of this exposure, the site itself may have degraded water quality. Therefore, it was judged that the project did not adequately compensate for the wetland impacts.

3.2.4 Type and Scale of Impacts

A final factor that was considered when evaluating whether a mitigation project provided adequate compensation was the type and scale of the authorized impacts to wetlands. This information provided a basis for comparing the impacts to the functions potentially being provided by the mitigation project. For example, a project resulting in the loss of several acres of higher-quality wetlands would be held to a higher standard of compensation than a project resulting in a quarter-acre impact to a wetland ditch dominated by non-native vegetation. This idea of type and scale of impact is involved in the replacement ratios that are used for projects during the original permitting phase. Higher-quality wetlands require a larger area of wetland mitigation, more successful/better functioning wetland mitigation or both.

Example 1:
One project (#33) resulted in a 0.07-acre impact to a portion of a high quality forested headwater wetland. Though this was a very small impact, it bisected the existing forested wetland, thereby diminishing the overall functioning of the whole system due to habitat fragmentation. The functions and overall quality of the mitigation would, therefore, need to be of a higher quality to adequately compensate for this type of impact. In this case, the 0.13-acre created wetland did not provide the functions that were lost but exchanged functions. The evaluation team judged that this exchange only somewhat compensated for the impact.

Example 2:
Another project of comparable size (#239) resulted in a 0.14-acre impact to a tidally influenced wetland ditch of low to moderate quality. Although the mitigation involved creating a swale adjacent to a highway, the functions and overall quality of the created wetland were, on average, moderate. The mitigation project provided the same functions that were lost as well as providing additional functions, and thus, the evaluation team judged that the project adequately compensated for the impact.

Example 3:
A project (#116) resulted in 17.4 acres of impact to low-quality wetlands. The 55.33-acre mitigation project primarily enhanced an extremely degraded wetland system (the mitigation also included some restoration and creation). The mitigation project provided the same functions that were lost as well as additional functions. The evaluation team judged that this project adequately compensated for the wetland loss.

Data on the type and scale of the impacts to wetlands came from background information in the project file or was provided by the project consultant. Detailed information, however, was often lacking.

For project-specific information on the type and scale of impacts, refer to the project summaries in Appendix F.

3.3 Success

Methods
The main purpose of the Phase 2 study was to determine the overall success of a representative sample of mitigation projects. Achievement of ecologically relevant measures and adequate compensation for wetland losses were considered the main indicators of a successful wetland mitigation project.

As described in section 3.1, a rating was used to evaluate how well the mitigation project achieved ecologically relevant measures. Achievement was rated as:

- Yes (achieving all measures) ,
- No (achieving no measures), or
- Somewhat (achieving some measures).

The degree of compensation for wetland losses for each mitigation project was rated as:

- Yes, adequately compensating for the loss of wetlands,
- No, not adequately compensating, or
- Somewhat compensating.

The evaluation team broke the results of the combination of the two ratings into four categories of success:

- Fully Successful mitigation projects received a "Yes" for both achieving all measures and adequately compensating for the impact,
- Moderately Successful projects received one "Yes" rating and one "Somewhat" rating,
- Not Successful projects received a "No" for both achieving measures and compensating for the impact,
- Minimally Successful projects involved all other combinations of "Yes," "Somewhat," and "No."

Results
The overall result of the combination of the two ratings is represented in Table 3.4. For project-specific results refer to Table 4 in Appendix A.

Table 3.4 Number of Projects Attaining the Factors Indicating Success

	Yes	Somewhat	No
Achieving Measures	7	12	5
Compensating for the Impact	9	6	9
Doing Both (Level of Success)	3 **Fully**	16 **Moderately or**	5 **Not**

	Successful	Minimally Successful	Successful

Figure 3.16 illustrates the distribution of the 24 projects by category of success.

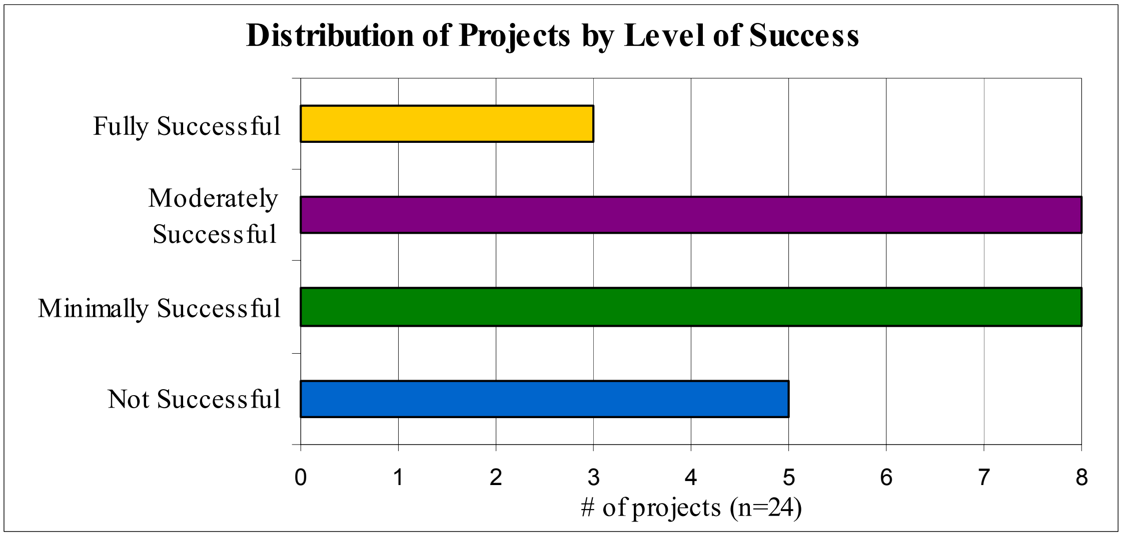


Figure 3.16 Distribution of 24 projects into four levels of success, based on whether the project compensated for the impacts to wetlands and whether the project achieved its ecologically relevant measures.

Of the 24 projects considered:

- Three projects (13%) were fully successful,
- Eight projects (33%) were moderately successful,
- Eight projects (33%) were minimally successful,
- Five projects (21%) were not successful.

<u>Discussion</u>

Thirteen percent of mitigation projects were judged to be fully successful, while more than half of the projects evaluated (54%) were minimally successful or not successful. This is consistent with results from other studies, which have found success rates from 12 to 50 percent, though a variety of criteria were used to define success (Holland and Bossert, 1994; Michigan Dept. of Environmental Quality, 2000; Morgan and Roberts, 1999; Redmond, 1992). However, interpreting the results another way suggests that the majority of projects (66%) are mediocre (moderately or minimally successful).

It is interesting to note that all of the projects that were judged to be not successful were also not built to plan according to the Phase 1 study (Johnson et al., 2000). For more discussion of this issue, refer to section 3.6.3.

3.3.1 Level of Success by Type of Mitigation Activity

Since there are three primary mitigation activities currently in common use (creation, restoration, and enhancement) it is important to examine the level of success of each type of mitigation activity. For a definition of the mitigation activities refer to section 2.3.1; for a description of how projects were assigned to a particular activity see section 3.1.1.1.

Results

Refer to Figure 3.17 below.

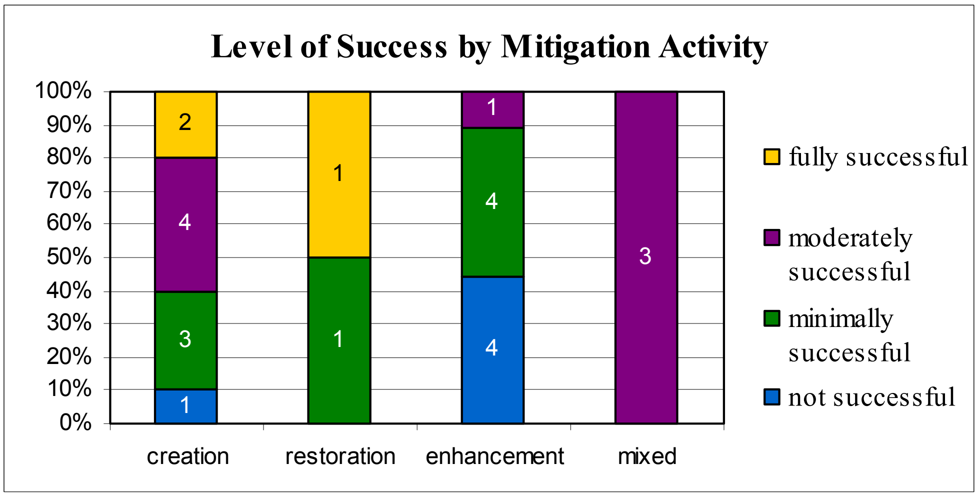


Figure 3.17 Comparison of level of success for each of the mitigation activities evaluated. Projects were assigned to a mitigation activity based on the predominate activity performed (>75% of the required mitigation acreage). n=24 projects.

Discussion

The results (Figure 3.17) show that, of the three fully successful projects, two (67%) were predominantly created wetlands, while one (33%) was a restored wetland. None of the enhancement projects were fully successful. Of the five projects that were not successful, four (80%) were enhanced wetlands, while one (20%) was a creation project.

The level of success of enhanced wetlands was significantly lower than the level of success of created wetlands ($p<0.05$) (Mann-Whitney U test – Sokal and Rohlf 1969).

3.3.1.1 Restoration and Mixed-Activity

The sample size of restoration and mixed-activity projects was too small to draw any relevant conclusion about the overall success of those activities. However, neither category had projects that were evaluated to be not successful. In regard to the mixed activity projects, all were a combination of creation/restoration and enhancement. Based on the level of success of enhancement projects, it could be speculated that the mixed projects did as well as they did (all were moderately successful) because enhancement comprised only about half of the wetland area.

3.3.1.2 Wetland Creation

The results of the Phase 2 study indicate that created wetlands are more successful than previous studies have shown. For example, 87 percent of the acreage required to be created was established, 60 percent of the creation projects were at least moderately successful, and only one project (10%) was not successful.

In comparison, a recent Michigan study of compensatory wetland mitigation found that only 50 percent of the total acreage required to be created had been established, and 29 percent of creation projects established the required acreage. Only 22 percent of the creation projects were determined to be successful according to the criteria used (Michigan Department of Environmental Quality, 2000).

An Ohio study found that about 66 percent of the total acreage required to be created was established, and 40 percent of projects established the required acreage. According to the criteria used, 80 percent of the created wetlands were found to be at least moderately successful (Wilson and Mitsch, 1996).

3.3.1.3 Enhancement

The Phase 2 results indicate that eight out of nine (89%) enhancement projects were minimally or not successful, and no enhancement projects were fully successful. From these results, it is apparent that enhancement projects are not as successful as the other mitigation activities evaluated. In fact, enhancement projects were significantly less successful than creation projects (see Figure 3.17).

It is acknowledged that enhancement activities result in a net loss of wetland acreage, since no new wetland area is established to compensate for the wetland area lost as a result of the authorized impact. The rationale for allowing the losses of area has been that mitigation would instead significantly enhance the performance of wetland functions in an existing wetland with degraded wetland functions.

The primary emphasis of enhancement projects has been targeted at improving wildlife habitat by:

- Adding structural diversity (e.g., planting shrubs and trees in a pasture),
- Adding vegetative diversity (e.g., planting numerous species of shrubs and trees),
- Adding open water (e.g., excavating permanent ponds for waterfowl habitat).

There are two main reasons for the low level of success among enhancement projects evaluated in Phase 2:

1. The enhancement project did not achieve the proposed vegetative structure and/or diversity (e.g., failed to achieve ecologically relevant measures).

> **For example:**
> A project (#334) proposed to enhance a degraded pasture by adding vegetative structure and diversity. Numerous trees and shrubs in a variety of species were planted, but after three years (at the time of the site visit), virtually none of these plants had survived and no natural colonization was observed. The site was essentially the same as it was prior to enhancement. This project failed to establish the required acreage of enhancement, and it did not compensate for the impact. Thus, it was judged to be not successful.

2. The enhancement project achieved the proposed structure and/or diversity, but despite this, it did not adequately compensate for the wetlands lost (i.e., it provided a low level of contribution to the performance of wetland functions and/or it did not provide functions over a sufficient enough area).

For example:
A project (#243) implemented what was required (planting and establishing trees and shrubs), and the project was achieving its ecologically relevant measures. However, the results of the function assessment and site evaluation indicated that this project was not adequately compensating what was lost. The moderate to minimal contribution to functions did not provide enough of a gain in functions over the acreage required to compensate for the original wetland impact. This suggests that what was originally required as mitigation was not sufficient. Thus, the project was judged to be minimally successful.

The Phase 2 results indicate that enhancement activities generally do not provide a high contribution to the improvement of wetland functions. This is not to say that enhancement sites are not potentially performing important wetland functions, but many of those functions already had the potential to be performed prior to the mitigation project's implementation. In order to compensate for the wetland acreage lost, the enhancement activity should provide a moderate to high gain in function potential above what the enhancement site previously had the potential to perform, or provide a minimal contribution over a much larger enhancement area.

3.3.2 Level of Success vs. Age of Mitigation

A question that is often raised when evaluating the "success" of wetland mitigation projects is whether older sites are more successful than younger sites. To attempt to answer this question, the age of mitigation projects was compared with the level of success of the 24 projects evaluated in Phase 2. See Figure 3.18.

Results

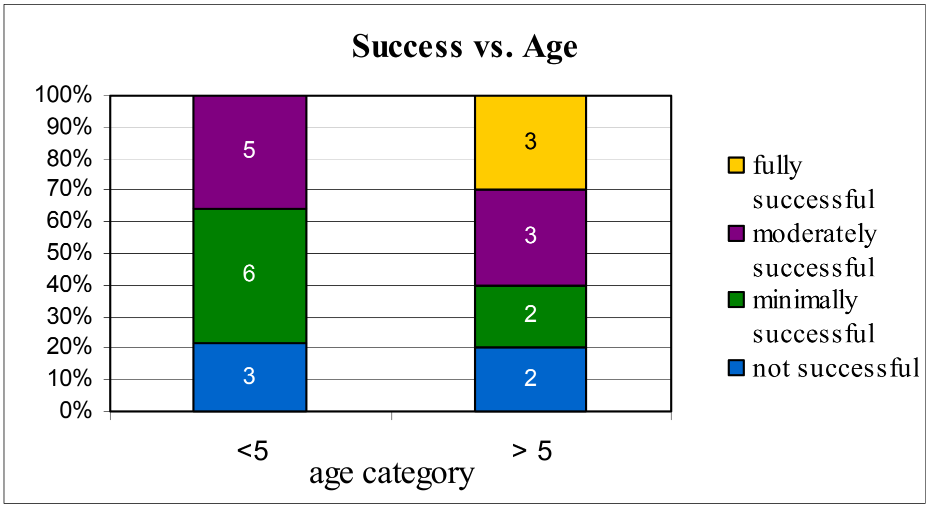


Figure 3.18 Comparison of the level of success for two age categories of mitigation projects: 14 projects <5 years old, and 10 projects ≥5 years old.

<u>Discussion</u>
It would seem logical that older sites would be more successful than younger sites. The longer a project has been established, the better it should be providing wetland functions. The results show (Figure 3.18) that 60 percent of older projects were at least moderately successful, while 36 percent of younger projects were at least moderately successful. However, both age categories had about the same proportion of projects that were not successful (20%), and the difference in the level of success between the two age categories was not statistically significant. This could be interpreted to mean that some projects are simply not successful, regardless of the age of the project.

3.3.3 Level of Success vs. Size of Mitigation

<u>Methods</u>
Size of the wetland mitigation project also may be a factor in the success of a project. Projects were broken out by the size of the required wetland mitigation acreage and assigned to one of three categories:

1. Projects required to establish less than one acre of wetland (<1 acre),
2. Projects required to establish one to five acres of wetland (≥1 but <5 acres),
3. Projects required to establish five acres or more of wetland (≥5 acres).

Required buffer and wetland preservation acreages were not included in the definition of the "required wetland mitigation acreage" and, therefore, did not have any bearing on the size category that a project was assigned to.

<u>Results</u>
See Appendix A, Table 1 for information on sizes of specific projects and Table 4 for level of success of specific projects.

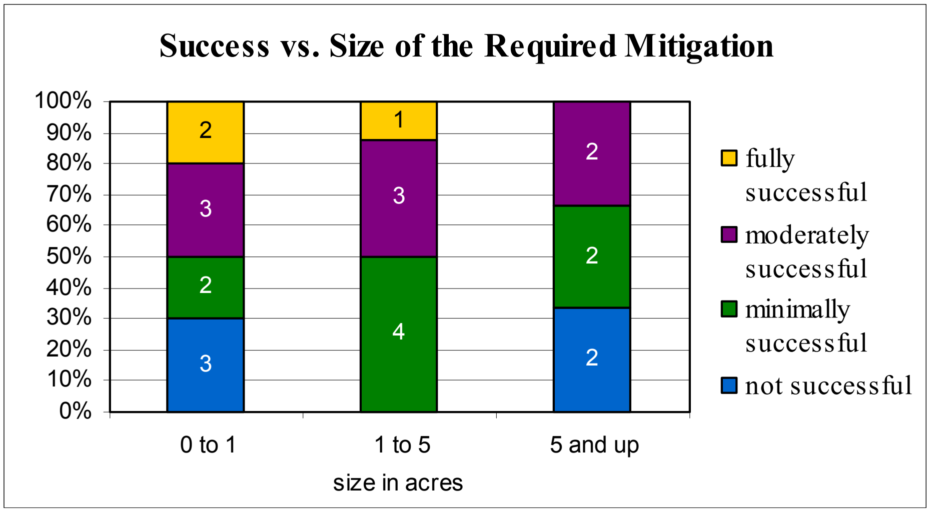


Figure 3.19 Comparison of the level of success for three size categories of required acreage of mitigation projects (n=24).

Discussion

The results (Figure 3.19) of the Phase 2 study reveal no statistically significant difference in the level of success between the three size categories. However, there were no fully successful projects in the five acres and greater category, and all of the projects in the 1-to-5-acre category were judged to be at least minimally successful. The results appear to suggest that smaller projects may be more successful. However, a study of wetland mitigation projects in Massachusetts found that larger projects were more likely to successfully comply with requirements than smaller projects (Brown and Veneman, 2001).

3.3.4 Level of Success by Type of Proponent and Location

3.3.4.1 Private vs. Public

Results were analyzed to compare the level of success of mitigation projects implemented by private entities to the level of success of mitigation projects implemented by public entities. As mentioned in section 2.2.1 (see footnote 2, p.4), WSDOT's mitigation projects were not included in the Phase 2 study and, therefore, were not a part of the "public" projects.

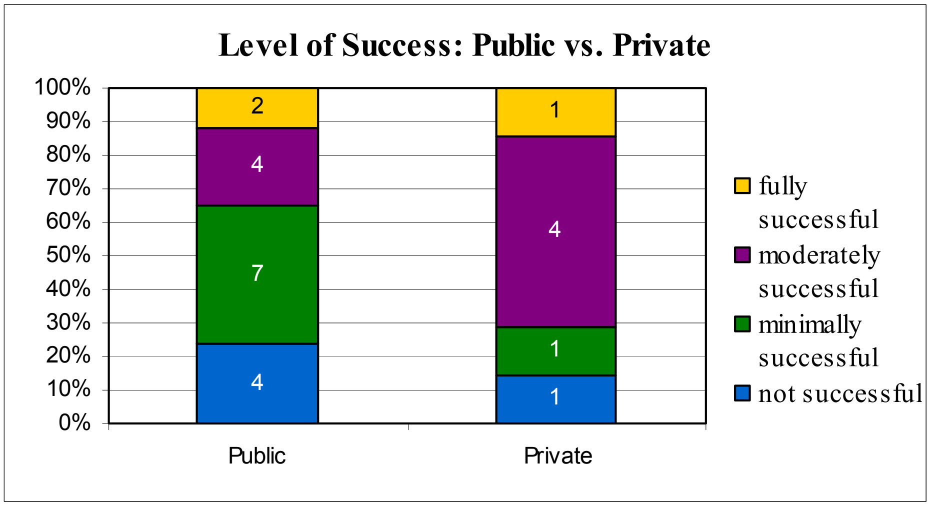


Figure 3.20 Comparison of the level of success as a percentage of mitigation projects implemented by private (7 projects) vs. public (17 projects) entities. n=24 projects.

Though there was not a statistically significant difference in the level of success between public and private entities, Phase 2 results (Figure 3.20) indicate that projects by private entities had a higher level of success than projects by public entities; 71 percent of “private” projects were at least moderately successful, while 65 percent of “public” projects were no better than minimally successful. In fact, public entities were the proponents on four out of the five projects (80%) judged to be not successful. However, half of the fully successful projects were public, while the other half were private.

3.3.4.2 West vs. East

Phase 2 results (Figure 3.21) indicate that 56 percent of the projects in Western Washington were moderately successful or better, while in Eastern Washington, 83 percent of the projects were no better than minimally successful, and 33 percent of projects were not successful.

Though there is an observable difference in the level of success between west-side projects and east-side projects, it is not statistically significant.

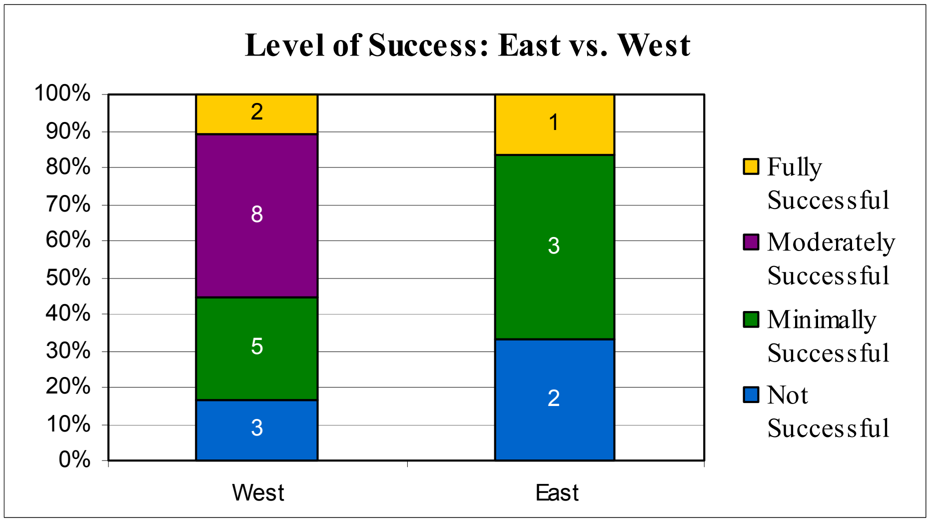


Figure 3.21 Level of success by percentage of projects located west of the Cascade crest (18) and east of Cascade crest (6). n=24 projects.

3.3.4.3 Discussion

Statistical methods did not reveal a significant difference in the level of success between west-side and east-side projects nor between private and public projects. However, Figure 3.20 and Figure 3.21 illustrate that there is an observable difference in the level of success for these analyses.

Both the lack of statistical significance and the poor showing by east-side projects could be due to the small sample size of projects. However, all applicable mitigation projects in Eastern Washington were included in the Phase 1 study, and only one of these projects was eliminated from Phase 2[13].

A confounding factor for the analysis of level of success by type of proponent and by location is that all of the eastern projects were implemented by public agencies. In addition, of the 10 public entity projects that were minimally or not successful, half of them (5 projects) were located on the east-side. However, if the western projects are considered separately, there is still an observable difference between private and public, but it is less striking (and still not statistically significant). See Figure 3.22.

[13] Project #7E was eliminated from Phase 2 consideration, because the mitigation area was indistinguishable from the adjacent wetlands, and determining the established acreage of mitigation would have been impossible.

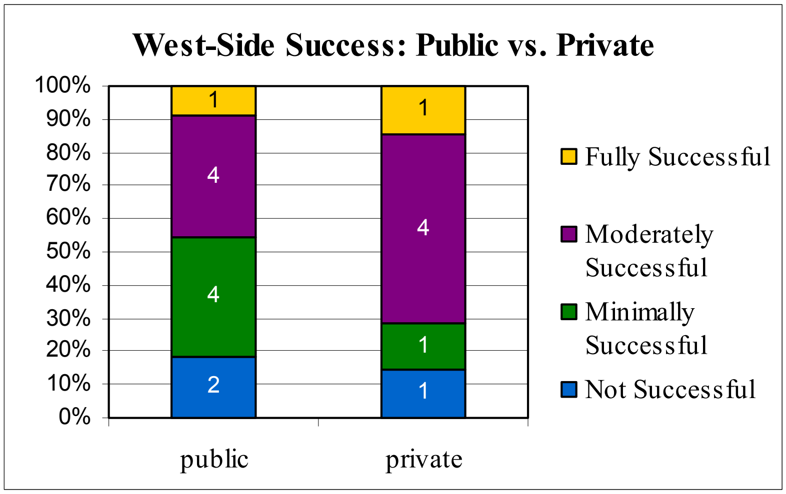


Figure 3.22 **C**omparison of projects done by private and public entities on the west-side. Level of success is by percentage of projects in each category.

It is not clear what, if any, relationship exists between the low level of project success on the east-side of the state and the low level of success of projects implemented by public entities. Regardless of the interpretation, the Phase 2 results do raise concerns about the success of mitigation projects done in Eastern Washington as well as mitigation projects done by public entities.

3.4 Wetland Resource Tradeoffs

One of the components of the overall success of a mitigation project was whether it adequately compensated for what was lost. For Phase 2, this was evaluated in terms of a mitigation project's contribution to functions, as well as the type and scale of wetland functions provided. However, compensating for impacts traditionally has been evaluated in terms of whether the mitigation was "in-kind" (e.g., same Cowardin class, same HGM subclass), "on-site" (e.g. located on the same property as the wetland impact), and of the same or higher wetland category.

In-kind and on-site compensation was not one of the considerations in evaluating the overall success of a mitigation project in Phase 2. However, whether the mitigation project provided the same wetland resources by type, location, and category as the wetlands lost was analyzed to understand what, if any, tradeoffs may be occurring as a result of mitigation policies.

3.4.1 In-Kind

The term "in-kind wetland mitigation" was applied to two analyses:

- Was the wetland mitigation project the same kind of Cowardin class?

- Was the wetland mitigation project the same kind of HGM subclass (see definition p.11)?

Cowardin class refers to the dominant vegetation type of the wetland (e.g., emergent, scrub-shrub, forested, aquatic bed, or open water). Scrub-shrub and forested classes must have greater than 30 percent cover by shrub or forest species (Cowardin et al., 1979).

3.4.1.1 Cowardin Class

Methods

One question that the Phase 2 study set out to answer concerned whether Washington state is losing certain Cowardin classes as a result of authorized impacts to wetlands, and disproportionately replacing that loss with other Cowardin classes. To examine this, background information was compiled to ascertain the acreage of impacts to each Cowardin class. For the mitigation sites, the site assessment team collected Cowardin class information during the site visits.

Acreage of Cowardin classes provided as a result of mitigation activities were categorized in the following manner:

For projects that created and/or restored new wetland area, the acreage of each Cowardin class found on-site was considered a **GAIN** of new acreage for the respective Cowardin class.

However, since enhancement projects occur in existing wetlands, some Cowardin class was present on the site prior to the commencement of any mitigation activity. This often resulted in an exchange of Cowardin classes.

For projects that enhanced wetlands, if one Cowardin class, such as emergent, was converted to another Cowardin class, such as scrub/shrub, then this was considered a **LOSS** in emergent acreage and a **GAIN** in scrub/shrub acreage.

For projects that enhanced wetlands, if the site was emergent before the mitigation activity and it remained emergent after the mitigation activity was completed then **NO CHANGE** in Cowardin class occurred

For example:
If a wetland enhancement project was meant to establish shrub cover on 3-acres of degraded pasture, but shrubs were found to cover only 1-acre, then this would be a **GAIN** of 1-acre for scrub/shrub, a **LOSS** of 1-acre of emergent, and **NO CHANGE** in 2-acres of emergent.

Table 3.5 summarizes the observed trade-offs in Cowardin class for 23 of the 24 mitigation projects evaluated in Phase 2[14]. For site-specific Cowardin class information please refer to Table 7a and 7b in Appendix A.

Results

Table 3.5 Acreage of Cowardin Classes Lost vs. Cowardin Classes Mitigated.

Acreage of IMPACT				Acreage of MITIGATION					
	OW/AB	**FO/SS**	**EM**	**OW/AB gain**	**FO/SS gain**	**FO/SS no change**	**EM gain**	**EM no change**	**EM loss**
West Side	0.06	4.99	48.09	15.98	19.57	1.87	20.67	46.29	-26.07
East Side	0.60	2.293	1.261	0.88	0	0	2.954	8.207	0
State Total	**0.66**	**7.29**	**49.35**	**16.86**	**19.57**	**1.87**	**23.62**	**54.50**	**-26.07**
Net Gain Cowardin				**+16.20**	**+12.28**				
Net Loss Cowardin									**-51.80**

OW/AB=open water/ aquatic bed, FO=forested, SS=scrub/shrub, EM=emergent.

Twenty-three projects were considered[14].

- Total acreage of mitigation = 116.42 (areas of "gain" + areas of "no change")
  - Established acreage of mitigation for the 23 projects = 107.83 acres
  - 2 enhancement projects (#334 & #29E) were judged "not successful" because all the enhancement activities failed. The wetland acreage for these two projects was not included in the total established acreage of mitigation, but was included in the Cowardin class analysis as "no change" area (0.10 SS no change and 8.49 EM no change).

- Net Gain is the amount of new area in a Cowardin class minus the area of that Cowardin class lost to permitted wetland impacts.
  - 16.86 acres of new OW/AB minus 0.66 acres of impacts to OW/AB, resulting in a NET GAIN of 16.20 acres of OW/AB.
  - 19.57 acres of new FO/SS minus 7.29 acres of impacts to FO/SS, resulting in a NET GAIN of 12.28 acres of FO/SS.
  - 23.62 acres of new EM minus 49.35 acres of impacts to EM and 26.07 acres of EM converted to other Cowardin classes as a result of mitigation activities, resulting in a NET LOSS of 51.80 acres of EM.

[14] One project (#89) was excluded, because it did not have specific background information on either the impact or the mitigation site prior to enhancement and creation activities.

- Another way to look at the numbers is to add up all of the gains (16.86 + 19.57 + 23.62 = 60.05) minus the losses from Cowardin class conversions (60.05 – 26.07 = 33.98) and compare this number to the area of authorized impacts to wetlands of all Cowardin classes.
  - 33.98 acres of gained wetland area compared to 57.30 acres of impacts to wetlands (0.66 + 7.29 + 49.35).
  - For the 23 projects considered in this analysis, new wetland area replaced only 60 percent of the wetlands lost. There was, therefore, a NET LOSS of 23.32 acres of wetland.

Net Loss of Wetland Area:
If project #89 (see footnote 13) is added into this computation, the result is:
GAINED wetland area (0.63 acre + 33.98 = 34.61) compared to
LOST wetland area (1.49 acres + 57.30 = 58.79) results in (58.79 – 34.61)
A NET LOSS of 24.18 acres of wetland

Forested and scrub/shrub acreages were combined for a couple of reasons. Background information about the Cowardin class of the wetland losses was vague for several projects. Forested and scrub/shrub often were described as one category and it was impossible to determine the exact amount of acreage for each. For the established acreage of mitigation, forested and scrub/shrub areas were combined, because much of the area evaluated as scrub/shrub was vegetated with young tree species and will become forested in the next few years. Of the nearly 20 acres of mitigation area categorized as FO/SS, it is estimated that about 66 percent will eventually be forested. In addition, all of this area was either completely or predominantly composed of native shrub or tree species.

Background information from the delineation reports and mitigation plans was used to estimate how much of the lost emergent area was non-native. Information collected during the site assessments was used to determine how much of the emergent mitigation areas were either native or non-native.

- Of the 49.35 acres of impacts to emergent wetlands, nearly 90 percent was non-native dominated, degraded pasture.
- Of the 26.07 acres of emergent area lost because mitigation activities converted them to another Cowardin class, 90 percent was non-native dominated, degraded pastures.
- Of the 54.50 acres of unchanged emergent area:
  - 70 percent was dominated by non-native species,
  - 30 percent was dominated by native, emergent species,
  - Nearly 100 percent of the area was non-native before enhancement activities were implemented, and
  - Enhancement activities on four projects resulted in native, emergent communities on at least a portion of the site.
- Of the 23.62 acres of emergent area gained as a result of creation or restoration:
  - 70 percent was non-native dominated,
  - 30 percent was dominated by native, emergent species,

- One large mitigation project, which accounted for 15.34 acres (65% of the emergent acreage listed above), was dominated by non-native species, and
- 12 projects were dominated by native, emergent, wetland communities.

Discussion

The analysis of Cowardin class results revealed that not only was there a net loss of emergent wetlands (51.80 acres), but there was also a significant net loss of wetland area; 24.18 acres of net wetland area has been lost as a result of the 24 permitted projects evaluated in this study.

The net loss of emergent wetlands (51.8 acres) is due to wetland impacts as well as to mitigation projects converting existing emergent wetlands to forested/scrub-shrub (FO/SS) or open water/aquatic bed (OW/AB) wetlands. **Although this seems like a startling loss, the vast majority of the emergent acreage lost to impacts or conversion was degraded pasture, dominated by non-native species (90%).** Likewise, 70 percent of the created emergent acreage was predominantly non-native. However, this was the result of one large non-native-dominated project that accounted for 65 percent of the new emergent acreage. The remainder of the projects created new emergent areas that were predominantly native, plant communities. It should be noted that a few enhancement projects (4) transformed some areas of non-native, degraded pasture into predominantly native, emergent communities, although these areas would have been considered EM no change.

Phase 2 results indicate that there has been a net gain of 12.3 acres of FO/SS wetlands. Though some of this area was created or restored (~4 acres), the gain in FO/SS acreage is primarily due to the conversion of emergent wetlands. Since many of the areas probably were historically FO/SS wetlands prior to conversion for agricultural uses, the wetland mitigation projects may be contributing to regional efforts to re-establish historic vegetation communities.

The net gain in OW/AB wetland areas (16.2 acres) was also primarily a result of converted emergent areas. Though generally considered aesthetically pleasing, many of the OW/AB wetland areas (44%) often result in mitigation projects that are an atypical HGM class (see section 3.4.1.2), such as excavated ponds with steep banks, or ponds excavated in a landscape setting where they would not naturally occur.

3.4.1.2 Replacement of Hydrogeomorphic (HGM) Subclass

Methods

The assessment team collected data to determine

- Whether the wetland mitigation project was of the same HGM subclass as the wetland lost, and
- Whether the wetland mitigation project was of an atypical HGM subclass.

An **atypical** subclass was defined as one that would not normally or naturally occur in that area or landscape position (Gwin et al., 1999). It included:

- Depressional out-flow wetlands with an exaggerated morphology (e.g., banks too steep),
- Depressions excavated in a slope wetland,
- Projects using a water-control structure (e.g., constructed weir or artificially controlled water inputs).

Results

Twenty-four mitigation projects were evaluated to determine whether the wetland mitigation project was the same HGM subclass as the wetlands lost.

- 13 projects (54%) were of the same HGM subclass as the wetlands lost.
- Four projects (17%) were partially the same HGM subclass as the wetlands lost. This occurred when there were impacts to wetlands of more than one HGM subclass, but the mitigation project had only one HGM subclass; or when the mitigation project consisted of multiple sites with more than one HGM subclass and not all of them were the same as the HGM subclass lost.
- Seven projects (29%) were not of the same HGM subclass as the wetlands lost.
    - 1 project (#50E) did not establish wetland conditions and, therefore was not the same HGM class,
    - 2 projects (#193 and 400) replaced slope wetlands with an atypical depression in slope or depressional out-flow,
    - 1 project (#378) replaced a depressional out-flow wetland with an atypical depressional out-flow that had exaggerated bank morphology,
    - 1 project (#294) replaced a depressional out-flow wetland with a depressional closed wetland, and
    - 2 projects on the east side (#10E and 14E) replaced depressional short duration wetlands with depressional long duration wetlands.

The 23 projects establishing wetland conditions were evaluated to determine whether the mitigation was of an atypical HGM subclass:

- 15 projects (65%) were judged to be typical or natural HGM subclasses,
- Six projects (26%) were atypical HGM subclasses, and
- Two projects (8%) were somewhat atypical, meaning that one site was typical or natural, but another portion of the project was atypical.

See Table 6 in Appendix A for project-specific information on HGM subclasses.

Discussion

More than half of the wetland mitigation projects evaluated in this study (54%) were the same HGM subclass as the wetlands lost, and 65percent of projects were considered typical subclasses. Of the 30 sites evaluated (for 23 projects), 10 (30%) were atypical, and all but one were less than five years old. This may indicate that in urban and urbanizing areas, on-site space for mitigation is limited, and therefore, more recent projects are utilizing atypical designs to maximize replacement ratios and "fit" mitigation projects onto a site.

Gwin et al. (1999) used HGM classification to determine what kind of landscape level changes or trade-offs were taking place within their study area. They concluded, "wetland morphology and associated hydrodynamics that evolved in a particular landscape setting have been replaced with a HGM form that does not naturally occur." Phase 2 results indicate that in 30 percent of the sites evaluated a HGM trade-off occurred to a form that does not naturally occur.

Gwin et al. (1999) advised careful consideration of the "positive and negative consequences of changing the relative abundances of wetland types". In regard to some of the atypical sites evaluated in Phase 2, positive consequences include improved water quantity functions, particularly in areas prone to floods, and improved waterfowl habitat.

The negative consequences include exchanged or possibly diminished wildlife habitat, particularly for native amphibians. For example, if a seasonally ponded wetland is replaced with an atypical permanently ponded depression with exaggerated morphology, habitat for native amphibians may be lost and replaced with habitat for non-native bullfrogs. In addition, atypical HGM subclasses may not be as sustainable, particularly if human manipulation is required to maintain wetland conditions. For example, a water control structure or berm may fail and potentially drain the wetland or cause downstream flooding.

However, many of the negative consequences associated with atypical HGM subclasses would likely result from typical HGM subclasses located in an urban setting, such as diminished wildlife habitat, and altered water regime due to surrounding land-use changes (Azous and Horner, 1997).

3.4.2 Wetland Category

Of the 31 sites (for 24 projects) evaluated, 28 were rated using Ecology's Wetland Rating System. Background information on the category of wetlands prior to impacts often was lacking, as was background information on the category of pre-existing wetlands prior to enhancement activities. Therefore, it is not possible to compare the wetland categories of the mitigation projects to those of the wetlands that were lost.

All sites were rated as either Category 2 or Category 3.

- 11 sites were rated a Category 2 wetland.
- 17 sites were rated a Category 3 wetland.
- Two sites were not rated.
  - One project was not a wetland; therefore, it was not rated.
  - One project was a long, linear, intermittent creek that did not fit the rating system.

See Table 1 in Appendix A for project-specific results of wetland ratings from Phase 2 site visits.

3.4.3 On-site Vs. Off-site

All 24 wetland mitigation projects evaluated in the Phase 2 study were established in the same basin[15] as the original wetland impact.

Of the 24 projects, 22 (92%) were established on-site (on the same property as the wetlands lost). Two projects (8%), #116 and #29E, were established off-site but within five miles of the wetland lost. Two projects (#89 and #294) had off-site wetland mitigation components that were not assessed by this study:

- #89 had an off-site wetland enhancement area, and
- #294 had an off-site wetland preservation area.

The high percentage of projects that were done on-site may be due to the fact that most of the projects evaluated in this study were permitted between five and nine years ago. Since that time, a landscape level approach to mitigation and managing resources from a watershed perspective (Bedford, 1996) has become more accepted. A study of projects permitted more recently may result in a higher percentage of projects that were done off-site.

3.5 Ecological Condition

Another concept that was explored as a way to further evaluate "ecological success" was an analysis of ecological health or condition. However, ecological condition was difficult to define, and the authors could not reach consensus on how to define or evaluate it.

For concerned regulators and scientists, several factors are generally considered useful for judging the condition of a site, such as, surrounding land uses, buffers and corridors, water regime, soil type, number and diversity of invertebrates and plants, etc.

Unfortunately, information on the factors does not result in an overall rating of the ecological condition of a mitigation project. Currently, there is no accepted quantitative measure or judgment-based method for evaluating the various factors and determining an overall rating of condition. Therefore, the ecological condition of a mitigation project was not used to evaluate the overall success of a project.

Though the authors were unable to develop an approach for evaluating ecological condition, some data collected for the Methods for Assessing Wetland Functions (Hruby

[15] Area that drains into a particular river, stream, or creek.

et al., 1999)[16] are related to the factors often used in making personal judgments about ecological condition. The data include:

- Land uses around the mitigation site (within 1 km),
- Quality of the buffer around the site,
- Quality of any riparian corridors or connections to other habitat areas from the site,
- Number and types of water regimes present at the site,
- Dominance by non-native, invasive plant species.

The data collected on each factor is summarized in the following subsections. For site-specific information related to ecological condition refer to Table 5 in Appendix A and the project-summaries in Appendix F.

3.5.1 Land Use

Methods
Land uses within one kilometer (km) of each mitigation site were estimated for all 31 sites (for 24 projects). Land uses were estimated from an aerial photo according to the method described in (Hruby et al., 1999) and were reported by percentage. Land uses included: undeveloped forest; agriculture; clear-cut logging; urban/commercial; high-density residential; low-density residential; and undeveloped areas (e.g., shrubland, wetlands, open water). However, to analyze ecological condition, the seven land uses were combined into three categories:

- Developed (commercial and residential)
- Agriculture/clear-cut logging
- Undeveloped/forest/shrub

For each of the 31 sites evaluated, the percent area of each land use category was assigned to one of three broad percentage groups:

- < 33 percent within 1 km of the mitigation site;
- 33 – 66 percent within 1 km of the mitigation site; and
- > 66 percent within 1 km of the mitigation site.

Results
Figures 3.23, 3.24, and 3.25 depict the percent of developed, agricultural, and undeveloped areas, respectively, around the 31 mitigation sites evaluated.

[16] Two projects (#10E and 14E) were assessed using the procedures and data collection forms for Depressional Wetlands in the Columbia Basin of Eastern Washington (Hruby et al., 2000).

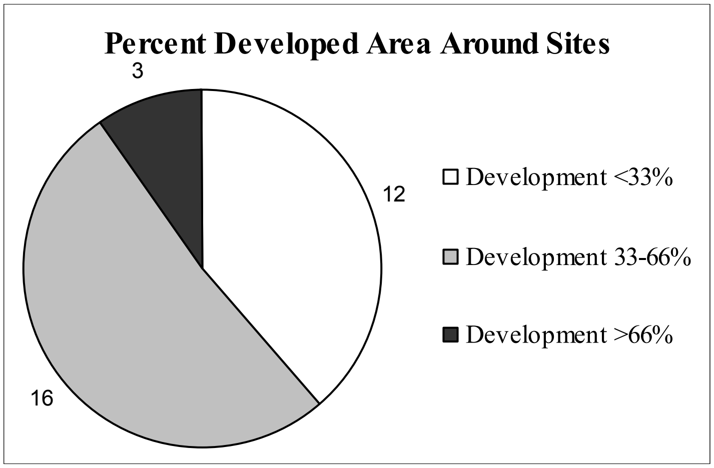


Figure 3.23 Distribution of mitigation sites by percent of developed area within 1 km of each (n=31). Developed areas included urban/commercial, high-density residential, and low-density residential.

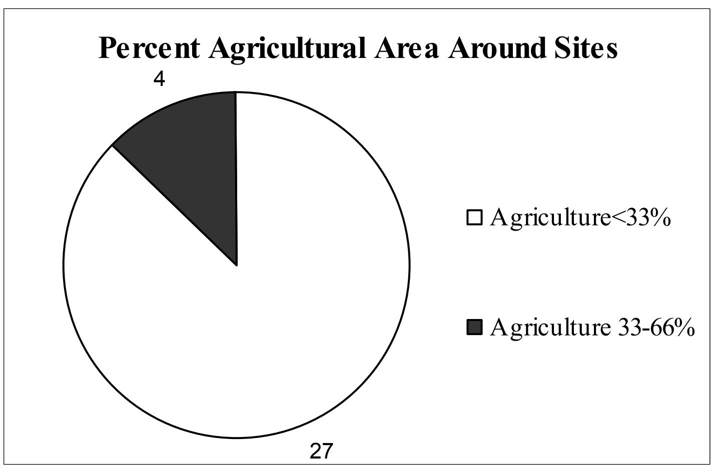


Figure 3.24 Percent of agricultural area within 1 km of each site (n=31). Agricultural areas included croplands, pasture, and clear-cut logging.

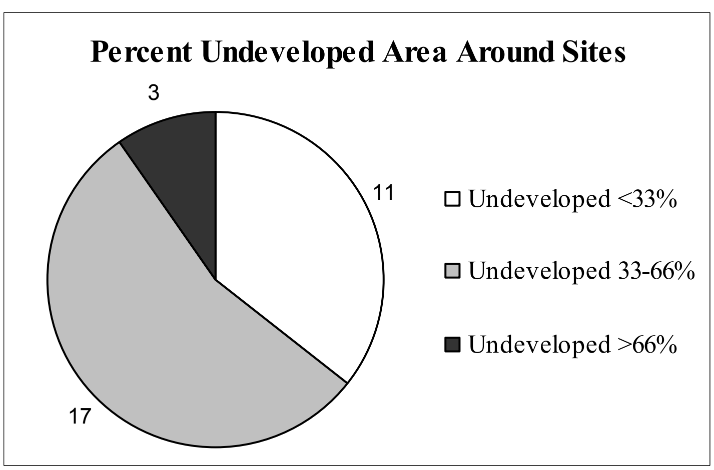


Figure 3.25 Percent of undeveloped area within 1 km of each site (n=31). Undeveloped areas included managed and unmanaged forests, shrublands, grasslands that are not grazed, wetlands, and open water.

3.5.2 Buffers

Methods
Characteristics of the buffer around each mitigation site were assessed during the site visit and using a recent aerial photo. The assessment team did not focus on buffer areas specifically required in a permit or mitigation plan, rather, buffers were assessed based on existing land uses adjacent to the sites.

Buffers were rated according to the width, relative disturbance, and extent of the buffer at the time of the site visit (Hruby et al., 1999). The ratings are as follows:

- High – 100 meters (330 feet) of forest, scrub, relatively undisturbed grassland, or open water for greater than 95% of the circumference around the site. A clear-cut older than 5 years would qualify. No developed areas should be within the undisturbed part of the buffer.
- Moderately high – 100 m of forest, scrub, relatively undisturbed grassland, or open water for greater than 50% of the circumference around the site; OR 50 m (170 ft) of forest, scrub, relatively undisturbed grassland, or open water for greater than 95% of the circumference around the site. No developed areas should be within the undisturbed part of the buffer.
- Moderate – 100 m of forest, scrub, relatively undisturbed grassland or open water for greater than 25% of the circumference around the site; OR 50 m of forest, scrub, relatively undisturbed grassland, or open water for greater than 50% of the circumference around the site. No developed areas should be within the undisturbed part of the buffer.
- Moderately low – No paved areas or buildings within 25 m (80 ft) for greater than 95% of the circumference around the site; OR no paved areas or buildings within 50 m for greater than 50% of the circumference around the site. Pasture and lawns would qualify.
- Low – Does not fit in any of the other categories. Has paved areas or buildings within 25 m for greater than 5% of the circumference around the site; OR has paved areas/buildings within 50 m for greater than 50% of the circumference of the site.
- None – Vegetated buffers are less than 2 m (6.6 ft) for greater than 95% of the circumference around the site.

Results
See Figure 3.26.

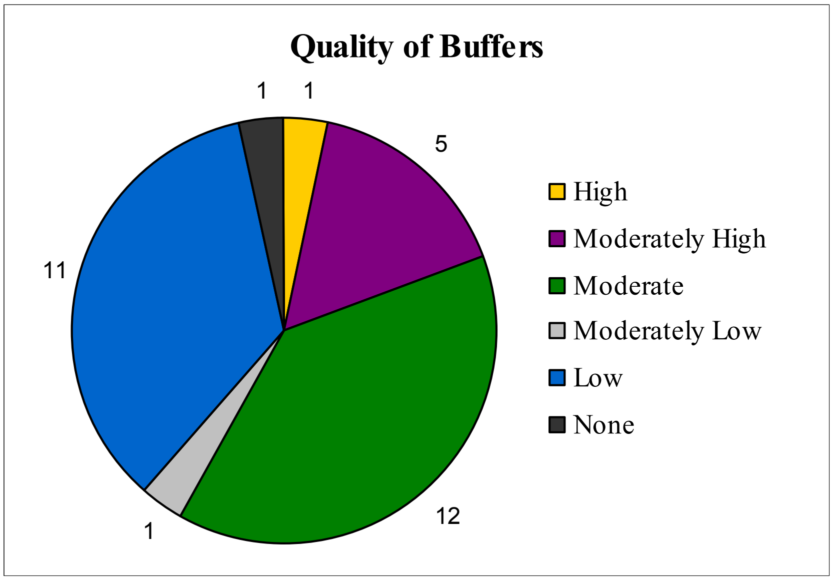


Figure 3.26 Rating of buffers around mitigation sites (n=31).

3.5.3 Corridors

Methods

The assessment team assessed the presence and condition of riparian or upland corridors to large wetland or upland habitat areas during the site visit using a recent aerial photo. The corridors were rated according to the width, vegetation type, and size of connected habitat (Hruby et al., 1999). Ratings of corridors are as follows:

- High
  - The site is part of a riparian corridor greater than 50 meters (170 ft) wide connecting two of more wetlands within 1 km with at least 30% shrub or forest cover in the corridor; OR
  - The site is connected to a corridor greater than 50 m wide with greater than 30% cover of forest or shrub to a natural upland area or open water that is greater than 100 hectares (247 acres) in size.
- Moderate
  - The site is part of a riparian corridor greater than 25-50 m (85-170 ft) wide connecting to other wetlands with at least 30% shrub or forest cover in the corridor; OR
  - The site is connected to a corridor 10-50 m (34-170 ft) wide with forest or shrub cover to a relatively undisturbed upland or open water that is greater than 10 hectares (25 acres) in size; OR
  - The site is connected to a relatively undisturbed corridor greater than 50 m wide to an undisturbed upland or open water area greater than 10 ha in size.

- Minimal
  - The site is part of a riparian corridor greater than 5 m (17 ft) wide with relatively undisturbed vegetation (grasslands and abandoned pasture qualify) that extends for greater than 1 km; OR
  - Any vegetated corridor 5-50 m wide between the site and any relatively undisturbed area or open water that is greater than 2.5 ha (6.2 acres) in size.
- None – The site does not have a corridor that fits any of the previous descriptions.

<u>Results</u>

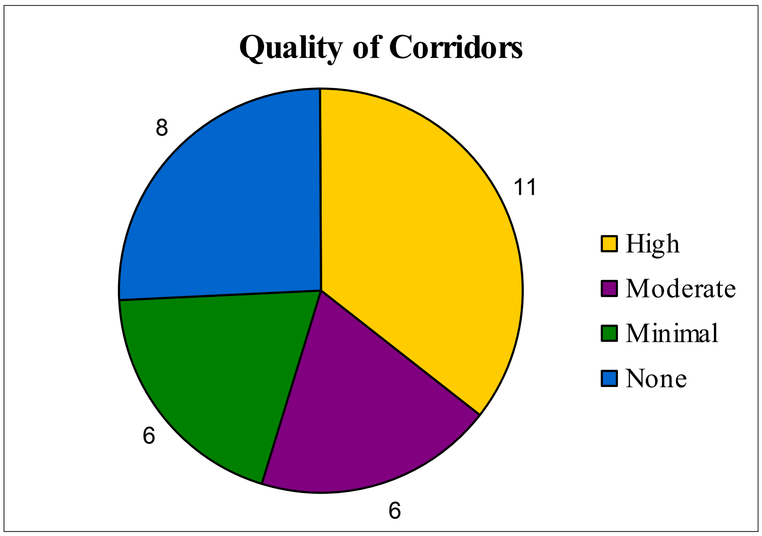


Figure 3.27 Rating of corridors to and from mitigation sites (n=31).

3.5.4 Water Regime

<u>Methods</u>
Water regime, for this analysis, refers to the duration and extent of inundation or saturation on a site. During site visits, the assessment team recorded the presence of each water regime that was observed or assumed to be present (based on hydrologic indicators) on at least a quarter acre or 10 percent of the site. Water regime categories were taken from the <u>Methods for Assessing Wetland Functions Volume 1</u> (Hruby et al., 1999) and are as follows:

- Permanently inundated or flooded,
- Seasonally inundated or flooded for greater than one month (#10E and 14E = inundated for greater than two months but less than nine months),
- Occasionally inundated or flooded for less than one month (#10E and 14E = inundated for less than two months),
- Saturated but seldom inundated,
- Intermittent stream,

- Permanent stream,
- Not applicable – site was not a wetland.

Results

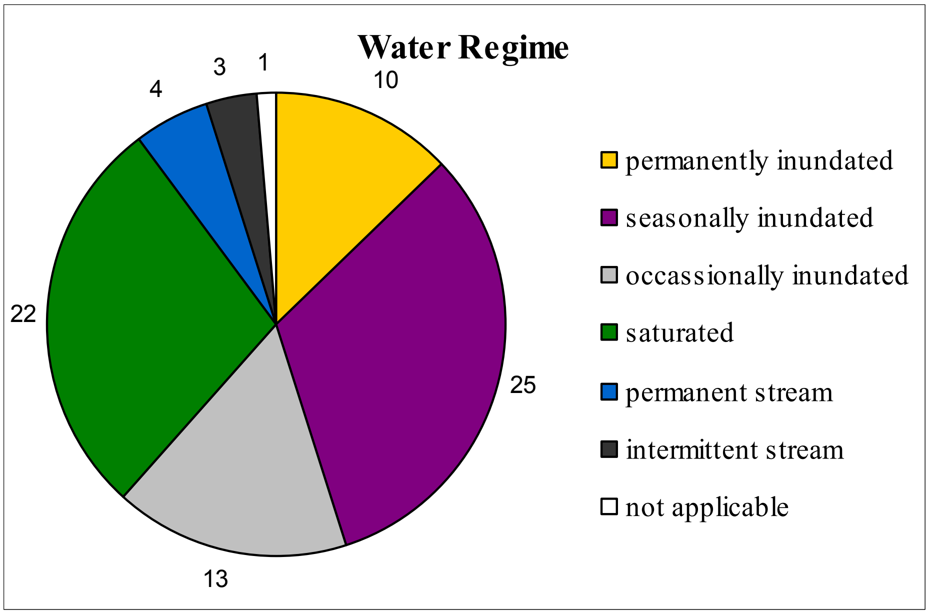


Figure 3.28 Distribution of mitigation sites (n=31) by inundation/saturation category present on each site. Most sites had more than one water regime.

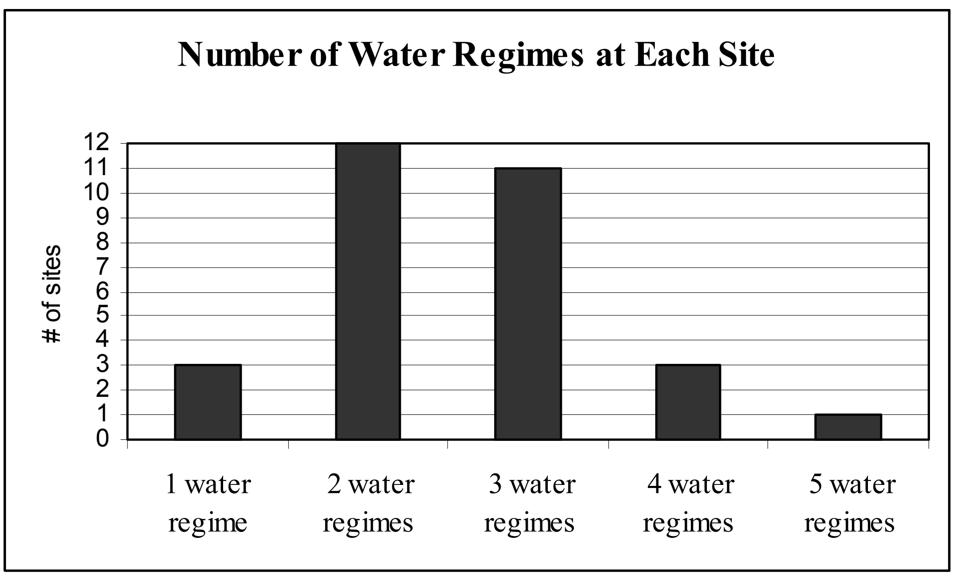


Figure 3.29 Distribution of mitigation sites by the number of water regimes at each site (n=30[17]).

[17] #50E was not a wetland. Therefore, it did not have a water regime and was not considered in this analysis.

3.4.5 Non-native Plant Species

Methods

The assessment team recorded all plant species observed in the mitigation area during the site visit. Plants were categorized as native or non-native, according to a non-native plant species list in the appendix of Methods for Assessing Wetland Functions, Volume I (Hruby et al., 1999) for Western Washington sites and Volume 2 (Hruby et al., 2000) for Eastern Washington sites.

In addition, the assessment team mapped or estimated areas dominated[18] by species categorized as non-native. For each site, the total amount of area dominated by non-native species was estimated and placed into one of the following categories:

- None of site dominated by non-native species,
- 1 to 24 percent of site dominated by non-native species,
- 25 to 49 percent of site dominated by non-native species,
- 50 to 75 percent of site dominated by non-native species, or
- Greater than 75 percent of site dominated by non-native species.

Results

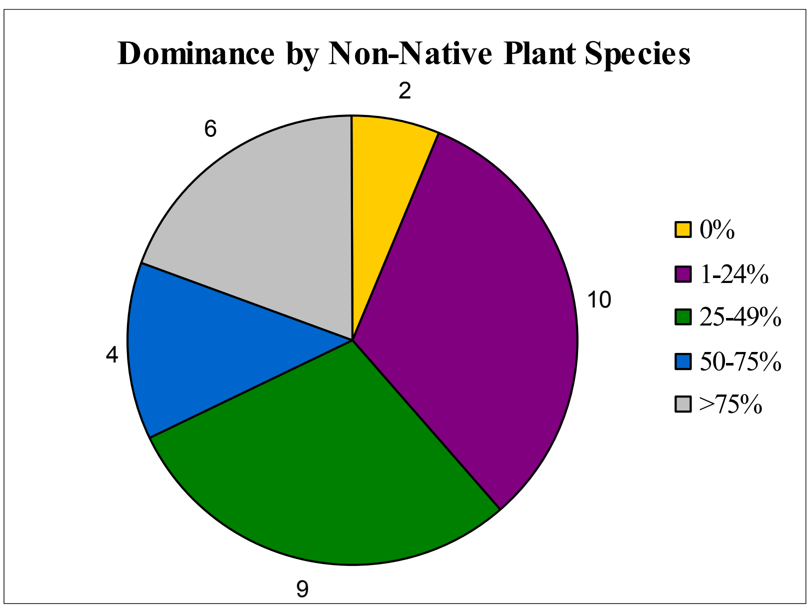


Figure 3.30 Distribution of mitigation sites (n=31) by percent of the site that is dominated by non-native plant species.

A list of all plants species encountered, their wetland indicator status, and whether they were categorized as native or non-native is located at the end of Appendix F.

[18] Dominant plant species generally comprise 20% or more of the relative cover in a vegetation strata.

3.5.6 Discussion

The various characteristics considered as part of a mitigation site's ecological condition were not correlated with one another to determine whether, for example, sites with higher quality buffers were less dominated by non-native plant species. This type of analysis was beyond the scope of this study. However, site-specific information on each of the ecological condition characteristics is presented in Table 5 (Appendix A) and in each project's summary (refer to Appendix F). The authors would encourage those who are interested to further analyze this data and look for any correlation or trends.

3.5.7 Ecological Appropriateness

Originally, ecological appropriateness was conceived as another factor to include when evaluating overall project success. However, the evaluation team decided that no conclusions could be drawn about the overall ecological appropriateness of a project for the following two reasons:

1. Ecological appropriateness was difficult to define and evaluate, particularly in urban or rapidly urbanizing settings, which was where most of the Phase 2 projects were located. Mitigation projects in urban settings may not be able to re-create a historic wetland ecosystem due to changes in water regime and nutrient inputs (Ehrenfeld, 2000; Horner, 1997). Additionally, management needs in a watershed or societal values may influence the design and goals of mitigation plans, such that the proposed mitigation does not fit a historical or "natural" wetland template.
2. Unlike the components of overall project success, in which evaluation team judgments followed the decision-making approach and were based on data and expert knowledge (Hruby, 1999), determining whether a project was ecologically appropriate was a strictly subjective, value-driven judgment. There were no data to evaluate that could inform or support the judgments of the evaluation team. Also, applying value judgments consistently from one project to another was difficult.

Therefore, the authors determined not to include the analysis of ecological appropriateness in this report. Ecological appropriateness is mentioned here as a way to stimulate discussion of this elusive and potentially contentious concept within the wetland profession.

3.6 Factors that Correlate with Success

One goal of this study was to identify some of the main factors that influence the level of success of mitigation projects. The factors identified by the Phase 2 study as potentially correlating with success were documented in three analyses:

- The evaluation team determined the primary reasons for a project's level of success during the site evaluation. This determination was based on aerial and site photos, data collected during field visits, and consultant questionnaire responses. The primary factors for all projects were combined and totaled, such that the top 10 factors most frequently cited as potentially influencing a project's success and failure were compiled into Tables 3.6 and 3.7.

- Responses on the consultant questionnaires were analyzed to determine whether follow-up by regulatory agencies might be correlated with a project's level of success.
- The level of success of the Phase 2 projects was compared with the same projects' level of compliance in Phase 1 to determine if there was a correlation between compliance and success.

3.6.1 Top Ten Factors

Originally, results from the Consultant Questionnaires were going to be analyzed to find correlations between the actions taken on successful mitigation projects and the actions taken (or not taken) on mitigation projects that were not successful. Questionnaires were completed for 19 of the 24 (79%) mitigation projects evaluated in Phase 2.

When the authors began reviewing the responses to the questionnaires, it became clear that the design of the questionnaire was inappropriate for statistical analysis. The responses varied from one-word answers to several paragraphs of useful anecdotal information. In addition, some questionnaires did not appear to be fully completed. Statistical analyses were, therefore, limited to questions pertaining to agency follow-up.

The evaluation team used the valuable information provided by the consultants, both in the questionnaires and during on-site conversations, to determine the primary factors that appeared to contribute to the success, lack of success, and overall outcome of a project.

See Appendix D to review a copy of the consultant questionnaire.

Table 3.6 Top Ten Factors that Contributed to the Success of Projects
Adequate source of hydrology present
Same consultant involved from the very beginning of the project (from delineation of impacts to mitigation monitoring and maintenance)
Good site selection
Oversight and follow-up by regulatory agencies
Mitigation designer on-site during construction
Good mitigation design
Natural revegetation (native seed source present) or native hydroseed mix used
Maintenance conducted on site
Irrigation was used for at least one growing season
Hydrologic monitoring was conducted prior to mitigation plan implementation

Table 3.7 Top Ten Factors that Contributed to the Lack of Success of Projects
No irrigation of planted material
Poor site location
Lack of maintenance (e.g., invasive species control) or a poor job of maintaining planted material (mowed over)
Poor design
Poor planning and a lack of prior hydrologic monitoring
Lack of follow-up by applicant and regulatory agencies
Compacted soil or lack of soil amendments creating a poor substrate for plant growth
A buffer that was too small or unvegetated
Lack of consistency between project goals and mitigation plan (e.g., not enough planted material to provide the required shrub cover)
Lack of experience by heavy equipment operators and/or planting crew

3.6.2 Agency Follow-up

Nearly all studies of wetland mitigation have recommended that regulatory agencies improve follow-up activities on mitigation projects, assuming that this would improve the success of wetland mitigation. The Phase 2 study attempted to determine if follow-up activities by regulatory agencies influenced (were a factor in) the success of a project.

The consultant questionnaire included the following question:

> "Have any agencies followed-up on the project?" And if so, what type of follow-up activity(ies) occurred?
>
> - "Sent a letter?"
> - "Made a phone call?"
> - "Performed a site visit?"

Any phone calls, letters, and/or site visits associated with the Wetland Mitigation Evaluation Study were not considered regulatory follow-up.

<u>Methods</u>
Consultant questionnaires were filled out and returned for 19 projects. These questionnaires were analyzed to determine how many projects received some type of follow-up by a regulatory agency. Responses were categorized as:

- "Yes," there was some follow-up by a regulatory agency,
- "No," there was no follow-up by a regulatory agency;
- "Don't Know," the respondent did not know if a regulatory agency followed up on the project, or
- "No Response" (i.e., the question was not answered).

Whether follow-up occurred was compared with the level of success of projects. Projects were divided into two categories:

- Projects that Phase 2 evaluated to be either Fully or Moderately Successful, or
- Projects that were evaluated to be Minimally or Not Successful.

<u>Results</u>

Table 3.8 Have Any Agencies Followed-up On the Project?

	Fully and Moderately Successful Projects	Minimally and Not Successful Projects	TOTAL
YES	**6**	**3**	**9**
NO	**0**	**6**	**6**
Don't Know	**1**	**1**	**2**
No Response	**1**	**1**	**2**
TOTAL	**8**	**11**	**19**

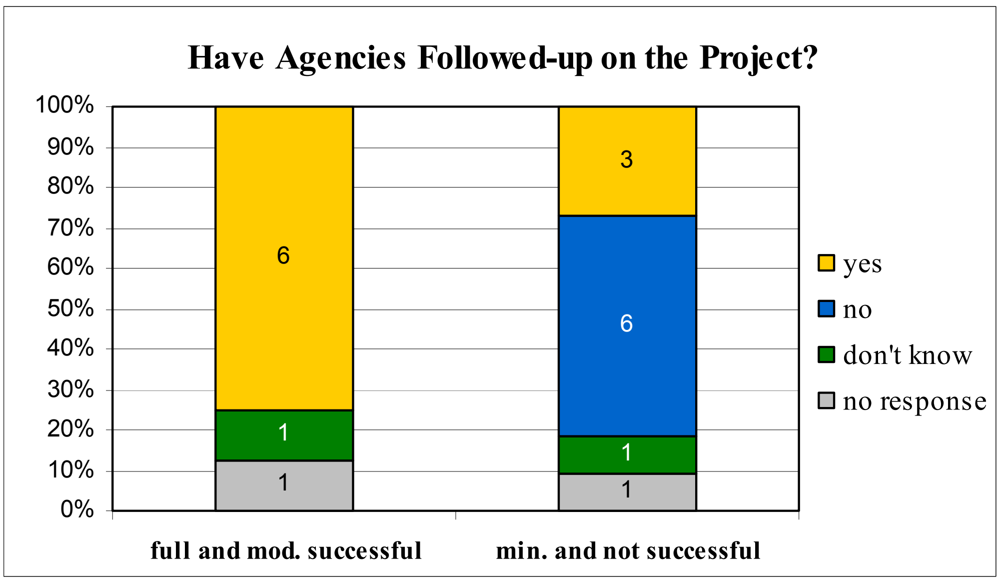


Figure 3.31 Comparison of agency follow-up for two categories of projects – fully and moderately successful vs. minimally and not successful (n=19).

Table 3.9 What Kind of Follow-up Was Conducted?

	Fully to Moderately Successful Projects	Minimally to Not Successful Projects
Total Projects with Follow-Up	**6**	**3**
Letter	**6**	**0**
Phone Call	**4**	**2**
Site Visit	**5**	**2**

Discussion
The results indicate that fully and moderately successful projects received more follow-up from regulatory agencies than minimally and not successful projects. This implies that follow-up by regulatory agencies results in a more successful mitigation project. Table 3.9 also indicates that most fully and moderately successful projects received more than one follow-up action (e.g., a letter, a phone call, a site visit) and at least half of them received all three follow-up actions.

The results appear to support recommendations made in mitigation studies over the years that assume follow-up activities improve mitigation success. However, there are a few caveats.

The primary caveat is that the question, "Have any agencies followed-up on the project?" is poorly worded and should have clearly stated that site visits, phone calls, etc. relating to the Wetland Mitigation Evaluation Study did not count as agency follow-up. In some cases, respondents identified that a site visit was performed because of the mitigation study and those responses are considered a "no" in the results. In other cases, however, the respondent indicated that "Ecology" performed a site visit. Those answers were considered a "yes" in the results unless it was determined that no staff at Ecology, aside from the mitigation study, had performed a site visit.

Other problems encountered in analyzing results from the questionnaires included:

- Incomplete questionnaires – several of the respondents did not complete all of the questions.
- Inconsistent answers
  - A consultant and an applicant both responded to the questionnaire for the same project, and their answers to the same question were different.
  - Some consultants verbally answered questions while assisting with the site visit and then answered the questions differently on the written questionnaire.
- Lack of (institutional) memory
  - Some individuals could not remember exactly what had occurred with a particular project, especially after four or more years.
  - Staff with knowledge about a particular project no longer worked for the consulting firm.

Though the results suggest that follow-up by a regulatory agency is a factor correlated with success and a lack of follow-up is a factor correlated with a lack of success, this analysis has its limitations.

3.6.3 Phase 2 Success vs. Phase 1 Compliance

The results of the Phase 1 - Compliance study were compared with the results of the Phase 2 - Success study to determine whether a project's level of compliance from Phase 1 correlated with that project's level of success in Phase 2.

Methods
As described in section 1.2.1 (p. 2), Phase 1 compliance was based on meeting three conditions:

1. Implementing the mitigation project;
2. Implementing the project according to the pre-approved plan; and
3. Attaining the project specific performance standards.

Since all the projects evaluated in Phase 2 were implemented, the first condition was disregarded. Thus, for this analysis, the level of compliance was based on meeting the second and third conditions.

- Projects that met both of the other two conditions were considered to be "in compliance."
- Projects that met one but not both of the other two conditions were considered to be "somewhat" in compliance.
- Projects that met neither of the other two conditions were considered to be "not in compliance."

The criteria involved in evaluating a project's level of success for Phase 2 were described in section 3.3 (p. 48).

Results
The same 24 projects from Phase 1 and Phase 2 were compared. For a site-specific comparison refer to Table 9 in Appendix A.

Table 3.10 Comparison of Success (Phase 2) and Compliance (Phase 1)

Phase 2 – Level of Success	Phase 1 – Level of Compliance		
	In Compliance	Somewhat	Not In Compliance
Fully Successful	0	1	2
Moderately Successful	2	5	1
Minimally Successful	4	2	2
Not Successful	0	0	5

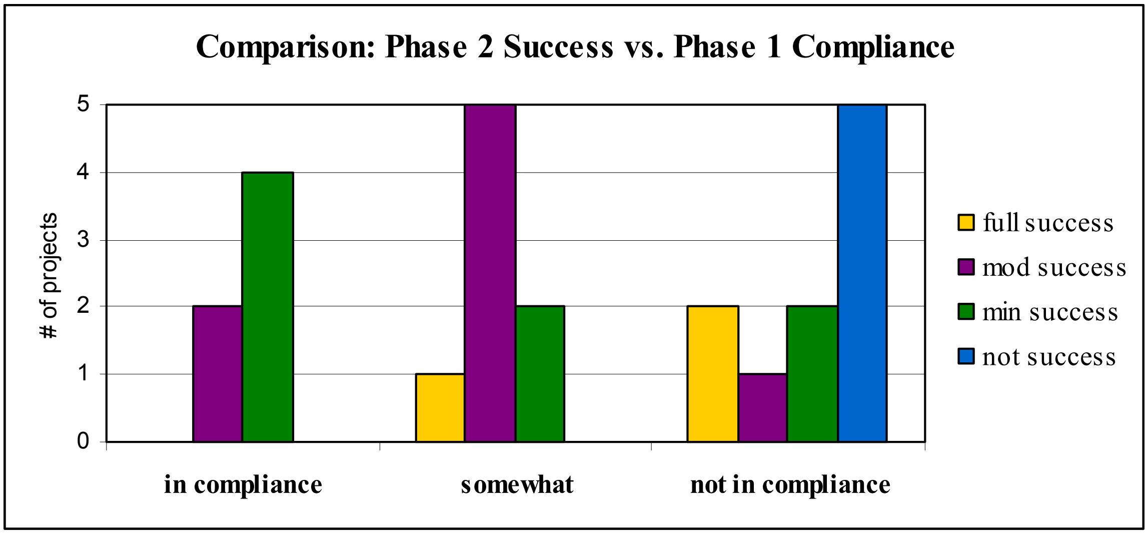


Figure 3.32 Distribution of 24 mitigation projects by their level of success according to the Phase 2 results compared to their level of compliance according to the Phase 1 results.

<u>Discussion</u>

The results (Table 3.10 and Figure 3.32) appear to suggest that compliance with permit conditions is not a definite indicator of the ecological success of a project. Of the three projects that were evaluated to be "fully successful" in Phase 2, two (67%) were found to be "not in compliance" in Phase 1, while none of the "fully successful" Phase 2 projects were "in compliance" in Phase 1. Also, four of the projects (67%) that were "in compliance" in Phase 1 were evaluated to be "minimally successful" in Phase 2.

However, all of the projects (100%) that were evaluated as "not successful" in Phase 2 also were found to be "not in compliance" in Phase 1. This suggests that a mitigation project that is not ecologically successful will likewise not be in compliance.

The lack of consistency between success and compliance could be due to the fact that one of the criteria for compliance in Phase 1 and success in Phase 2 was attaining performance standards. The methods and timeframe of the Phase 1 study did not allow for assessing ecologically significant performance standards, such as water regime or wetland area, while other performance standards, such as for signage and fencing, were assessed in Phase 1. Therefore, attaining performance standards in Phase 1 was not necessarily representative of how a site was functioning ecologically.

In contrast, the timing and methods of the Phase 2 study focused on assessing wetland area, hydrologic criteria, and percent cover and acreages of different Cowardin classes. As mentioned in section 3.1.2 (p. 32), overall attainment of performance standards in Phase 2 was limited to those standards that provided a significant measure of how a project was functioning or developing ecologically.

Understanding the limitations of the comparison between Phase 2 "success" and Phase 1 "compliance," this analysis suggests that being "in compliance" is not a primary factor that correlates with success. The results suggest that if a project is "in compliance," it is not completely unsuccessful ecologically. However, since all of the projects that were evaluated as "not successful" in Phase 2 were also "not in compliance" in Phase 1, a lack of compliance may be a factor correlated with a lack of success.

Refer to Table 8 in Appendix A for a project specific comparison between Phase 1 and Phase 2 performance standard attainment results.

3.7 Problems Encountered

A few problems were encountered in the process of conducting the Phase 2 study, mostly involving inconsistencies in the project files, such as: the availability of background information and, if available, the type and quality of information included.

3.7.1 Lack of Baseline Information

The lack of baseline or background information for many projects caused some difficulties particularly during site evaluations and the analysis of Phase 2 results. For example:

- Conflicting information about the type of mitigation activity to be performed made it difficult to evaluate the effectiveness of each mitigation activity.
- Conflicting information about the exact acreage of wetland mitigation that was required made it difficult to determine whether a project established the required acreage.
- Incomplete, vague, or lacking information on the wetland impacts made it difficult for the evaluation team to determine if the wetland mitigation project provided adequate compensation.
- Vague description of the impacts to Cowardin class(es) made it difficult and time-consuming to analyze impacts to Cowardin class acreages vs. the acreages mitigated, as well as to determine if the mitigation project was the same Cowardin class as the impacts.
- Absence of specific baseline information on enhancement sites prior to mitigation meant that the evaluation team had to make some assumptions about the pre-mitigation conditions and functions provided, based on general information about the site.

For the most part these problems were overcome at the expense of time and research, which may be expected or appropriate for this type of extensive and inclusive study of wetland mitigation. However, an agency employee attempting to follow up on a project or track its compliance probably would have difficulty prioritizing and committing the time necessary to overcome the problems of incomplete background information.

3.7.2 Lack of Standardization in Reporting

Compounding the problem of missing or incomplete background information was the lack of any kind of consistent format for reporting this background information. Key information (e.g., acreage of wetland impacts; acreage of required wetland mitigation; types of mitigation activities, description of wetland impacts, description of mitigation site prior to mitigation actions, goals/objectives and performance standards) is typically scattered throughout a mitigation plan and delineation report.

In some cases, information is repeated, but the information is somewhat contradictory. This is particularly true of wetland mitigation acreages, where the executive summary of a mitigation plan may give an overall required mitigation acreage and elsewhere in the report there may be a breakdown of the various mitigation activities to be implemented and their respective acreages, but the respective acreages do not add up to the overall total listed in the executive summary. Another example involves projects that list the goals/objectives of a mitigation proposal in one location of a report and the performance standards, or success criteria, in a completely separate section of the report.

Combing meticulously through all the reports and associated correspondences and permits was part of the Phase 2 study methods. However, agency staff reviewing this information to either make an initial decision about a project or track the compliance of an approved project cannot spend time going back and forth through a document to find the information they need or to verify the acreages listed in multiple locations in a report.

4 Conclusions

The results of this study reveal that mitigation continues to have significant shortcomings. Although mitigation may be doing better than it was 10 years ago and better than some previous studies have shown, this study suggests that the state of Washington is still experiencing a net loss of wetland acreage and functions due to authorized wetland impacts. However, the study also suggests that changes in the use of enhancement as a mitigation tool and increased follow-up on mitigation projects could substantially improve the success of wetland mitigation. The results and conclusions stated in this report should be considered a beginning point from which all interested parties can engage in collaborative problem solving to address the issue of wetland mitigation. The Department of Ecology is committed to working with interested parties to review the methodology and results of this study, discuss additional analyses and conclusions, and work together to make improvements to the current approach to wetland mitigation.

4.1 Overall Mitigation Success

The Phase 2 study evaluated the achievement of ecologically relevant measures for 24 projects and found that:

- Only 29 percent of projects were achieving all measures.
- 84 percent of the total acreage of mitigation that was required was actually established.
- Only 65 percent of the total acreage of lost wetlands was replaced with new wetland area, thereby resulting in a net loss of approximately 24 acres for the projects evaluated.

Whether a mitigation project adequately compensated for the impact also was evaluated, and the results indicate that:

- 37.5 percent of the projects *did* adequately compensate for the lost wetlands.
- 37.5 percent of projects *did not* compensate for the lost wetlands.
- 25 percent of projects partially compensated for the lost wetlands.

Based on the results of these two factors, the overall success of the 24 mitigation projects was evaluated. The results indicate that:

- 46 percent of mitigation projects were judged to be fully or moderately successful.
- 54 percent of projects were minimally successful or not successful.

Mitigation projects designed and implemented by public agencies fared worse than private mitigation projects, although the sample size was not large enough to produce statistically reliable results.

- 71 percent of private mitigation projects were judged to be fully or moderately successful.

- 35 percent of public mitigation projects were judged to be fully or moderately successful.

4.2 Enhancement

The results of the Phase 2 study have revealed that enhancement, in general, is doing poorly.

- Only 22 percent of enhanced wetlands were achieving all measures, while 44 percent of enhanced wetlands were not achieving any measures.
- Only 11 percent of enhanced wetlands adequately compensated for the impact, while 78 percent of enhanced wetlands did not compensate.

Enhancement projects did a poor job compensating for the impacts to wetlands, primarily because enhancement activities provided a low contribution to wetland functions.

- Over 50 percent of the enhancement sites provided minimal or no contribution to overall wetland functions.
- 75 percent of enhancement sites provided minimal or no contribution to the general habitat function.

This is troubling, since the vast majority of enhancement activities focus on improving habitat by adding vegetative structure and species diversity. If the majority of enhancement areas are not even providing a moderate contribution to wildlife habitat, then enhancement projects are resulting in a net loss of wetland acreage and functions.

4.3 Creation

While enhancement wetlands are doing worse than had been expected, the wetlands created from uplands that were evaluated in the Phase 2 study were doing better than expected.

- Only one creation project (out of ten) failed to establish wetland conditions.
- 60 percent of created wetlands were moderately or fully successful.
- Created wetlands provided significant overall contribution to both water quality and quantity functions.
  - 88 percent of created wetland sites provided at least a moderate contribution to water quality functions, and 55 percent provided a high contribution.
  - 44 percent of created wetland sites provided a high contribution to water quantity functions.

4.4 Agency follow-up/compliance

Phase 2 findings suggest that follow-up by regulatory agencies results in more-successful mitigation projects. Responses to the consultant questionnaire indicated that 75 percent of the fully and moderately successful projects experienced some degree of agency follow-up, while 27 percent of the minimally and not successful projects had some follow-up.

Compliance, as defined in Phase 1, did not appear to correlate with project success, as defined in Phase 2. A comparison indicated that 67 percent of the fully successful projects were not in compliance in Phase 1. However, a *lack of success* does appear to be associated with a *lack of compliance*, since all of the projects that were not successful were also not in compliance.

4.5 Wetland Resource Tradeoffs

Ninety-two percent of the mitigation projects evaluated in Phase 2 were located on the same site as the wetland impact. The high percentage of on-site mitigation projects also may have influenced the level of contribution to functions. On-site mitigation projects, in general, are more likely to have a higher opportunity to perform water quality and quantity functions and a lower opportunity to perform general habitat functions, primarily because of their proximity to urban and urbanizing areas. This is reflected in the relatively low levels of contribution to general habitat functions and the higher contributions to water quality and quantity functions.

The analysis of Cowardin classes indicates that non-native degraded pastures are being traded for forested/scrub-shrub and open-water/aquatic-bed habitats. The conversion of emergent to forested/scrub-shrub classes is merely reversing a 150-year-old trend of converting forested and scrub-shrub habitats to agriculture. The conversion of emergent to open-water/aquatic-bed classes is more disconcerting, since 60 percent of sites with open-water or aquatic-bed classes were considered to be of an atypical hydrogeomorphic subclass.

5 Recommendations for Improving Mitigation

Introduction

The following recommendations are intended to help those involved in wetland mitigation to improve the success of wetland mitigation projects. Regulatory agencies, project applicants and their consultants share responsibility for the success of mitigation projects, and it will take a concerted effort from all parties to improve the current situation. These recommendations should be considered as a beginning point to initiate a collaborative effort between the Department of Ecology and regulatory agency staff, landowners, project proponents, environmental organizations, consultants, and other interested parties to refine and implement these recommendations

Wetland mitigation involves many steps, including:

1. Determining whether proposed impacts can be avoided or minimized.
2. Deciding on the appropriate type and location of compensatory mitigation activities.
3. Developing a mitigation plan that includes appropriate goals, objectives, performance standards, etc.
4. Implementing the actions called for in the plan.
5. Maintaining the mitigation site and conducting monitoring to determine progress.
6. Performing contingency actions to correct problems that are encountered.

These steps generally occur in sequential order and, ideally, include a feedback loop, where information learned at each step in the process helps improve future decisions and actions. However, current practices appear to place most of the time and attention on the first four steps in this process, and little energy is devoted to ensuring that mitigation sites are maintained and monitored, and that adaptive-management procedures are implemented.

The authors believe that the greatest improvements in wetland mitigation will result from agencies and applicants investing time and attention to ensure that mitigation projects are properly constructed and maintained and adaptively managed. Although better site selection, design and performance standards will help to improve wetland mitigation, consistent follow-up, both to correct problems with current projects and to provide feedback for decision-making on future projects, will result in the greatest overall improvement.

The following recommendations are offered as suggestions for improving wetland mitigation. They are followed by a more-detailed discussion of how to improve each step in the mitigation process.

Recommendations

- Improve mitigation follow-up
- Develop new guidance for all steps in the mitigation process
- Develop new guidance for using enhancement
- Support mitigation banking and other forms of advance mitigation
- Conduct additional studies of wetland mitigation in Washington

5.1 Improve Mitigation Follow-up

While the federal Corps of Engineers conducts regular compliance site visits, the state Department of Ecology rarely does. Ecology should improve its follow-up of wetland mitigation projects by developing and implementing a compliance tracking system. This will require developing an electronic database and compliance tracking procedures, as well as allocating staff time to conduct site visits and work with applicants to correct deficiencies. Ecology and the Corps should work together to coordinate their compliance programs since they often review and approve the same mitigation projects. Further, the Corps and Ecology should publish annual reports on their compliance programs to help improve future mitigation projects and provide a yardstick for evaluating how mitigation projects are faring.

Additionally, since many local governments require mitigation for wetland impacts that are not reviewed by the Corps or Ecology, they should develop programs for tracking and assuring that wetland mitigation projects are implemented and maintained adequately.

Applicants and their consultants share the responsibility for ensuring that mitigation follow-up occurs. They should adhere to permit requirements for maintenance and monitoring and submit regular monitoring reports to all applicable agencies. They should actively participate in compliance site visits and work diligently to implement necessary contingency measures.

5.2 New Guidance for Mitigation Projects

Based on the results of this study and other studies of wetland mitigation, virtually every step in the mitigation process needs improvement. Ecology should work with all parties involved in the mitigation process (particularly consultants and other regulatory agencies) to develop new guidance that builds on the 1994 multi-agency document (Hruby et al., 1994). At a minimum, the new guidance should address the following areas.

5.2.1 Mitigation Sequencing

The mitigation process includes taking steps to avoid and minimize wetland impacts to the extent practicable before compensatory mitigation actions are considered. Guidance that clarifies the criteria used to determine appropriate avoidance and minimization actions would help applicants and regulatory staff apply sequencing in a consistent and rigorous manner.

5.2.2 Mitigation Type and Location

Once unavoidable impacts are identified, the next step involves determining the type of mitigation that is appropriate and the proper location for conducting the mitigation activities. This study found that most compensatory mitigation sites are located on or very near the impact site. A recent report on wetland mitigation by the National Academy of Science (National Research Council, 2001) recommends that mitigation be considered in a watershed context, and that locating mitigation sites on or near the impact site may not be desirable. The new guidance should provide more direction on how mitigation options should be evaluated in a watershed context. Other issues that should be addressed include: when each type of mitigation activity (creation, restoration, enhancement, preservation) is appropriate, and when advance mitigation is necessary.

In addition, the guidance should address the important factors to be considered in selecting an appropriate mitigation site. A preliminary list of considerations could include:

- Source of water and potential water regime for the proposed mitigation.
- Current and historical land uses of the site and any proposed or foreseen land uses for the areas adjacent to the proposed site.
- Connections or corridors to protected wildlife habitats or existing wetlands.
- Landscape position of the site and the (proposed) HGM subclass.
- Presence and extent of invasive species on the site and any nearby or upstream seed sources.
- Existence of a native seed bank on the site.
- Description of existing soils on the site and whether they will require any amendments or ripping.
- Any long-term maintenance requirements for the site or the proposed mitigation design.

5.2.3 Mitigation Plan Elements

The guidance should update and expand recommendations for every element in a mitigation plan. In particular, the guidance should provide more-detailed recommendations for the following:

- Standardized reporting
- Baseline monitoring
- Performance standards

5.2.3.1 Standardized Reporting
To avoid the inefficiency experienced while conducting the Phase 2 study, it is recommended that mitigation documents use a standard format for reporting crucial information. The mitigation guidelines should outline the acceptable format for the organization of mitigation plans, among other considerations.

Preliminary recommendations would require that:
- Baseline information on the impact site be presented together in one section at the beginning of a mitigation plan,
- Baseline information on the proposed mitigation site be presented together in one section, along with information on the mitigation proposal,
- Goals, objectives and performance standards of the mitigation project be presented together in one section,
- Reporting, maintenance and contingency plans be presented in one section.

5.2.3.2 Baseline Monitoring
Due to the problems encountered in Phase 2 with vague, incomplete, or missing background information, it is recommended that all wetland mitigation projects require documentation of baseline information for the site proposed to be filled. The mitigation guidelines should specifically identify what type of baseline information should be collected.

A preliminary list would include:
- Acreage of wetland impacts.
- Acreage of the Cowardin class(es) affected.
- Description of the plant communities at the impact site.
- Description of the soils on the impact site.
- Description of the landscape position and geomorphology of the impact site.
- HGM classification of wetlands affected by the development
- Description of the water regime of the impact site.
- List of functions provided at the impact site and relative level of potential to perform each.

In addition, it is recommended that similar baseline information be collected at the proposed mitigation site. This is particularly true for sites proposed for wetland enhancement. It is also important to record what the initial conditions were at a created or restored site. This information would be useful for a couple of reasons: to understand where a site is coming from for scientific purposes and future studies of how similar sites progress and develop; and to discover important features of a site that may have otherwise been overlooked. The baseline information that would be required for creation/restoration sites would be similar to the type of information necessary for selecting an appropriate mitigation site.

5.2.3.3 Performance Standards
This study revealed that 75 percent of the projects had some performance standards that were not considered a significant indicator of ecological development (see Appendix B).

Further, most were lacking basic performance standards addressing either the goals/objectives of the project or required wetland parameters.

Performance standards need to be tailored to each specific project. However, project-specific standards still need to target, in a measurable way, the basic parameters of wetland development. Therefore, it is recommended that specific guidance on performance standards be developed to:

- Identify the types or categories of performance standards that all wetland mitigation projects should include, such as:
  - Wetland area,
  - Water regime (permanently ponded, seasonally inundated, seasonally saturated, or a mixture of these)
  - Area of Cowardin class(es),
  - Percent cover of native wetland vegetation species desired,
  - Maximum percent cover of invasive vegetation species tolerated.
- Clarify the crucial connection between a project's goals, objectives, and performance standards.
- Explain and provide examples of how performance standards should be written to provide a measurable benchmark indicating if a project is fulfilling its goals and objectives.
- Provide examples of performance standards which demonstrate the difference between clear, concise, measurable standards and vague, confusing, non-measurable, meaningless standards.

The Oregon Department of Environmental Quality has developed and performed workshops for consultants that address the above-mentioned list of guidance recommendations (McCabe and Devroy, 2001). It is recommended that Ecology or another organization (such as the Society of Wetland Scientists) develop a similar workshop for consultants and state and local wetland project reviewers.

5.2.4 Site Construction

One of the concerns frequently raised by consultants is the difficulty of getting sites constructed appropriately because of poor construction oversight. In many cases, the consultant who designs a mitigation plan is not involved in constructing, maintaining and monitoring the site. Guidance on construction management and oversight would help address this problem. Also, guidance on the proper type of construction as-built reporting would be useful.

5.2.5 Site Maintenance and Monitoring

Regular site maintenance is a crucial component to ensure mitigation site success. Guidance should address how and when maintenance should be conducted.

The standard monitoring period for most of the projects evaluated in Phase 2 was five years. Phase 2 results suggest that projects five years and older are more successful than projects less than five years old. However, many mitigation projects (40 percent) that were at least five years old were still judged to be minimally successful or not successful. To help ensure the success of projects it is, therefore, recommended that mitigation site monitoring be conducted over a period of at least 10 years. This is particularly true for projects hoping to establish forested wetlands.

5.3 New Guidance for the Use of Enhancement

Some of the more important findings of the Phase 2 study relate to the use of wetland enhancement as compensation for wetland losses. The results of the Phase 2 study indicate that enhancement projects are not providing the gain in functions necessary to justify the associated loss of wetland area. Therefore, projects involving predominantly enhancement are less likely to adequately compensate for the wetland loss.

Guidance should be developed on what types of enhancement are acceptable. Enhancement can range from planting trees in an existing wetland to making significant hydrologic modifications. Guidance should indicate to applicants and regulatory staff which types of enhancement activities generally provide higher gains in functions and how the benefits of enhancement could be evaluated and documented.

Some additional information that may be useful in reviewing the appropriateness of an enhancement proposal includes:

- Detailed description of the proposed wetland impact.
- Detailed description of the site proposed for enhancement (e.g., water regime and water sources, HGM subclass, plant communities present, Cowardin class(es) present, wetland functions provided, etc.).
- Proposed enhancement actions (e.g., excavation, tree/shrub planting, eradication or control of *Phalaris arundinacea*, etc.).
- The landscape position of the site to be enhanced.
- Current and historical land uses of the site, and any proposed land uses of the area adjacent to the proposed enhancement site.

Guidance should also address the issue of enhancement replacement ratios. The Phase 2 results indicate that, in general, enhancement projects did not provide a high enough contribution to functions to adequately compensate for the wetland impacts. Typically, ratios of 2:1 to 6:1 have been required for enhancement activities. One way of addressing the disparity between the small gain in function from enhancement activities and the loss of wetland area and functions from a fill project would be to provide a greater area of enhanced wetland.

5.4 Wetland Mitigation Banking and Advance Mitigation

Wetland mitigation banks have the potential to address many of the problems with current mitigation practices. They can provide successful mitigation sites in advance of wetland impacts and can also address regional concerns or identified management problems within a specific basin or watershed, such as sedimentation, water quality degradation, or flood control. In addition, banks could provide larger contiguous wildlife habitat areas with the necessary buffered connections to other wildlife habitats, thereby greatly increasing the value of the site, particularly for larger wildlife. Regulatory agencies should promote the use of mitigation banks and work with interested parties to develop environmentally sound bank projects.

In situations where specific project impacts are known, conducting mitigation actions in advance of the impacts is desirable. Advance mitigation should be considered when a particularly risky mitigation plan is proposed, or when impacts are to higher quality wetlands that may be difficult to replicate

5.5 Additional Studies of Wetland Mitigation in Washington

Several types of additional studies could provide useful information including:

- **Local government mitigation projects** - King County found a very poor rate of success for mitigation projects approved by the county. Other counties and cities in Washington should evaluate their mitigation programs to determine if they are faring better or worse.

- **Scientific studies to validate ecological performance** - Studies of wetland mitigation (including this one) do not attempt to measure whether mitigation sites perform wetland functions similarly to "natural" wetlands. Studies conducted elsewhere in the U.S. have found differences in functioning between mitigation wetlands and "natural" wetlands, but the data are sparse. Additional studies of wetland mitigation sites in Washington would add to this knowledge base and would be ideal for graduate students.

- **Follow-up study of this study's sites** - A follow-up study of the same 24 sites evaluated in Phase 2 would tell more about how mitigation sites evolve over time. The same 24 sites should be re-evaluated in 5 to 10 years.

- **Long-term studies of mitigation sites** - A study of different types of mitigation sites over a long period of time (5-20 years) would help determine how wetland mitigation sites evolve over time. This would help with developing appropriate performance standards.

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<u>Appendix A</u>

Tables

Table 1a. Phase 2 Raw Results

Project #	County	wetland impact acreage	required wetland mitigation acreage	required creation acreage	required restoration acreage	required enhancement acreage	other required mitigation acreage
Westside Sites							
9*	Whatcom	21.1	21.1	16.1	0	5	75 (preservation)
14	Skagit	1.76	2.21	0	0	2.21	2 (buffer/upland)
33	King	0.07	0.14	0.14	0	0	0
46	Pacific	0.24	0.3	0.3	0	0	0
89	Pierce	1.49	2.52	1.12	0	1.4	2.26(upl) 1.89(wl)
116	King	17.4	56.5	1.5	9.2	45.8	0
151	King	1.2	1.6	0	1.4	0.2	0
163	Snohomish	1.84	5.75	0	1.97	3.78	1.25(buffer)
193	King	1.59	3.32	1.75	0	1.57	2.5 (buffer)
233*	Snohomish	0.41	0.82	0	0.27	0.65	buffer
239	Grays Harbor	0.14	0.21	0.09	0	0.12	0
243	Skagit	1.99	6	0	0	6	0
278	Snohomish	0.06	0.28	0	0.28	0	buffer
294	King	0.22	0.21	0.21	0	0	2.5 (preservation)
300	Clark	1.31	3.49	0	0	3.49	0.05 (upland)
334	Kitsap	0.67	0.9	0	0	0.9	1.96 (upland)
378	Clark	1.6	6.86	0	0	6.86	buffer
400	Snohomish	1.54	2.35	2.03	0	0.32	2.27 (buffer)
Westside Total		**54.63**	**114.56**	**23.24**	**13.12**	**78.3**	**89.09**
Eastside Sites							
10E	Benton	0.13	0.137	0	0	0.137	0
13E	Kittitas	0.99	2.47	1.92	0.55	0	buffer
14E	Spokane	0.141	0.144	0.144	0	0	buffer
29E	Ferry	0.935	9.5	0	0	9.5	riparian
41E	Spokane	1.87	3.53	3.53	0	0	0
50E	Spokane	0.09	0.46	0.46	0	0	rest. of temp. imp
Eastside Total		**4.156**	**16.241**	**6.054**	**0.55**	**9.637**	**0**
Statewide Total		**58.79**	**130.80**	**29.29**	**13.67**	**87.94**	**89.09**

*9-of the 16.1 acres of creation, 12.7 acres were to become an area that was previously wetland, but this area was re-graded and was considered part of the 21.1 acres of impact. Of the 15.35 acres of established creation acreage, 12.24 acres were generated from this "impact" area.
*233-The mitigation was called restoration in the permits and the mitigation ratios were determined based on this. In our evaluations we determined (based on definitions, pg 9) that only 0.27 acres of the mitigation was actually restoration, while the rest (0.65 acres) was enhancement.

Table 1b. Phase 2 Raw Results continued…

Project #	established wetland mitigation acreage	established creation acreage	established restoration acreage	established enhancement acreage	year implemented (age when evaluated)	Ecology wetland rating category(points)
Westside Sites						
9	19.69	15.34	0	4.35	1994 (6)	3(15),3(13),3(18)
14	3.11	0	0	3.11	1997 (3)	2 (23)
33	0.13	0.13	0	0	1997 (3)	3 (14)
46	0.3	0.3	0	0	1993 (6+)	3 (11)
89	2.03	0.63	0	1.4	1995 (5)	3 (19), 3 (8)
116	55.33	0.33	9.2	45.8	1996 (4)	2 (40), 2 (32)
151	1.58	0	1.38	0.2	1992 (7+)	2 (27)
163	2.56	0	1.97	0.59	1997 (3)	2 (29)
193	4.31	1.75	0	2.56	1997 (3)	2 (24), 2 (27)
233	0.55	0	0	0.55	1996 (3+)	3 (14)
239	0.26	0.14	0	0.12	1994 (6)	3 (7)
243	5.85	0	0	5.85	1996 (3+)	2 (23)
278*	0.23	0	0.23	0	1996 (3+)	3 (10)
294	0.16	0.16	0	0	1995 (5)	3 (5)
300	3.34	0	0	3.34	1994 (6)	2 (23)
334*	0	0	0	0	1996 (3+)	3 (15)
378	3.26	0	0	3.26	1998 (2)	3 (21)
400	3.14	2.82	0	0.32	1997&8(3&2)	2 (23), 3 (9)
W. Total	**105.83**	**21.6**	**12.78**	**71.45**		
Eastside Sites						
10E	0.124	0	0	0.124	1996 (3+)	3 (12)
13E	1.4	1.4	0	0	1997 (3)	2 (34)
14E	0.217	0.144	0	0.073	1995 (5)	3 (14)
29E*	0	0	0	0	1993 (7)	3 (20)
41E	2.29	2.29	0	0	1997 (2+)	NA
50E*	0	0	0	0	1995 (5)	NA
E. Total	**4.031**	**3.834**	**0**	**0.197**		
Total	**109.86**	**25.43**	**12.78**	**71.65**		

*278-This project was described in the permit to be creation and enhancement. Information from the consultant and the mitigation plan indicated that fill was removed from a historic wetland area. We therefore classified the project as restoration (based on definitions, pg. 9).
*334-This project was an enhancement project. None of the wetland enhancement plantings survived, therefore, the mitigation activities resulted in the establishment of 0 acres of enhancement.
*29E- This project was an enhancement project. None of the wetland enhancement plantings survived, therefore, the mitigation activities resulted in the establishment of 0 acres of enhancement.
*50E – This project was a creation project. The area where the mitigation activities took place was determined to not be wetland; therefore, the mitigation activities resulted in the establishment of 0 acres of creation.

Table 2. Achievement of Ecologically Relevant Measures

Project #	Did the project establish the acreage for the required mitigation activity(ies)? (within 10%)	Did the project attain the "significant" or appropriate performance standards?	Did the project fulfill the appropriate goals/ objectives?	**Did the project achieve the ecologically relevant measures?**
9	Y	N	S	S
14	Y	S	S	S
33	Y	Y	NA	Y
46	Y	NA	Y	Y
89	N	Y	Y	S
116	Y	Y	S	S
151	Y	NA	Y	Y
163	N	S	S	S
193	Y	S	S	S
233	N	NA	N	N
239	Y	NA	Y	Y
243	Y	Y	Y	Y
278	N	NA	S	S
294	*Y	NA	S	S
300	Y	N	Y	S
334	N	NA	NA	N
378	N	N	N	N
400	Y	S	Y	S
10E	Y	NA	NA	Y
13E	N	Y	S	S
14E	Y	NA	Y	Y
29E	N	N	N	N
41E	N	N	S	S
50E	N	N	N	N

Y = Yes, N = No, S = Somewhat, NA = Not Applicable

*294- Though this project was not within the 10% margin of error we gave the project the benefit of the doubt due to the fact that there was a thick canopy which did not allow for the collection of very many GPS points. Based on the SAT's knowledge of the site it was determined that the GPS positions did not adequately represent the size of the site.

Table 3. Factors Used in Determining Adequate Compensation for the Impacts

Site #	H20 quality Function potential/ contribution (L, ML, M, MH, H)/ (Hi, Mod, Min, NAA, Neg)	H2O quantity function potential/ contribution (L, ML, M, MH, H)/ (Hi, Mod, Min, NAA, Neg)	Wildlife habitat function potential/ contribution (L, ML, M, MH, H)/ (Hi, Mod, Min, NAA, Neg)	Did the mitigation project provide the same functions as those lost? (Y,N,S)	Did the mitigation project exchange functions? (Y,N,S)	**Did the mitigation project adequately compensate for the impacts? (Y,N,S)**
9A	NA	ML/ Mod	ML/ Mod	N	Y	S
9B	NA	L/ NAA	L/ Min			
9C	MH/ Mod	MH/ NAA	ML/ Min			
14	M/ Min	ML/ NAA	M/ Mod	N	Y	S
33	M/ Hi	ML/Mod	ML/ Mod	N	Y	S
46	unable to assess	unable to assess	unable to assess	S	Y	S
89-1	M/ Hi	M/ Hi	M/ Min	Y	Y	Y
89-2	MH/ Hi	H/ Mod	L/ Min			
116E	MH/ Hi	MH/ Mod	MH/ Hi	Y	Y	Y
116W	MH/ Mod	M/ Mod	MH/ Mod			
151	MH/ Hi	M/ Mod	M/ Hi	Y	Y	Y
163r	H/ Hi	NA	M/ Hi	Y	Y	Y
163e	/NAA	/NAA	/NAA			
193s	M/ Mod	ML/ Mod	MH/ Mod	Y	Y	Y
193G	M/ Mod	L/ Min	MH/ Hi			
233	M/ Mod	M/ NAA	ML/ Min	N	N	N
239	H/ Hi	NA	ML/ Min	Y	Y	Y
243	M/ Mod	ML/ Mod	ML/ Min	N	Y	N
*278	M/ Hi	M/ Mod	ML/ Mod	Y	Y	*N
294	MH/ Hi	H/ Hi	M/ Mod	S	Y	Y
300	MH/ Min	NA	ML/ Min	N	Y	N
334	/ NAA	/ NAA	/ NAA	N	N	N
378	MH/ Min	ML/ Mod	M/ Min	N	Y	N
400A	M/ Hi	M/ Hi	M/ Mod	Y	Y	Y
400B	M/ Hi	M/ Hi	L/ Min			
10E	MH/ Min	ML/ NAA	M/ Min	N	Y	N
13E	MH(sed)/ Hi	NA	MH/ Hi	Y	N	S
14E	M/ Mod	M/ Hi	ML/ Mod	N	Y	Y
29E	H(sed)/ NAA	M/ NAA	ML/ NAA	N	N	N
41E	MH(sed)/ Mod	M/ Neg	M/ NAA	S	N	S
50E	/NAA	/NAA	/NAA	N	N	N

L = Low, ML = Moderately Low, M = Moderate, MH = Moderately High, H = High
Hi = High, Mod = Moderate, Min = Minimal, NAA = Not at all, Neg = Negative
NA = Not applicable
Y = Yes, N = No, S = Somewhat

*278. This site was contaminated with a toxic organic substance that was mobilized during mitigation construction. This and other factors, including the site's location in the watershed resulted in the conclusion that the site did not replace the lost wetlands, which primarily provided wildlife habitat.

Table 4. Level of Success

Project #	Mitigation activity (activity that comprised >75% of the project)	Did the mitigation project achieve the ecologically relevant measures? (Y,N,S)	Did the mitigation project adequately compensate for the impacts? (Y,N,S)	**Level Of Success**
151	Restoration	Y	Y	Full Success
239	*Creation	Y	Y	Full Success
14E	Creation	Y	Y	Full Success
400	Creation	S	Y	Mod Success
89	Mixed	S	Y	Mod Success
294	Creation	S	Y	Mod Success
116	Enhancement	S	Y	Mod Success
163	Mixed	S	Y	Mod Success
193	Mixed	S	Y	Mod Success
33	Creation	Y	S	Mod Success
46	Creation	Y	S	Mod Success
9	Creation	S	S	Min Success
14	Enhancement	S	S	Min Success
13E	Creation	S	S	Min Success
41E	Creation	S	S	Min Success
243	Enhancement	Y	N	Min Success
10E	Enhancement	Y	N	Min Success
300	Enhancement	S	N	Min Success
278	Restoration	S	N	Min Success
233	Enhancement	N	N	Not Success
29E	Enhancement	N	N	Not Success
334	Enhancement	N	N	Not Success
378	Enhancement	N	N	Not Success
50E	Creation	N	N	Not Success

Y = Yes, N = No, S = Somewhat

*239-Though this project was a mixture of creation and enhancement, the site assessment and evaluation focused on the creation area, and therefore, the project was considered creation in the Phase 2 results.

Table 5. Ecological Condition

Site #	Hydroperiods observed/ assumed	Dominance by non-native plant species (by %)	Number of native spp.\ Number of non-native spp.	Buffers	Corridors/ connectivity	Land Use in percentage		
						U	A	D
9A	SF,S	75+	25\24	MH	HIGH	50	10	40
9B	SF,OF,S	75+	6\14	L	MIN	34	15	51
9C	SF,S	1 to 24	47\17	L	MIN	35	11	54
14	SF,S	1 to 24	36\10	MH	HIGH	19	63	18
33	SF,S	0	38\4	MH	HIGH	56	0	44
46	SF,OF	0	25\2	M	MOD	76	1	23
89-1	SF,S,IS	25 to 49	45\24	L	NONE	24	14	62
89-2	SF,S	25 to 49	16\10	L	NONE	24	14	62
116E	PF,SF,S,IS	25 to 49	52\20	M	MOD	55	3	42
116W	PF,SF,S,PS	50 to 75	48\26	M	HIGH	63	2	35
151	SF	1 to 24	48\10	M	HIGH	20	0	80
163r	PF,SF,S	25 to 49	43\11	M	MIN	40	28	32
163e	OF,S	75+	?	M	MOD	40	28	32
193s	PF,OF,S	25 to 49	44\14	M	HIGH	26	31	43
193G	PF,SF,OF,S	50 to 75	25\11	M	HIGH	29	39	32
233	OF,S	50 to 75	16\6	M	MOD	54	20	26
239	PF,SF,OF,S,PS	25 to 49	29\14	N	NONE	74	1	25
243	SF,OF,S	25 to 49	40\18	M	MIN	14	11	75
278	PF,SF,S	1 to 24	20\5	L	HIGH	41	31	28
294	SF,OF,S	25 to 49	35\6	L	NONE	38	0	62
300	SF,S	75+	39\9	M	MIN	10	48	42
334	SF,OF	25 to 49	28\16	MH	MOD	38	22	40
378	PF,SF	1 to 24	56\14	L	NONE	38	31	31
400A	PF,SF,S	1 to 24	36\9	L	NONE	17	20	63
400B	SF	1 to 24	29\9	L	NONE	17	20	63
*10E	SF,OF	1 to 24	16\15	L	HIGH	53	2	45
13E	PF,SF,PS	1 to 24	40\14	MH	HIGH	82	3	15
*14E	SF	1 to 24	19\8	M	HIGH	55	1	44
29E	OF,S,PS	75+	50\19	L	NONE	60	25	15
41E	OF,S,IS	50 to 75	22\13	ML	MIN	3	9	88
50E	NA	75+	13\16	H	MOD	47	47	6

U=undeveloped (forest, shrubs, wetlands, open water)
A=agriculture (Ag and clearcut logging)
D=developed (urban commercial, residential)

See the next page for descriptions of the hydroperiods, buffers, and corridors/connectivity.

*The Columbia Basin methods were used for these two sites. Certain data collected using the data sheets for the Columbia Basin differ from those collected for the Western WA methods: SF=seasonal inundation, which is 2-9 months and OF=brief inundation which is less than 2 months. Different categories of buffers and corridors are used for the Columbia Basin. These categories were adapted to the numbering system of the other sites. See the project summaries (Appendix F) for specific information on water regimes, buffers, and corridors.

<u>Inundation Regimes</u> - observed or assumed to be present on at least ¼ acre or 10% of the site
PF= permanently flooded or inundated
SF= seasonally flooded or inundated for greater than 1 month (#10E and 14E = inundated greater than 2 months but less than 9 months)
OF= occasionally flooded or inundated for less than 1 month (10E and 14E = inundated for less than 2 months)
S = saturated but seldom inundated
IS= intermittent stream
PS= permanent stream
NA= not applicable (because the site wasn't a wetland)

<u>Buffer Categories</u> (#10E and 14E same categories, but definitions are slightly different to reflect different vegetation structure of the Columbia Basin)

- High (H) - 100m (330ft) of forest, scrub, relatively undisturbed grassland or open water for greater than 95% of the circumference around the site. A clear-cut older than 5 years would qualify. No developed areas should be within the undisturbed part of the buffer.
- Moderately high (MH) - 100m of forest, scrub, relatively undisturbed grassland or open water for greater than 50% of circumference around the site; OR 50m (170ft) of forest, scrub, relatively undisturbed grassland, or open water for greater than 95% of the circumference around the site. No developed areas should be within the undisturbed part of the buffer.
- Moderate (M) - 100m of forest, scrub, relatively undisturbed grassland or open water for greater than 25% of the circumference around the site; OR 50m of forest, scrub, relatively undisturbed grassland, or open water for greater than 50% of circumference around the site. No developed areas should be within the undisturbed part of the buffer.
- Moderately low (ML)- No paved areas or buildings within 25m (80ft) for greater than 95% of the circumference around the site; OR no paved areas or buildings within 50m for greater than 50% of the circumference around the site. Pasture and lawns would qualify.
- Low (L)– Does not fit in any of the other categories. Has paved areas or buildings within 25 m for greater than 5% of the circumference around the site; OR has paved areas/buildings within 50m for greater than 50% of the circumference of the site.
- None (N)- Vegetated buffers are less than 2m (6.6ft) for greater than 95% of the circumference around the site.

<u>Corridors/Connectivity Categories</u>

- High
  -The site is part of a riparian corridor greater than 50 meters (170ft) wide connecting 2 or more wetland within 1 km with at least 30% shrub or forest cover in the corridor; OR
  -The site is connected to a corridor greater than 50m wide with greater than30% cover of forest or shrub to a natural upland area or open water that is greater than 100 hectares (247 acres) in size.
- Moderate (MOD)
  -The site is part of a riparian corridor greater than 25-50 m (85-170 ft) wide connecting to other wetlands with at least 30% shrub or forest cover in the corridor; OR
  -The site is connected to a corridor 10-50m (34-170 ft) wide with forest or shrub cover to a relatively undisturbed upland or open water that is greater than 10 ha (25 acres) in size; OR
  -The site is connected to a relatively undisturbed corridor greater than 50m wide to an undisturbed upland or open water area greater than 10ha in size.
- Minimal (MIN)
  -The site is part of a riparian corridor greater than 5 m (17 ft) wide with relatively undisturbed vegetation (grasslands and abandoned pasture qualify) that extends for greater than 1 km; OR
  -Any vegetated corridor 5-50m wide between the site and any relatively undisturbed area or open water that is greater than 2.5 ha (6.2 acres) in size.
- None – The site does not have a corridor that fits any of the previous descriptions.

Table 6. Hydrogeomorphic Subclass and Cowardin Classification

Site #	HGM subclass of mitigation site	mitigation same HGM subclass as the impacts? (Y, N,S)	atypical HGM subclass? (Y, N)	Cowardin Classes present at mitigation site	mitigation same Cowardin class(es) as the impacts? (Y,N,S)
9A	flat	Y	N	EM	N
9B	flat	Y	N	EM	N
9C	depres out	N	Y	EM, SS	N
14	slope/DO	Y	Y	EM, SS	S
33	depres out	Y	N	EM	N
46	dunal	Y	N	EM, SS	N
89-1	depres out	Y	N	EM, SS	Y
89-2	depres close	Y	N	EM, SS	Y
116E	depres out	Y	Y	EM, OW, AB, SS	N
116W	DO/RI	N	N	EM, SS, OW, AB	N
151	depres out	S	N	EM, SS/FO	S
163r	depres out	Y	N	EM, AB	Y
163e	depres out	~	N	EM	~
193s	depr in slop	N	Y	AB, EM, SS	N
193G	depr in slop	N	Y	SS, EM, OW	N
233	river flow-thr	Y	N	SS	N
239	tidal	Y	N	EM, SS	S
243	DO w/weir	Y	Y	EM, SS	S
278	DO/RI	Y	N	EM, OW	N
294	depres close	N	N	FO, EM, SS	N
300	slope	Y	N	EM, SS	S
334	DO/DC	N	N	EM, SS	N
378	depres out	N	Y	EM, AB, OW	S
400A	depres out	N	Y	EM, SS, AB	S
400B	depres out	N	Y	EM	Y
10E	depres LD	N	N	EM	Y
13E	riverine Imp	Y	Y	AB, EM, OW	Y
14E	depres LD	N	N	EM	Y
29E	riverine flow	S	N	EM, OW	N
41E	riverine flow	Y	N	EM	N
50E	not wetland	N	NA	not wetland	N

Y = Yes, N = No, S = Somewhat
OW = Open Water, AB = Aquatic Bed, EM = Emergent, SS = Scrub-Shrub, and FO = Forested

Table 7a. Cowardin Class Acreages (Impacts)

Impacts				
Site #	County	Forest (FO) / Scrub-Shrub (SS)	Emergent (EM)	Open Water (OW)/ Aquatic Bed (AB)
Westside Sites				
9A	Whatcom	3.60	17.50	0
9B	Whatcom	[redacted]	[redacted]	[redacted]
9C	Whatcom	[redacted]	[redacted]	[redacted]
14	Skagit	0	1.76	0
33	King	0.07	0	0
46	Pacific	0.14	0.10	0
89*	Pierce			
116E	King	0.30	17.10	0
116W	King	[redacted]	[redacted]	[redacted]
151	King	0.08	1.12	0
163	Snohomish	0	1.78	0.06
193s	King	0	1.59	0
193G	King	[redacted]	[redacted]	[redacted]
233	Snohomish	0.41	0	0
239	Grays Harbor	0	0.14	0
243	Skagit	0	1.99	0
278	Snohomish	0.06	0	0
294	King	0	0.22	0
300	Clark	0	1.31	0
334	Kitsap	0.33	0.34	0
378	Clark	0	1.60	0
400A	Snohomish	0	1.54	0
400B	Snohomish	[redacted]	[redacted]	[redacted]
Westside Totals		4.99	48.09	0.06
Eastside Sites				
10E	Benton	0	0.13	0
13E	Kittitas	0.09	0.30	0.60
14E	Spokane	0	0.141	0
29E	Ferry	0.875	0.06	0
41E	Spokane	1.24	0.63	0
50E	Spokane	0.088	0	0
Eastside Totals		2.293	1.261	0.6
Statewide Totals		**7.28**	**49.35**	**0.66**

*#89- was not considered for this analysis, because information on Cowardin classes lost, enhanced, and mitigated was incomplete.

Table 7b. Cowardin Class Acreages (Mitigation)

MITIGATION						
Site #	FO/SS gain	FO/SS *no change	EM gain	EM loss due to conversion	EM *no change	OW / AB gain
Westside Sites						
9A	0	0	3.11	0	0	0
9B	0	0	12.23	0	0	0
9C	2.61	0	0	-2.61	1.74	0
14	0.40	0	0	-0.40	2.71	0
33	0	0	0.13	0	0	0
46	0.03	0	0.27	0	0	0
89	Could not determine					
116E	3.29	0	0	-7.85	14.35	12.25
116W	6.77	1.10	0	-5.70	16.80	0.77
151	1.11	0	0.47	-0.2	0	0
163	0	0	1.53	0	0.59	0.44
193s	0.17	0	0.25	0	0	0.30
193G	2.56	0	0.08	-1.97	0.59	0.36
233	0	0.55	0	0	0	0
239	0.03	0.12	0.11	0	0	0
243	1.70	0	0	-1.70	4.15	0
278	0	0	0.19	0	0	0.04
294	0.11	0	0.05	0	0	0
300	0.43	0	0	-0.43	2.91	0
334	0	0.10	0	0	0.48	0
**378	0	0	0	**-5.07	1.79	1.47
400A	0.36	0	0.63	-0.14	0.18	0.35
400B	0	0	1.62	0	0	0
W. Total	19.57	1.87	20.67	-26.07	46.29	15.98
Eastside Sites						
10E	0	0	0	0	0.124	0
13E	0	0	0.52	0	0	0.88
14E	0	0	0.144	0	0.073	0
***29E	0	0	0	0	***8.01	0
41E	0	0	2.29	0	0	0
50E	Not applicable - No wetland area established					
E. Total	0	0	2.954	0	8.207	0.88
Total	**19.57**	**1.87**	**23.62**	**-26.07**	**54.50**	**16.86**

*"No change" = areas where mitigation actions failed or did not result in a change of Cowardin class (i.e., shrubs provided <30% cover).
**#378 resulted in wetland loss due to re-grading; the loss was "EM loss due to conversion" (to upland); it was not included as impacts (Table 1).
***#29E had OW (stream channel), but this was not a change from the pre-mitigation condition of the site. Therefore, the OW acreage was included in "EM no change." OW was included in Table 6.

Table 8. Performance Standard Attainment

Project #	Built to plan? (from Phase 1-updated)	Total # of performance standards	% attainment of assessed performance standards (#met / #assessed) **Phase 1**	% attainment of assessed performance standards (#met / #assessed) **Phase 2**	% attainment of assessed "significant" performance standards **Phase 2**
9	Y	11	80% (4/5)	50% (2/4)	0% (0/1)
14	Y	9	100% (3/3)	50% (2/4)	50% (2/4)
33	N	3	100% (1/1)	50% (1/2)	100% (1/1)
46	N	0	NA	NA	NA
89	Y	4	33% (1/3)	100% (3/3)	100% (2/2)
116	Y	25*	0% (0/4)	50% (5/10)	100% (5/5)
151	Y	4	67% (2/3)	67% (2/3)	NA
163	Y	9	0% (0/1)	60% (3/5)	50% (2/4)
193	Y	3*	80% (4/5)*	67% (2/3)	67% (2/3)
233	N	10	0% (0/2)	67% (2/3)	NA
239	CND	1	0% (0/1)	NA	NA
243	Y	2	CND (0/0)	100% (1/1)	100% (1/1)
278	Y	4	100% (2/2)	100% (2/2)	NA
294	Y	3	100% (1/1)	100% (2/2)	NA
300	Y	2	50% (1/2)	0% (0/1)	0% (0/1)
334	N	2	0% (0/2)	0% (0/2)	NA
378	N	2	0% (0/2)	0% (0/2)	0% (0/1)
400	Y	3	100% (2/2)	50% (1/2)	50% (1/2)
10E	N	1	0% (0/1)	100% (1/1)	NA
13E	Y	6	100% (1/1)	67% (2/3)	100% (2/2)
14E	N	0	NA	NA	NA
29E	CND	1	0% (0/1)	0% (0/1)	0% (0/1)
41E	N	3	50% (1/2)	67% (2/3)	0% (0/1)
50E	N	6	0% (0/4)	0% (0/5)	0% (0/1)
Totals		**114**	**48% (23/48)**	**53% (33/62)**	**60% (18/30)**

Y = Yes, N = No, CND = Could Not Determine
NA = Not Applicable (for example, #46 did not have any performance standards, #239 did not have any that we could assess and #29E did not have any significant ones that we could assess)

*116 – In Phase 1, there were 26 P.S. evaluated for this site. Since the Phase 1 site visit, one of the approved P.S. was eliminated from monitoring as approved by the appropriate agencies, therefore only 25 P.S. were included in the Phase 2 study.
*193- Based on new background information collected for Phase 2, it was determined that this site had three performance standards, according to the most recent approved monitoring plan.

Table 9. Phase 2 Success vs. Phase 1 Compliance

Project #	County	**Level Of Success Phase 2**	**Level Of Compliance Phase 1**
151	King	Full Success	S
239	Grays Harbor	Full Success	N
14E	Spokane	Full Success	N
400	Snohomish	Mod Success	Y
89	Pierce	Mod Success	S
294	King	Mod Success	Y
116	King	Mod Success	S
163	Snohomish	Mod Success	S
193	King	Mod Success	S
33	King	Mod Success	S
46	Pacific	Mod Success	N
14	Skagit	Min Success	Y
13E	Kittitas	Min Success	Y
41E	Spokane	Min Success	N
243	Skagit	Min Success	Y
10E	Benton	Min Success	N
300	Clark	Min Success	S
9	Whatcom	Min Success	S
278	Snohomish	Min Success	Y
233	Snohomish	Not Success	N
29E	Ferry	Not Success	N
334	Kitsap	Not Success	N
378	Clark	Not Success	N
50E	Spokane	Not Success	N

Y = Yes, N = No, S = Somewhat

Appendix B

Performance Standards

Significant Assessed Performance Standards

1. (9 - NO) Provide 2.0 acres of palustrine emergent wetland and 1.4 acres of palustrine scrub-shrub wetland in Area A; provide 12.7 acres of palustrine emergent wetland in Area B; provide 5.0 acres palustrine scrub-shrub wetland in Area C.

2. (14 - NO) A minimum % survival OR minimum combined tree and shrub cover of planted stock within a representative permanent sample plot as follows: 80% survival OR 10-15% cover after 3 growing seasons, 80% survival OR 15-25% cover after 4 growing seasons, 80% survival OR 25-40% cover after 5 growing seasons.

3. (14 - YES) Invasive non-native plants (*Phalaris arundinacea*) will not exceed 10% cover within the enhancement areas.

4. (14 - YES) Presence of ground water within 6 inches of the surface or standing water for at least 14 consecutive days between March 1 and October 31 of a normal rainfall year within enhanced wetland areas.

5. (14 - NO) After three growing seasons, at least 80% of all plantings (average of about 800 stems per acre throughout all planting areas) shall survive OR shall be at least 35% combined cover for trees and shrubs (Corps condition).

6. (33 - YES) The wetland area must contain inundated or saturated soils in a similar manner to adjacent existing wetland areas during the growing season.

7. (89 - YES) Non-native blackberries, reed canary grass, and purple loosestrife may not account for more than 10% of total cover at any monitoring occasion.

8. (89 - YES) All nest boxes and platforms shown on the as-built drawings must be in place and useable at each monitoring occasion.

9. (116 - YES) > 24" depth of water year-round in deepest part of the creek channel; overtopping of banks during 1-year and larger flood events.

10. (116 - YES) 2 summer ponds, 1-1.5 acres and 2-2.5 acres. Winter flooding of isthmus between ponds to create one winter pond, 6-9 acres. Maximum winter depth 6 ft.; minimum summer depth 1 ft.

11. (116 - YES) 3.5-4 acres of shallow water, 2-4' deep in winter with rooted, vascular aquatic plants growing at margins.

12. (116 - YES) 5-7 acres of seasonally saturated wetland in higher portions of emergent area A, becoming dry in summer as indicated by monitoring-well data.

13. (116 - YES) Island with an area of 0.2-0.3 acre and 3 peninsular lobes, 0.4-1.0 acre each, more than 75% surrounded by open water and aquatic bed habitat.

14. (163 - NO) For total mitigation area: the wetland areas around open water will have 0.65 acres of emergent vegetation and 0.85 acres of scrub-shrub vegetation within the restoration area and 3.78 acres of scrub-shrub vegetation within the enhancement area.

15. (163 - YES) For the total mitigation area, after 3 and 5 years: the emergent vegetation will cover at least 0.65 acres of the wetland and native emergent species will have at least 80% cover in this area.

16. (163 - NO) For the total mitigation area, after 3 and 5 years: scrub-shrub vegetation will cover at least 4.63 acres of the wetland (with 1.25 acres of enhanced upland), and cover of native species will be at least 40% in the restoration area and 20% in the enhancement area.

17. (163 - YES) The ratio of actual water edge to average circumference of the open water is greater than 2.

18. (193 - NO) Exotic and invasive plant species will be maintained at <20% total cover in all wetland mitigation areas. Species include: Scot's broom, Himalayan and evergreen blackberry, reed canary grass, purple loosestrife, morning glory, Japanese knotweed, and creeping nightshade.

19. (193 - YES) Areal cover and percent survival in planted tree and shrub areas:

Years After Planting	Minimum % Cover	% Survival
One	20%	85%
Two	30%	85%
Three	45%	85%
Five	80%	85%

(Note: cover has to be provided by desirable species, which are any species other than the ones listed in P.S. #18).

20. (193 - YES) Areal cover in planted emergent areas:

Years After Planting	Minimum % Cover
One	60%
Two	70%
Five	80%

(Note: cover has to be provided by desirable species, which are any species other than the ones listed in P.S. #18).

21. (243 – YES) Presence of groundwater within 12 inches of the surface or standing water for at least 14 consecutive days between March 1 and October 31 of a normal rainfall year (shall be observed and recorded at all four of the hydrology monitoring stations, which includes the 2 staff gauges and 2 shallow monitoring wells—this was added on in the WQC).

22. (300 – NO) The vegetated portions of the site shall have a minimum of 80% average cover of native wetland species appropriate to the site and to its hydrologic regime (WQC condition and found in the mitigation plan supplement).

23. (378 – NO) The vegetated portions of the site shall have a minimum of 80% average cover of native wetland species appropriate to the site and to its hydrologic regime (WQC condition and found in the mitigation plan supplement). **This standard was encountered and assessed for two projects (also #22).*

24. (400 – NO) For planted and non-noxious volunteer shrubs and trees, percent cover will be as follows: 25% cover after the first year, 30% after the second year , 40% after the third year, 50% after the fourth year and 60% after the fifth year.

25. (400 – YES) For herbaceous planted and non-noxious volunteer species, percent areal cover will be as follows: 30% cover after the first year, 50% after the second year, 60% after the third year, 70% after the fourth year and 85% after the fifth year. *Some areas are designed to have standing water only; these areas may be expected to be barren of vegetation.

26. (13E – YES) Flow (from the project) and the log weirs will maintain the water level at 0 to 6 inches over the emergent wetlands and at 1 to 2 feet in the constructed channel.

27. (13E – YES) After 3 years, the emergent wetland has >30% coverage of at least 2 FACW or OBL species (excluding reed canary grass).

28. (29E – NO) The plantings will be considered a success if the riparian area has achieved a 75% or greater aerial coverage of planted or colonizing native vegetation as quantified by the monitoring plots.

29. (41E – NO) Adequacy of water reaching the associated wetlands: continuous presence of saturated soil within 12 inches of the soil surface for 12.5 % of the growing season (121 days) to be measured at 22 locations along 5 transects. Failure determination will be based on the finding that soil saturation is not present high enough in the soil profile for a long enough time for two years in a row.

30. (50E – NO) Create 0.46 acres of forested/scrub-shrub and emergent marsh wetland habitat.

Not Significant Assessed Performance Standards

[**Note**: *Why a performance standard was considered not significant is briefly explained in italics at the end of each performance standard.*]

1. (9 - YES) Establish plant communities in the mitigation areas, which are composed of woody and herbaceous plant species <u>native</u> or <u>naturalized</u> to the western part of the county. *Not specific or measureable (What does establish mean?).*

2. (9 - YES) Establish a vegetated buffer composed of trees and shrubs in the upland berm around the mitigation area. *Not specific or measureable (What does establish mean?).*

3. (9 - NO) Establish a permanent interpretive sign for the mitigation area. *Does not necessarily relate to attainment of wetland functions (does not reflect ecological development of the site).*

4. (33 - NO) The minimum canopy cover of trees and shrubs shall be as follows:

Years After Planting	Minimum Tree and Shrub Cover
One	10-20%
Two	20-30%
Five	>45%

Not specific (for this particular site if the standard includes existing canopy cover, then the standard is not necessarily related to the mitigation activities attainment of wetland functions. If it does not include existing canopy then attainment of this standard in this particular location was not feasible under an already existing canopy).

5. (89 - YES) Throughout the monitoring period, planted trees and shrubs must maintain 80% survival. *Does not necessarily relate to attainment of wetland functions (Survival throughout the monitoring period is difficult to assess. Cover could be more appropriate after year 1).*

6. (116 - NO) 1-1.5 acres dominated by native emergent wetland plants in the *Carex rostrata* community type (area A) in swales and depressions; 0.5-1 acre dominated by plants other than *Typha* in the *Typha latifolia* community type (area B)/ Planted areas with 30% cover of desirable native wetland species after 1 year and beyond as measured by quadrats in permanent plots. Standard deviation of mean cover value in plots will be less than ¼ of the mean value. *Too rigorous.*

7. (116 - NO) 10-12 acres dominated by native scrub/shrub wetland vegetation in the *Salix spp.* community types (areas 4, 5, 7, 8); 30% cover in scrub/shrub areas after 1 year, 50% after 3 years, 70% after 5 years, as measured along permanent transects using line intercept method. Standard deviation of mean cover value along transects will be less than ¼ of the mean value. *Too rigorous.*

8. (116 - NO) 7-9 acres dominated by native forested wetland vegetation in the *Alnus rubra/Rubus spectabilis, Alnus rubra/Lysichitum americanum*, and *Fraxinus latifolia/Carex obnupta* community types (areas 1, 2, 3); 15% canopy cover in forested areas after 1 year, 30% after 3 years, >45% after 5 years, as measured along permanent transects using line intercept method. Standard deviation of mean cover value along transects will be less than ¼ of the mean value. *Too rigorous.*

9. (116 - NO) 11-13 acres dominated by native emergent wetland plants in the *Carex rostrata* and *Carex vesicaria* community types (areas A,D). Planted areas with 30% over of desirable native wetland species after 1 year, 50% after 2 years, 65% after 3 years, >80% after 5 years, seeded areas >80% cover after 1 year and beyond, as measured by quadrats in permanent plots. Standard deviation of mean cover value in plots will be less than ¼ of the mean value. *Too rigorous.*

10. (116 - NO) 10-12 acres dominated by native scrub/shrub and forested wetland plants in the *Alnus rubra/Rubus spectabilis, Alnus rubra/Lysichitum americanum, Fraxinus latifolia/Carex obnupta,* and *Salix spp.* community types (areas 1, 2, 3, 6). 30% cover in scrub/shrub areas after 1 year, 50% after 3 years, 70% after 5 years; 15% canopy cover in forested areas after 1 year , 30% after 3 years, > 45% after 5 years; as measured along permanent transects using line intercept method. Standard deviation of mean cover along transects will be less than ¼ of the mean value. *Too rigorous.*

11. (151 - YES)

Time Elapsed	Minimum % of Ground Area Coverage in which Plants are Massed
Forested habitat:	
1 year	5-10%
2 years	10-20%
4 years	20-35%
6 years	**35-50%**
8 years	50-75%

Not specific (could be met my anything non-native, including Scot's broom).

12. (151 - YES)*Shrub habitat(scrub/shrub or upland)*

1 year	10-15%
2 years	15-30%
4 years	30-40%
6 years	**40-70%**
8 years	70-100%

Not specific (could be met my anything non-native, including Scot's broom).

13. (151 - NO) *Herbaceous layer*

1 year	60-80%
2 years	80-100%
3 years	100%
6 years	**100%**
8 years	100%

Not specific (could be met by Phalaris).

14. (163 - YES) For the total wetland mitigation area: use of the wetland by one species of amphibians will be documented by observation of egg masses during the breeding season. *Not specific (a bullfrog could meet this).*

15. (233 – YES) After 3 years, wetland has 80% survival of facultative species, or is supplemented or replaced by a native plant community regenerating a 80% or greater tree, shrub, and forb cover. *Confusing and vague and does not necessarily relate to the attainment of wetland functions (Is cover cumulative?).*

16. (233 – NO) After 3 years, buffer has 80% survival of planted species, or is supplemented or replaced by a native plant community regenerating an 80% or greater cumulative plant cover. *Does not necessarily relate to attainment of wetland functions (does not specify tree or shrub cover - could be met by anything native).*

17. (233 – YES) After 3 years, wildlife habitat support will be measured by documentation of the areal cover or woody vegetation. This measurement will be used as an indicator of an increase in habitat structure and complexity. The initial establishment and survival of either planted or colonizing tree and shrub species should begin to determine the future habitat structure of the wetland and decisions on possible restructuring of the installed plant community, if needed. *Not a measurable standard.*

18. (278 – YES) In wetland areas aerial coverage of canopy, subcanopy, and understory shall be at least 50% by year 2 and 90% by year 5 (this applies to both planted and volunteer species). *Does not necessarily relate to attainment of wetland functions (this standard could be met by a wide variety of conditions, including a weedy meadow).*

19. (278 – YES) In upland buffer areas, aerial coverage of canopy, subcanopy, and understory shall be at least 50% by year 2 and 90% by year 5 (this applies to both planted and volunteer species). *Does not necessarily relate to attainment of wetland functions (this standard could be met by a wide variety of conditions, including a weedy upland site).*

20. (294 – YES) By the end of the fifth year, there will be 95-100% coverage. *Not specific and does not necessarily relate to the attainment of wetland functions (This standard does not specify what type of coverage (cumulative or relative), or what should be providing the cover – it could be Scotch broom or Canada thistle).*

21. (294 – YES) Mitigation shall be considered successful if there is 80% survival of planted species one year after planting, and if after 2 years, the revegetated area is thoroughly healthy and vigorous. Additional plantings shall be made necessary to ensure success of the mitigation area (WQC condition). *Not measurable (What do they mean by healthy and vigorous?).*

22. (334 – NO) By the third year, a minimum of 90% survival rate of the individual planted species, determined within the sample plots by counting the number of dead individuals and comparing that number with the total number of plants in the sample plot, as shown on the as-built design. *Does not necessarily relate to attainment of wetland functions (by the third year a measure of percent areal cover could be a better indicator of how the wetland is functioning).*

23. (334 – NO) By the third year, a minimum of 90% cover by the planted species, as determined by estimating % cover within the individual sample plots. *This standard is too rigorous and not feasible to attain by the third year (Cover of PLANTED species? Should this standard include native (and/or naturally colonizing) plant species?).*

24. (378 – NO) There must be at least 75% survival of individual cultivars, transplants, or of native naturally colonizing woody plant species. If planted stock do not survive, but are replaced by native naturally colonizing wetland plant species, the project will be judged to meet the threshold for successful enhancement with respect to the vegetative component (WQC condition and found in the mitigation plan supplement). **This standard was encountered for two projects and assessed for one of them.*

Not clear or measurable (How do you have survival of naturally colonizing plant species? I think what they mean is that if the planted stock do not survive, but native naturally colonizing plant species provide a certain amount of cover, then it will be successful?).

25. (10E – YES) If, after two years, plant success is less than 80% of site coverage, additional plantings may be required (WQC condition). *Confusing and not measurable (What is plant success? Does it mean that living plants must cover 80% of the site, and dead plants can cover no more than 20% of the site?).*

26. (13E – NO) After 3 years, the riparian fringe and tree/shrub zone has 80% survival of each planted species. *Does not necessarily relate to attainment of wetland functions (survival after 3 years).*

27. (41E – YES) Vegetative Cover.

- End of the first growing season; 50% cover
- End of the second growing season; 75% cover
- End of the third growing season; 80% cover
- End of the fourth growing season; 85% cover
- End of the fifth growing season; 90% cover

Does not necessarily relate to attainment of wetland function (cover could be non-native and/or non-wetland, should specify native wetland cover).

28. (41E – YES) Wetland Vegetation Dominance.

- End of the first growing season; 20% wetland species (FAC or wetter).
- End of the second growing season; 30% wetland species (FAC or wetter).
- End of the third growing season; 40% wetland species (FAC or wetter).
- End of the fourth growing season; 55% wetland species (FAC or wetter).
- End of the fifth growing season; 75% wetland species (FAC or wetter).

Not specific (Need to better define vegetation dominance. Is it 20% cover or 20% of species FAC or wetter? Confusing – not clear what is meant).

29. (50E – NO) Establish at the end of three years, a 75% survivorship of all initial large trees and shrub plantings; and 50% survivorship of all small tree and shrub plantings. *Poorly worded (What does survivorship mean? If it means the same as survival, then at 3 years it is not necessarily indicative of wetland function).*

30. (50E – NO) Establish 70% ground cover of native vegetation within the wetland creation area. *Not specific (does not specify wetland vegetation).*

31. (50E – NO) Establish a minimum of four native tree species; four native shrub species; and two native groundcover species. *Does not necessarily relate to attainment of wetland function (What does establish mean?).*

32. (50E – NO) Provide habitat for waterfowl and other wetland dependent birds through the creation of wetland communities. *Not measurable.*

Not Assessed Performance Standards

[**Note:** *Why a performance was not assessed as part of the Phase 2 evaluation is briefly explained in italics at the end of each performance standard.*]

1. (9) Establish at the end of the monitoring period a 75% survivorship of all tree and shrub plantings and 75% groundcover within the emergent wetland mitigation areas. *It was not the end of the monitoring period at the time of the Phase 2 site visit.*

2. (9) Establish at the end of the first year a 100% viability of the number of planted trees and shrubs. *The Phase 2 site visit occurred during the sixth year.*

3. (9) For the 75 acre conservation and stream channel enhancement: No installed structure or habitat feature will cause any excessive stream bank erosion or negatively impact the natural conditions of the existing headwater wetlands. *The site assessment team did not visit this area during Phase 2.*

4. (9) For the 75 acre conservation and stream channel enhancement: At the end of the monitoring period all installed stream structures will be secure and in place and integrated into the existing stream system. *The site assessment team did not visit this area during Phase 2.*

5. (9) For the 75 acre conservation and stream channel enhancement: Areas designed to provide spawning habitat will be established and stable by the end of the monitoring period. *The site assessment team did not visit this area during Phase 2.*

6. (9) For the 75 acre conservation and stream channel enhancement: 80% of the materials planted to enhance plant community diversity in the headwater areas along the stream channel will be alive and established by the completion of the monitoring program. *The site assessment team did not visit this area during Phase 2.*

7. (9) For the 75 acre conservation and stream channel enhancement: The mitigation area will not be monopolized by invasive or non-native weeds is such vegetation could threaten planted material during the monitoring period. *The site assessment team did not visit this area during Phase 2.*

8. (14) Survival of 85% of all plantings after 1 growing season. This will be calculated through a direct count of all dead rooted and severely stressed stock plantings within the permanent sample plots. *The Phase 2 site visit occurred after the third growing season.*

9. (14) Survival of 80% of all plantings after 2 growing seasons OR a minimum combined tree and shrub cover of 5-10% within a representative sample plot. *The Phase 2 site visit occurred after the third growing season.*

10. (14) After two growing seasons, at least 80% of all plantings (average of about 800 stems per acre throughout all planting areas) shall survive OR there shall be at least 25% combined cover for trees and shrubs (Corps condition). *The Phase 2 site visit occurred after the third growing season.*

11. (14) After four growing seasons, at least 80% of all plantings (average of about 800 stems per acre throughout all planting areas) shall survive OR there shall be at least 50% combined cover for trees and shrubs (Corps condition). *The Phase 2 site visit occurred during the fourth growing season, not after.*

12. (14) After five growing seasons, there shall be at least 65% combined cover for trees and shrubs (Corps condition). *The Phase 2 site visit occurred during the fourth growing season.*

13. (33) The wetland mitigation and buffer areas should have 80% overall coverage of self-sustaining native wetland vegetation at the end of the five year monitoring program. *It was not the end of the five year monitoring period at the time of the Phase 2 site visit.*

14. (89) Monitoring reports will be submitted to the County after each monitoring period. *The site assessment team did not contact the County to verify receipt of the monitoring reports, therefore this P.S. was not assessed for Phase 2.*

15. (116) Except on northwest and extreme southwestern boundaries, where meeting grades of adjacent property, surface grades no higher than 59.5 ft. This is < 1.1 ft above average April 1994 water surface elevation of 58.4 ft., as monitored at wells 1 and 10 near existing uplands. At a minimum, inundation or saturation within 12" of surface throughout site beyond April 1 in years of normal rainfall. *The site assessment team did not measure surface grades and elevations during the Phase 2 site visit.*

16. (116) To increase flood storage capacity: Grades of 60-61+feet on existing upland areas reduced by 0.5-1.5 ft., except for minimum area needed on northwestern boundaries to meet grades of adjacent property. *The site assessment team did not measure surface grades during the Phase 2 site visit.*

17. (116) In the creek, average values for temperature, dissolved oxygen, pH, conductivity, fecal coliform bacteria, total suspended solids, turbidity, ammonia, nitrogen, and phosphorous equal to better than baseline conditions, as measured by difference between upstream and downstream sampling stations, and using standard statistical analysis. *The site assessment team did not measure water quality parameters during the Phase 2 site visit.*

18. (116) 10 years after Phase 1 planting, no single area >100 square feet dominated by reed canary grass; total cover of reed canary grass on this portion reduced from existing cover of approximately 16 acres to < 1 acre after 10 years and for the remainder of the 15-year monitoring period. *The Phase 2 site visit occurred during the fourth year.*

19. (116) 5 years after Phase 3 plantings, mean Shannon diversity index (H')>2.0 for all species in plots in emergent communities and along transects in scrub/shrub and forested communities. 5 years after phase 3 plantings, average increase in richness >100% in plots in emergent communities and along transects in scrub/shrub and forested communities. *The Phase 2 site visit occurred during the fourth year and the site assessment team did not measure species diversity in plots or transects using the Shannon diversity index.*

20. (116) Two back channels off the creek, roughly parallel to creek, deep and narrow at confluence, broader and shallower upstream. Bottom elevation of channels 53 ft. at confluence, rising at < 1.5% maximum slope to 56 ft. within 400 lineal ft. of confluence. Channels 20-40 ft. wide for first 400 lineal ft. upstream of confluence to allow for closure of scrub/shrub and forested canopy. *The site assessment team did not measure slopes and elevations during the Phase 2 site visit.*

21. (116) 16 logs and root wads still in place in new channel and its banks after 5 years, at intervals of 15-50 ft. Material will be 10-24 inches in diameter, 10-15 ft. long, and will provide shade over portions of the stream channel and aquatic habitat diversity. *The Phase 2 site visit occurred during the fourth year.*

22. (116) Except on southeastern boundaries, where meeting grades of adjacent property, surface grades no higher than 59 ft. This is < 1 ft. above average April 1994 water surface elevation of 58 ft. as monitored at wells 16, 20, 24 in existing uplands. At a minimum, inundation or saturation within 12" of surface throughout site beyond April 1 in years of normal rainfall. *The site assessment team did not measure surface grades and elevations during the Phase 2 site visit.*

23. (116) Grades of 60-61 + feet on existing upland areas reduced by > 1 ft., except for minimum area needed on southeastern boundaries to meet grades of adjacent property. All existing structures, impermeable surfaces, and fill removed. *The site assessment team did not measure surface grades during the Phase 2 site visit.*

24. (116) 10 years after Phase 1 planting, no single area > 100 square feet dominated by reed canary grass; total cover of reed canary grass on this portion reduced from existing cover of approximately 1.5 acres to < 0.25 acres after 10 years and for the remainder of the 15 year monitoring period. *The Phase 2 site visit occurred during the fourth year.*

25. (116) *Nuphar* or *Potamogeton* growing on shallow margins of both ponds after 2 years; increased cover after 5 years. *The Phase 2 site visit occurred during the fourth year.*

26. (116) 5 years after phase 3 plantings, mean Shannon diversity index (H') > 2.0 for all species in plots in emergent communities and along transects in scrub/shrub and forested communities. 5 years after phase 3 plantings, average increase in richness > 100% in plots in emergent communities and along transects in scrub/shrub and forested communities. *The Phase 2 site visit occurred during the fourth year and the site assessment team did not measure species diversity in plots or transects using the Shannon diversity index.*

27. (116) 7 logs, 5 snags, and 5 brush piles in place 5 years after installation in year 1. Logs and snags > 24" in diameter and 10-20 ft. long; brush piles at installation 3-5 ft. high, 60-100 sq. ft. At base, composed of logs and branches 2-8" in diameter, with smaller twigs attached. Woody debris elements to be installed at > 8 widely scattered locations; average distance between locations > 200 ft. *The Phase 2 site visit occurred during the fourth year.*

28. (116) Natural decline of water table during the dry season to expose > 3 acres of unvegetated, previously inundated areas, < 30 ft. wide, at edges of ponds during first year (these will be colonized by emergent vegetation in 1-3 years). *The Phase 2 site visit occurred during the fourth year.*

29. (116) Ponds with 8-24" of water in February and March, in or adjacent to emergent areas that contain stems of plants with diameters < 0.25 inches (e.g. *Eleocharis, Sparganium, Scirpus*). *The Phase 2 site visit occurred in late June.*

30. (151) 80% of planted trees and shrubs should be living after three years for the project to be determined a success (Corps condition and in consultant letter describing monitoring). *The Phase 2 site visit occurred after the third year.*

31. (163) For total mitigation area: open water will be 0.47 acres during the dry season with a minimum depth of 12 inches. Saturated wetland area will be 0.65 acres during the dry season. Saturated wetland area will be 5.28 acres during the spring growing season (excluding open water). *The Phase 2 site visit occurred in July, which was not during the spring growing season.*

32. (163) Phalaris arundinacea (reed canary grass) shall comprise no more than 20% of total stand composition at the end of the monitoring period. *It was not the end of the monitoring period during the Phase 2 site visit.*

33. (163) The use of the site by at least three species of water birds will be documented with a photographic record. *The site assessment team did not document the use of the site by water birds with a photographic record during Phase 2.*

34. (163) At the end of year 5, success of the total revegetation effort in wetland or riparian areas shall be based on a minimum of 80% cover of species representative of the area prior to pipeline construction (WQC condition). *The Phase 2 site visit did not occur at the end of year five.*

35. (233) After 5 years, wetland has about 50% cover of scrub-shrub species. *The Phase 2 site visit did not occur after five years.*

36. (233) After 5 years, wetland has about 50% cover of forest species. *The Phase 2 site visit did not occur after five years.*

37. (233) After 5 years, at least 90% of the total cumulative cover is native species. *The Phase 2 site visit did not occur after five years.*

38. (233) After 5 years, buffer has about 50% cover of shrub species. *The Phase 2 site visit did not occur after five years.*

39. (233) After 5 years, buffer has about 50% cover of tree species. *The Phase 2 site visit did not occur after five years.*

40. (233) After 5 years, at least 90% of the cover is native species. *The Phase 2 site visit did not occur after five years.*

41. (233) After 5 years, habitat support measurements as indicated by aerial tree and shrub coverage should increase over time. Habitat structure is predicted to change from a single layer of vegetation to multiple layers over time as trees and shrubs become better established and continue to mature. *The Phase 2 site visit did not occur after five years.*

42. (239) At least 80% survival of all plantings. The mitigation shall be replanted until 80% survival is attained (Corps permit special condition). *The site assessment team was unable to evaluate this P.S. The Phase 2 site visit occurred in year six, therefore the site assessment team could not determine survival of plantings.*

43. (243) Survival of 80% of all plantings within the four-acre enhancement planting area OR minimum combined tree and shrub cover of the planted stock of 30% after five years. *The Phase 2 site visit occurred during the fourth growing season.*

44. (278) If an area includes more than 50% exotic species at the end of year 5 then the restoration will not be considered successful for that area and a contingency plan will be required. *The Phase 2 site visit did not occur at the end of year five.*

45. (278) If hydrology in the emergent, scrub/shrub, and forested components consists of saturated soil or standing water from depths of 1 inch to 4 feet by year 5 the creation of proper hydrology will be considered successful. *The Phase 2 site visit did not occur at year five.*

46. (294) 100% survival of planted species is expected one year after planting. *The Phase 2 site visit occurred during the sixth year after planting.*

47. (300) There must be at least 75% survival of individual cultivars, transplants, or of native naturally colonizing woody plant species. If planted stock do not survive, but are replaced by native naturally colonizing wetland plant species, the project will be judged to meet the threshold for successful enhancement with respect to the vegetative component (WQC condition and found in the mitigation plan supplement). **This standard was encountered for two projects and assessed for one of them.*
The site assessment team was unable to assess this standard. The Phase 2 site visit occurred at the end of year 3, therefore survival would have been difficult to assess at the time of the site visit.

48. (400) 90% survival of woody species after the first season of growth. *The Phase 2 site visit occurred after the first season of growth.*

49. (13E) After 5 years (excluding reed canary grass), the emergent wetland had aerial vegetative coverage of at least 85%. *The Phase 2 site visit did not occur after five years.*

50. (13E) After 5 years (excluding reed canary grass), the emergent zone has >60% coverage by FACW or OBL species. *The Phase 2 site visit did not occur after five years.*

51. (13E) After 10 years, no decrease in vegetative cover in the emergent wetland. *The Phase 2 site visit did not occur after ten years.*

52. (50E) Establish at the end of the first year, a 100% survivorship of trees and shrubs. This generally is a normal contractual component of professional landscape installation, with a standard one year warranty. *The Phase 2 site visit occurred after the first year.*

---

(116) Yellow pond lily (*Nuphar*), pondweed (*Potamogeton*), and other species in the Nuphar community type (area C in planting plan) growing on shallow margins of back channels after 2 years; increased cover after 5 years. *This standard was removed from monitoring by the applicant and approved by the appropriate agencies so it was not assessed in Phase 2.*

Appendix C

Mitigation Project Evaluation Form

Mitigation Project Evaluation Form

Evaluators: ____

Date:

Function Rating Sheet

- Please rate the site's potential to perform the listed functions using the following rating system:

High	H
Moderately High	MH
Moderate	M
Moderately Low	ML
Low	L
Not applicable	NA

- Please rate the site's opportunity to perform the listed function using: "HIGH", "MODERATE", or "LOW".

- Please rate how much the mitigation activity contributed to or improved the performance of the function using:

High	HI
Moderate	MOD
Minimal	MIN
Not at all	NAA
Negative	NEG

Functions	**Pre-Pot.**	**Potential**	**Opportunity**	**Contribution**
Removing sediment				
Removing nutrients				
Removing metals & toxic organics				
Reducing peak flows				
Decreasing downstream erosion				
Recharging groundwater				
Habitat suitability - General				
Habitat for invertebrates				
Habitat for Anadromous Fish				
Habitat for Resident Fish				
Habitat for amphibians				
Habitat for wetland associated birds				
Habitat for wetland associated mammals				
Native plant richness				
Primary production/organic export				

<u>Possible Goals of our Mitigation Policy</u> (and the context in which these questions should be answered)**:**

1) Replace what was lost – as best as possible. (Promotes on-site, in-kind mitigation.)
2) Improve upon what was lost – do better. (Promotes off-site, out of kind mitigation.)

<u>Questions</u>

1) How well does the wetland mitigation project perform functions?

*Summarize the results from the table.

2) How much did the mitigation activity contribute to or improve the performance of functions?

*Summarize the results from the table.

3) a. Is the replacement wetland the same HGM subclass as the lost wetlands? If not, is the HGM subclass of the replacement wetland a natural HGM subclass or is it atypical? Is it appropriate for the landscape?

b. Is the replacement wetland the same Cowardin class(es) as the lost wetlands?

4) How well does the project attain its performance standards?

*Use percentage of PS met vs the total number assessed along with raw numbers.

5) Are any performance standards related to water regime?

6) How well did the project attain "appropriate" or "significant" performance standards?

*This is a way of getting at "is it meeting PS that reflect how the project is progressing?"

7) Are the performance standards appropriate for monitoring functions and ecological success?

*Such as, do the standards target the features necessary to determine if the objectives have been met? Or are the standards worded appropriately to determine if the site is progressing toward a self-sustaining system?

8) What other performance standards should have been considered as appropriate and significant measures of ecosystem success?

*If the project had poorly worded or inappropriate performance standards, this is an opportunity to brainstorm standards that would have been more appropriate. These might be used as suggestions for new 401 conditions or to include in future mitigation plans that you are reviewing.

9) a. How successful is the project at meeting its goals and/or objectives (e.g. doing what it set out to do or what it proposed to do)?

b. Are the goals and objectives appropriate for the site?

10) a. Was the mitigation plan appropriate for the site?

b. How well did the mitigation project fulfill the potential of the site (for restoration, creation, or enhancement)?

*This question is trying to get at how successful the project is at developing a functioning ecosystem given the constraints of the site location.

11) To what degree does the wetland mitigation project replace the lost wetlands?

*Consider the following questions when answering this question:
What were the important/significant functions lost?
Were the important/significant functions adequately replaced?
Did the mitigation provide other functions that were in addition to, or in exchange for, functions lost?
If an exchange of functions occurred, was the exchange appropriate replacement for the lost functions?

Consultant Questionnaire

What factors appear to have contributed to the "success" of the project?

What factors may have contributed to the "failure" of the project?

Which of these factors seem to be most important in determining the "outcome of the project?

Appendix D

Consultant/Applicant Questionnaire

Questionnaire for Consultants and/or Contractors

Design

1. Why was the site for mitigation chosen? Do we need guidelines for how to choose sites?

2. What type of mitigation activity(ies) was performed?

3. What type of construction activity(ies) was performed (e.g. excavation, removing drain tiles, plugging drainage ditches, removing fill, etc.)?

4. Was baseline monitoring performed?

Construction

5. Was the mitigation site designer on-site or available during construction?

6. Was the same consultant used for design and implementation?

7. Did the consultant have previous experience with mitigation projects?

8. What time of year did construction occur?
   - Grading?
   - Planting?

9. Was all of the construction completed at the same time, or was the project phased?

10. Were problems encountered during construction? If so, what? How were they addressed?

11. Was there someone to oversee project implementation? How did this effect implementation? Examples?

12. Did the design change once construction activities commenced? How and why?
    - What was the impetus for change?
    - Was it documented in an As-built?

13. If design changes were made during construction, was the water regime different? If so, was the planting plan adjusted to reflect this?

14. Were other habitat features required and/or placed (e.g. logs, stumps, rock piles, nest boxes)?

Hydrology

15. What was the source of water?
    - What type of background information was collected on the source of water?
    - How was the targeted water regime determined?

16. Is wetland hydrology in place?

17. Describe the water regime.

18. Is the water regime supplemented by runoff from any on-site development?

Soils

19. What was the source of the top layers of soil (e.g. on-site, imported, etc.)?

20. Were donor hydric soils used for the top layers of soil at the mitigation site?

21. What techniques were used, if any, to amend the soils (e.g. organics, alder compost, leaf composted material, ripping, etc.)?
    - Were soils sterilized?
    - Was the soil inoculated with native soil?
    - Were they cleared off?

22. How were the soils installed?

23. What type of organic or mineral soil was installed (loam, sand, gravel, peat, clay, muck)?

Planting

24. What was the source of plant material (e.g. local native plant nursery, nursery from out of state, wetland salvage, etc.)? What nursery?

25. Do you have documentation that plant materials were from locally native stock? If so, may we get a copy?

26. Was plant salvage material used? If so, what did you use and where from? Did it work?

27. What type(s) of plants were used (e.g. cuttings, bare roots, container, seeds, etc.)?

28. Size of plants planted? Spacing?

29. Who installed the plants (e.g. volunteers, contractor, and any previous experience)?

30. When was the planting done – what time(s) of year?
    - For woody vegetation? For emergent vegetation?
    - How long did plant installation take?
    - Who was in charge of overseeing this?

31. Was phased planting used? If so, what worked?
    - Was thinning required if the site was inter-planted with conifers?

32. Were planting substitutions made? If so, why?

33. Were the plants irrigated after installation?
    - How long where they irrigated (48 hrs, first growing season, etc.)?
    - Who was in charge of overseeing this?

34. Were the plants fertilized? What was used? Quantity? And Cost?

35. What steps were taken, if any, to protect the plants from:
    - Herbivory (tubed, taped, etc.)? Did it work?
    - Invasive vegetation (weed control fabric, mulch, etc.)?
    - Vandalism?

36. Exotic plants on-site?

37. What was the ground cover – seed mix, source?
    - Native seed mix used?
    - Did these seeds germinate successfully, or did other seedling species become established and dominate the site?

Monitoring

38. Have any monitoring activities been performed? If so, were all the planned monitoring activities carried out?

39. What were the Monitoring methods?

40. Were monitoring reports required?
    - If so, were they performed by the same consultant that designed or implemented the site?

41. Were monitoring requirements appropriate to assess the site? If not, what would you suggest?

42. When was monitoring done?
    - For what parameters?

Management/Maintenance

43. What steps, if any, were taken to control invasive vegetation on the site over time (e.g. herbicide application, mowing, plowing, hand pulling, etc.)?
    - How often?

44. Who was in charge of maintenance?

45. Was there a maintenance plan? Who was contracted and for how long?

46. Was replanting required? If so, how often? To what extent (50% of plants, 100%, ect.)?
    - What appears to have been the cause of original plant failure?

47. Were there other maintenance activities planned and/or implemented (e.g. litter control, etc.)?

48. Was there a contingency plan?

49. Were contingency measures ever implemented?
    - If so, what?
    - When?
    - Did it work?

50. Were bonds (performance, construction, contingency) required?
    - Was funding adequate?

General

51. Is there anything else that was done, in regard to ________ that helped or hurt the success of the site?

52. What worked for you, either in regard to a specific element or overall?

53. What would you do differently to avoid problems or increase success?

54. Have any agencies followed-up on the project (e.g. local, state, federal)?
    - Sent a letter?
    - Made a phone call?
    - Performed a site visit?

55. What do you perceive to be needed by agencies to help ensure mitigation projects succeed?

56. What can agencies do to help?

57. How should Corps permit requirements and 401 conditions be written to ensure that projects succeed?

58. Was there any type of land protection mechanism implemented (deed restriction, easement, fee-simple transfer, etc.)?

59. Did you spend a lot of money on something that did not work?
    - Did you do something that did work that was worth the money?

Appendix E

Technical Assistance Groups

Advisory Committee

Joan Cabreza (USEPA)
Anna Mockler (wetland consultant)
Linda Storm (USEPA)
Yvonne Vallette (USEPA)
Chris McAuliffe (USACOE)
T.J. Stetz (USACOE)
Emily Teachout (USFWS)
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Perry Lund (Ecology)
Susan Meyer (Ecology)
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Cathy Reed (Ecology)
Stephen Stanley (Ecology)
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Dick Clark (EPA)
Patricia Johnson (Ecology)
Chris Merker (Ecology)
Dana Mock (Ecology)
Brad Murphy (Ecology)
Mark Schuppe (Ecology)
Erik Stockdale (Ecology)
Sarah Suggs (Ecology)

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Erik Stockdale (Ecology)

Appendix F (Samples)

Project Summaries

Two examples of project summaries have been provided in this sample Appendix F. The complete Appendix F (Ecology Publication # 02-06-010) provides project summaries for all 24 projects evaluated in Phase 2. The samples are provided to show what types of information were utilized to assess and evaluate the sites, including the rationale we used to make our determinations. If you would like the complete project summaries (100 + pages), see below for order information.

CDROM (also contains the complete Phase 2 Report)
Department of Ecology
Publications Distribution Center
P.O. Box 47600
Olympia, WA 98504-7600
(360)407-7472
jewi461@ecy.wa.gov

OR

Paper Copy at cost (separate from the Phase 2 report)
Department of Printing On-line Ordering
http://www.prt.wa.gov

OR

This complete document is available on the
World Wide Web at:
http://www.ecy.wa.gov/programs/sea/mit-study/

Note: Plants are abbreviated in most cases with a four-letter acronym. The first two letters are from the first two letters of the genus and the second two letters are the first two letters of the species. For example PHAR is the abbreviation for *Phalaris arundinacea* or Reed canary grass. A complete plant species list is available at the end of the complete Appendix F (Publication # 02-06-010).

#378

Impact information

This project, implemented by a private entity, is located in Clark County. It entailed the filling of 1.6 acres of wetlands under a U.S. Army Corps of Engineers Nationwide 26 (headwaters and isolated waters discharges) permit. [Note: additional wetland acres, determined to be prior converted croplands (PCC), were impacted and were not in the Corps jurisdiction.] The impacts were to several small palustrine emergent, temporarily flooded to seasonally saturated hillside seep and depressional closed swale wetlands (the on-site wetlands were also mapped on the National Wetland Inventory (NWI) as palustrine, emergent, seasonally flooded). Several small wetlands at the edge of the cropland contained some tree and shrub canopy.

According to the Clark County Wetlands Protection Ordinance, on-site wetlands were Category 4 "wetlands that are smaller, isolated, and less diverse vegetatively. It is possible to replace these wetlands and even improve them from a habitat standpoint. Category 4 wetlands do provide important functions and losses must be mitigated. Intermittent streams not utilized by salmonids are also included in this category." The PCC wetlands on-site were rated Category 5, which were not regulated by the Clark County Wetlands Protection Ordinance.

Dominant vegetation and water sources

There were several small grass dominated wetlands impacted. 1- A swale wetland dominated by PHAR. 2-Hillside seep wetlands dominated by CAOB, JUEF, HOLA, FEAR, and ANOD, 3- Others dominated by JUEF, HOLA, ALPR, Agrostis spp., tall buttercup (RAAC), RARE, and PHAR. The site forms the headwaters of an unnamed tributary of a river.

Functions provided

There was not a detailed description of the functions provided by the on-site wetlands.

Other details

NRCS and the Corps had to verify the delineation due to the mixed use of the site in agricultural and non-agricultural uses. Most of the area had been cleared and used to grow annual crops or as pasture. No active cultivation occurred on the site for a couple of years, however, corn was seeded on the northern portion of the site in 1991. The NRCS PCC determination applies to the agricultural wetlands on-site since they were cleared prior to 1985, have been cropped with a commodity crop at least once every 5 years since 1981, and were not inundated for 15 or more consecutive days during the growing season.

Wetland Mitigation Required/Implemented

This project required the enhancement of 6.86 acres of agriculturally degraded wetlands on-site and a 37.5-foot buffer. The wetland to be enhanced was a large headwater wetland area that ran east-west through the center of the northern portion of the site. Vegetation was dominated by reed canarygrass. Prior to enhancement the wetlands were considered to be Category 4 "wetlands that are smaller, isolated, and less diverse vegetatively," according to the Clark County Wetlands Protection Ordinance. The *goal* of the mitigation plan was:

- To compensate for the loss of functions of 1.6 acres of low quality wetlands through enhancement of 6.86 acres of low quality wetland and creation of a stream corridor with the associated fringe wetlands and riparian zone on the site.

More specific objectives outlined in the mitigation plan were as follows:

- Excavate two ponds that will each have open water and emergent vegetative components along with a scrub-shrub shoreline. This combination of vegetative classes will provide an increased diversity of habitat for both wetland dependent animals that currently exist on site;
- Storm water entering the enhancement area will pass through bio-filtration swales and meet the quality requirements of the Puget Sound Stormwater Manual. The ponds will provide increased water quality by allowing sediments to settle out of the storm water and removal of nutrients and toxicants through plant uptake;
- The riparian zone (stream channel and buffer zone) will provide a corridor for animal movement through this area down to the fork of the river, which this tributary empties into;
- Although, there is a small chance of flooding on this site, the ponds and fringe wetlands should protect from downstream flooding by providing storm water storage areas;
- Bat boxes and raptor perch poles will be constructed to provide these animals the opportunity to use this area;
- Large woody debris will be placed within the riparian zone to provide micro-habitats and perch areas for animals using the site; and
- An enhanced buffer zone is being provided to protect the wetland and stream corridor and provide increased plant diversity.

Major mitigation actions included:

1. Excavation of the top 18"-24" of the site to remove the mat of reed canarygrass and the potential seed base for re-growth;
2. Excavation of two ponds and a connecting channel;
3. Planting the riparian zone with native vegetation (hydroseed in emergent areas),
4. Placement of large woody debris within the riparian zone;
5. Construction of bat boxes and raptor perch poles; and
6. Creation of biofiltration swales within the buffer zone.

Grading was completed in the late summer and planting of emergent hydroseed in the fall and bare root plants in the winter. Plants were irrigated for the first growing season. The hydrologic regime was to be supported by groundwater and storm water runoff. Monitoring was required for five years to assess survivability of planted species. Replanting has occurred every year to get back to 100%.

Also, the mitigation plan stated that the proposed enhancement would raise the wetland classification from Category 4 to Category 2 wetlands (wetlands greater than five contiguous acres in size, which have two or more wetland subclasses and open water). The buffer would also be enhanced from Type D (areas with monotypic or no vegetation; or areas with a predominance of exotic species) to Type B (immature versions of Type A?).

Site Assessment Information

This site was approximately 2 years old at the time of the site visit. The site assessment team (SAT) identified approximately 3.26 acres of enhanced wetland. This is NOT within the 10% margin of error for acreage establishment. They were required to enhance 6.86 acres of non-native emergent wetland. It is assumed that during re-contouring of the site, upland areas were unintentionally created resulting in a loss of 3.6 acres of wetlands. The site was a depressional outflow, emergent (1.79 acres), open water (0.39 acres) and aquatic bed (1.08 acres) wetland. Two ponds on either end of the site were connected via a meandering seasonally flooded channel.

This site was considered an atypical Hydrogeomorphic (HGM) class because it had exaggerated morphology.

The drier areas of the site were dominated by grass spp., including Agrostis spp. and Holcus spp. The two ponds were dominated by TYLA and SCAC, with some ELPA and Sparganium spp. A couple of Potamogeton spp. also dominated the ponds. Wild rice has become more abundant in the eastern pond area as well.

Wildlife observations included: a belted kingfisher, male and female American kestrel nesting in a snag, barn swallow, red-wing blackbird, bullfrogs, tree frogs, rat or field mouse (dead), American crows, song sparrows, olive-sided flycatcher, American goldfinch, cedar wax wings, lazuli bunting, dragonflies, swallow-tail butterfly, and a orange sulfur butterfly.

This site was considered a Category 3 (21 points) wetland according to the WA State Wetland Rating System for Western Washington.

A 37.5 foot forested buffer zone was proposed. A forested buffer has not been established and will not establish unless it is replanted because survival was minimal at best.

Site Evaluation Results

Did the mitigation project achieve the ecologically relevant measures?

1. The mitigation project did not establish the acreage (within 10%) for the required mitigation activity (3.26 acres established / 6.86 acres required); **NO**
2. This project had two performance standards (P.S.):
   - Two of the P.S. were assessed during Phase 2,
   - None of the assessed P.S. were attained (0%),
   - One of the assessed P.S. was considered to be significant, and
   - The significant P.S. was not attained (0%).

Therefore, this project did not attain the significant P.S. **NO**

3. This project did not fulfill the appropriate goals and objectives. The site did not meet the area goal, there was no scrub-shrub habitat established along the shoreline, the buffer was not enhanced, and there was not a riparian zone for animal movement. A few objectives that were fulfilled, but were not considered significant, were the placement of large woody debris, perch poles and bat boxes throughout the wetland. **NO**

Based on the above, **the mitigation was determined to be NOT achieving the ecologically relevant measures.**

Phase 1 comparison – This mitigation project was determined to not be built to plan (there was no as-built available) in Phase 1. Grading was not completed as planned and some of the habitat structures were not present. The two assessed P.S. were not attained in Phase 1 or Phase 2 (0%). This project was determined to be not in compliance in Phase 1.

Did the mitigation project adequately compensate for the impacts?

The following table provides an overview of the results from the function assessment evaluations. Due to a lack of detailed information on the pre-enhancement sites potential to perform functions, the site evaluation team used the physical description of the characteristics and structure of the wetland and relied on expert knowledge to determine the level of functioning prior to enhancement activities. This was done using the approach for decision-making (Hruby, 1999).

FUNCTION	Pre-P.	Poten.	Oppor.	Contri.	Comments
Sediments	MH	MH	H	NAA	Ponds increase, but lost wetland area for this to be performed. Net result =No change.
Nutrients	M	M	H	NAA	Performing at this level before.
Metals/toxic organics	M	MH	H	MOD	Added standing water, which decreased pH.
Peak flows	L	ML	H	MOD	Excavated, deeper water provides some storage.
Downstream erosion	L	ML	H	MOD	Excavated, deeper water provides some storage.
General habitat	L	M	L	MIN	
Invertebrates	L	M	-	MOD	
Amphibians	L	L	-	NAA	Performed at this level before. Also, bull frogs present.
Anadromous fish	L	M	L	MIN	No access
Resident fish	L	M	-	MOD	
Wetland assoc. birds	L	M	-	MOD	
Wetland assoc. mammals	L	M	-	MOD	
Native plant richness	L	M	-	MOD	Went from PHAR to 56 natives.
Primary prod/export	M	MH	-	MIN	

*Pre-P. = pre-potential of the site to perform a function; Poten. = current potential of the site to perform a function; Oppor. = opportunity of the site to perform function; Contri. = contribution of mitigation activities to the performance of a function.
*NA = Not Applicable; L = Low; ML = Moderately low; M = Moderate; MH = Moderately high; H = High.
*NAA = Not at all contributing; MIN = Minimal contribution; MOD = Moderate contribution; HI = High contribution.

Summary of Functions

- *Water quality* – Moderately high potential, Minimal contribution
- *Water quantity* – Moderately low potential, Moderate contribution
- *General habitat* – Moderate potential, Minimal contribution

Overall Rationale

This project resulted in impacts to 1.6 acres of PHAR dominated wetlands. The mitigation activities were to result in the enhancement of 6.86 acres of existing wetlands. The SAT identified 3.26 acres of wetlands on-site. Grading and excavation resulted in an apparent loss of 3.6 acres of wetlands in addition to the 1.6 acres of wetlands impacted for the development.

In the areas that were determined to be wetland, the mitigation activities had a moderate contribution to water quantity functions by excavating two deep ponds at either end of the site, which provide some storage in area with a high opportunity to perform this function. The mitigation activities had a minimal contribution to the other functions and may have even contributed negatively to water quality functions by allowing storm water to enter the site. Water quality functions were the main functions that were lost and the mitigation activities had a minimal contribution to water quality functions. Also, the opportunity for the site to provide general habitat functions is minimal due to the small width of the buffers and the surrounding development. The mitigation activities, therefore, did not replace the functions lost, but did provide an exchange of functions by providing water quantity functions. The mitigation activities (excavation) appear to have resulted in the loss of wetland area on the site resulting in an overall decrease in wetland functions provided by the site. **It was determined that this mitigation project DID NOT adequately compensate for the impacts.**

Overall Success and Possible Factors Correlated with Success

This enhancement project was considered **NOT SUCCESSFUL** (the project did not achieve the ecologically relevant measures and did not adequately compensate for the impacts). The main factors that could have determined the outcome of this project are listed below.

Contributed to success

- Hydroseed mix worked well for native plant diversity; and
- Excavation of PHAR seemed to work.

Did not contribute to success

- Compaction of soil;
- Lack of soil nutrients resulted in high plant mortality (lack of thriving);
- Poor grading (may have resulted in more loss of wetland area); and
- Lack of experience of excavator operator.

Was the mitigation site the same HGM and Cowardin class(es) as the impacts?

Most of the impacts were to depressional closed emergent wetlands. The mitigation site is a depressional outflow, emergent, open water and aquatic bed wetland with exaggerated morphology (pre-enhancement the site was a swale). Thus, it is of an atypical HGM subclass and is not the same as the impact site. The enhanced area was once all emergent and some areas are now open water and aquatic bed. Therefore, the mitigation site was partly the same Cowardin class as the impact. The mitigation activities resulted in 5.07 acres of emergent loss as a result of conversion to open water, aquatic bed and upland (due to grading and recontouring the site).

Ecological Condition

Hydroperiods

This mitigation site had areas with permanent flooding or inundation and seasonal flooding or inundation (> 1 month).

Dominance by Non-native Plant Species

At the time of the site visit, non-native species dominated 1-24% of the cover within the wetland.

Plant Species Diversity

The SAT identified 56 native species and 14 non-native species on this site.

Buffers

At the time of the site visit, this site had a low quality buffer (have paved roads within 25m around at least 5% of the wetland or within 50m for greater than 50% of the circumference of the site).

Corridors and Connectivity

At the time of the site visit, this site did not have any corridors or connections to other habitat areas.

Land Uses

Within 1 km of the wetland mitigation area the land uses were as follows: 31 % developed (22% high density residential, 7% low density residential, 2% urban/commercial), 38% undeveloped (25% undeveloped forests, 13% other undeveloped areas), and 31% agriculture.

#400

Impact information

This project, implemented by a private entity, is located in Snohomish County. It entailed the filling of 1.54 acres of wetlands under a U.S. Army Corps of Engineers Nationwide 26 (headwaters and isolated waters discharges) permit. The impacts were to a palustrine emergent, seasonally flooded slope wetland system. There was no wetland rating available for the impacted wetlands.

Dominant vegetation and water sources

Vegetation was dominated by JUEF, which provided 80% cover in some places, and pasture grasses. The wetlands were associated with groundwater seepage. On-site wetlands had a long history of drainage and use as a pasture/hayfield.

Functions provided

The wetlands discharged groundwater via seeps and contributed water during peak rain events. Emergent vegetation took up available nutrients, but the wetlands were too sloped to trap sediments and toxicants. The wetlands provided forage for songbirds and small mammals (1995 Mitigation Plan).

Wetland Mitigation Required/Implemented

This project required the creation of 2.03 acres of wetlands on-site, in two areas (A & B), and the enhancement (incorporation) of 0.32 acres of wetlands in one of the areas. In addition, 2.27 acres of upland buffer was required. The *goals* of the mitigation plan were:

- To provide 1:1.25 replacement of wetland acreage by creating two new wetland areas;
- To provide an upland buffer for the created wetlands; and
- To produce the following plant associations: douglas-fir forest, red alder/black cottonwood patches, Pacific willow scrub-shrub/forested patches, emergent/aquatic marsh, and patches of grassy meadow (1995 Mitigation Plan).

The created wetlands were designed to detain larger volumes of water and to provide greater diversity of wildlife habitat than the JUEF dominated wet meadow that was impacted. The proposed Cowardin classification of the mitigation areas was forested, scrub-shrub and emergent.

Major mitigation actions included:

1. Excavation and regrading to create various vegetated islands and berms;
2. Dense planting; and
3. Water routing via installation of a series of french drains to intercept surface and groundwater moving through the sloped portion of the site (there are two separate wetland areas that are separated by a road).

The overall strategy was to reproduce a matrix community typical of early successional stages of vegetation in the Pacific Northwest.

Plantings were done in the spring and early summer. Due to heavier than expected stormwater inputs, the water level of Area B was about a foot higher than its target elevation, therefore planting was completed later than expected. Islands were to be planted with clumps (CAOB, OESA, SCAC, ELPA, SCMI, ALPL-AQ), whips (POTRI, SALA), bare root (ALRU, PSME, THPL), and seeds (DECE, LOMU, FERU). A mass planting strategy (plant in large, dense quantities) was implemented on this site. Plantings were maintained by mechanically clearing weeds and grasses from around the plants. Water levels in both areas were controlled by the elevation of a notch in a log weir. Monitoring was required for five years to assess revegetation success and to provide photodocumentation.

Site Assessment Information

This site had two areas that were completed at different times. Area A was approximately 3 years old at the time of the site visit and Area B was approximately 2 years old at the time of the site visit. The site assessment team (SAT) identified approximately 3.14 acres (2.82 acres of creation and 0.32 acres of enhancement) of wetland. [Note: Mitigation also included the establishment of 2.27 acres of buffer, which we did not assess.] They were required to create 2.03 acres of wetland. The SAT was unable to determine if the additional 0.79 acres that was created was at the expense of buffer. The SAT did note that there was pretty good survival of planted species in the buffer area. It was determined that the combined acreage of the two areas was within the 10% margin of error for acreage establishment.

There are two mitigation areas for this project:

- Area A (1.52 acres) is a scrub-shrub (0.36 acres), emergent (0.81 acres) and aquatic bed (0.35 acres) wetland. At the time of the site visit, the vegetation in the scrub-shrub areas had nearly attained the height required for the forested class (>20 feet). This area is a depressional outflow wetland. It is considered atypical for two reasons: water levels are controlled via a weir and depressions in a slope are typically not natural in this landscape setting. The dominant vegetation species in Area A were ALRU, Salix spp., SCAC, SCMI, CAST, JUEF, and TYLA. Aquatic bed species were Utricularia spp. (flowering), Potamogeton spp., and Alisma spp. Area A has standing water throughout the year, ranging in depth from 2 feet to a few inches. This site was considered to be a Category 2 (23 points) wetland according to the WA State Wetland Rating System for Western Washington.
- Area B (1.62 acres) is an emergent wetland. There were small areas of scrub-shrub vegetation, which were not large enough to be counted as a Cowardin class. Area B is also a depressional outflow wetland. It is considered atypical for two reasons: water levels are controlled via a weir and the banks had exaggerated morphology (steep sides). Area B was dominated by TYLA and TYAN. In the southern area, which had longer duration inundation, there were pockets of Salix spp. with SPEM, ELPA, JUEF, Alisma spp., SCMI, and SCAC. The other end was much drier with bare ground. Area B receives surface water inputs from numerous sources including roadside stormwater (off-site), stormwater detention ponds on-site, Area A (on-site), and from overflow in the case of flooding. Water depths range from 2 feet during the wettest part of the year to pockets of soil saturation during the driest parts of the year. Water that spills over the control weir is discharged from the wetland via a culvert. This site was considered to be a Category 3 (9 points) wetland according to the WA State Wetland Rating System for Western WA.

Wildlife observations included: song sparrows, Cedar waxwings, red-wing blackbirds, red-tail hawks (2 adults and 2 fledglings), common snipe, American robin, cowbirds, European starling, house finch, barn swallow, warbler spp., violet-green swallow, and tree frogs. Within 20m we observed an American goldfinch, turkey vulture, flicker, rock dove, and a sharpshin hawk.

Problems included mice damage in the form of trunk girdling in the grassy meadow area and encroachment of blackberries.

Site Evaluation Results

<u>Did the mitigation project achieve the ecologically relevant measures?</u>

1. The mitigation project established the acreage (within 10%) for the required mitigation activity (3.14 acres out of 2.35 acres); **YES**
2. This project had three performance standards (P.S.):
   - Two of the P.S. were assessed during Phase 2,
   - One of the assessed P.S. was attained (50%),
   - Both of the assessed P.S. were considered to be significant, and
   - One of the significant P.S. was attained (50%).

Therefore, this project somewhat attained the significant P.S. **SOMEWHAT**

3. This project fulfilled the appropriate goals and objectives. The mitigation provided greater than 1.25:1 replacement and provided the necessary plant associations. Buffers were present, although the SAT did not assess them. **YES**

Based on the above, **the mitigation project was determined to be SOMEWHAT achieving the ecologically relevant measures.**

Phase 1 comparison - This mitigation project was determined to be built to plan in Phase 1. Of the 3 P.S. for this mitigation project two could be assessed with the Phase 1 methods. Both of the P.S. were met (100%). [Note: One of the standards that was met in Phase 1 was not attained in Phase 2.] This project was determined to be in compliance in Phase 1.

<u>Did the mitigation project adequately compensate for the impacts?</u>

The following table provides an overview of the results from the function assessment evaluations for Site A. Area A is an atypical (HGM type) depressional outflow wetland. The scores form the function assessment models for typical depressional outflow wetlands could not be used. Therefore, the potentials were determined based on the data/characteristics collected on the function assessment forms rather than the calculated scores.

FUNCTION	Pre-P.	Poten.	Oppor.	Contri.	Comments
Sediments	NA	MH	L	HI	
Nutrients	NA	ML	H	HI	
Metals/toxic organics	NA	M	H	HI	
Peak flows	NA	M	M	HI	
Downstream erosion	NA	M	M	HI	
General habitat	NA	M	L	MOD	
Invertebrates	NA	MH	-	HI	
Amphibians	NA	M	-	HI	
Anadromous fish	NA	ML	L	MIN	
Resident fish	NA	ML	-	MOD	
Wetland assoc. birds	NA	M	-	HI	
Wetland assoc. mammals	NA	L	-	MIN	
Native plant richness	NA	M	-	HI	
Primary prod/export	NA	MH	-	HI	

*Pre-P.= pre-potential of the site to perform a function; Poten. = current potential of the site to perform a function; Oppor. = opportunity of the site to perform function; Contri. = contribution of mitigation activities to the performance of a function.
*NA = Not Applicable; L = Low; ML = Moderately low; M = Moderate; MH = Moderately high; H = High.
*NAA = Not at all contributing; MIN = Minimal contribution; MOD = Moderate contribution; HI = High contribution.

The following table provides an overview of the results from the function assessment evaluations for Area B. Area B is an atypical (HGM type) depressional outflow wetland. The scores form the function assessment models for typical depressional outflow wetlands could not be used. Therefore, the potentials were determined based on the data/characteristics collected on the function assessment forms rather than the calculated scores.

FUNCTION	P.Pot.	Poten.	Oppor.	Contri.	Comments
Sediments	NA	MH	H	HI	
Nutrients	NA	M	H	HI	
Metals/toxic organics	NA	M	H	HI	
Peak flows	NA	M	H	HI	
Downstream erosion	NA	M	H	HI	
General habitat	NA	L	L	*MIN	*This reflects the average contribution for the other species specific habitat contributions.
Invertebrates	NA	ML	-	MOD	
Amphibians	NA	ML	-	MOD	
Anadromous fish	NA	L	L	NAA	
Resident fish	NA	L	-	MIN	
Wetland assoc. birds	NA	ML	-	MOD	
Wetland assoc. mammals	NA	L	-	MIN	
Native plant richness	NA	ML	-	MOD	
Primary prod/export	NA	MH	-	HI	

*Pre-P. = pre-potential of the site to perform a function; Poten. = current potential of the site to perform a function; Oppor. = opportunity of the site to perform function; Contri. = contribution of mitigation activities to the performance of a function.
*NA = Not Applicable; L = Low; ML = Moderately low; M = Moderate; MH = Moderately high; H = High.
*NAA = Not at all contributing; MIN = Minimal contribution; MOD = Moderate contribution; HI = High contribution.

Summary of Functions for Area A
- *Water Quality* – Moderate potential, High contribution
- *Water Quantity* – Moderate potential, High contribution
- *General Habitat* – Moderate potential, Moderate contribution

Summary of Functions for Area B
- *Water Quality* – Moderate potential, High contribution
- *Water Quantity* – Moderate potential, High contribution
- *General Habitat* – Low potential, Minimal contribution

Overall Rationale

This project resulted in impacts to 1.54 acres of emergent slope wetlands. The mitigation activities resulted in the creation of 2.82 acres of wetlands and enhancement of 0.32 acres of wetlands. The mitigation area replaced the lost wetland area and functions associated with the lost wetland area at an almost 2:1 ratio. The mitigation activities also resulted in a high contribution to the potential of the site to perform water quality and water quantity functions that were not being performed to a significant extent by the filled slope wetlands. The created wetlands provided additional functions, including peak flow reduction and flood alteration that were determined to be regionally necessary. The mitigation had a minimal contribution to wildlife habitat, but provided this at an almost 2:1 ratio. **It was determined that this mitigation project adequately COMPENSATED for the impacts.**

Overall Success and Possible Factors Correlated with Success

This creation project was considered **MODERATELY SUCCESSFUL** (the project somewhat achieved the ecologically relevant measures and adequately compensated for the impacts). The main factors that could have determined the outcome of this project are listed below.

Contributed to success

- Continuity - the same experienced consultant was involved throughout the entire project (delineation, mitigation plan, implementation, monitoring and maintenance);
- Adequate hydrologic source;
- The use of sterile subsoil rather than topsoil;
- Ongoing maintenance; and
- The technique of using a wrapped berm on a hillside to create a wetland basin.

Did not contribute to success

- Area B was wetter than expected (did not allow for establishment of scrub-shrub vegetation on the proposed islands), and therefore did not attain the P.S. for required scrub-shrub cover.

Were the mitigation sites the same HGM and Cowardin class(es) as the impacts?

The mitigation project resulted in the creation of two depressional outflow wetlands, while the HGM subclass of the filled wetlands was slope. In addition, the mitigation sites were of an atypical HGM subclass because the morphology of the depressions was exaggerated and the water levels were controlled by a weir. A typical HGM subclass for this project's landscape position would have been a slope wetland. The mitigation wetlands consisted of emergent, scrub-shrub, and aquatic bed with some open water, whereas the wetlands lost were emergent. The mitigation was somewhat the same Cowardin classes as the impacts.

Ecological Condition

Hydroperiods

Both Areas A and B had areas with seasonal flooding or inundation (>1 month). Area A also had areas with permanent flooding or inundation and saturation (seldom inundated).

Dominance by Non-Native Plant Species

At the time of the site visit, non-native species dominated 1-24% of the cover within both Areas A and B.

Plant Species Diversity

The SAT identified 36 native species and 9 non-native species in Area A and 29 native species and 9 non-native species in Area B.

Buffers

At the time of the site visit, both wetland areas had low quality buffers (have paved roads within 25m around at least 5% of the wetland or within 50m for greater than 50% of the circumference of the site).

Corridors and Connectivity

At the time of the site visit, neither area had any corridors or connections to other habitat areas.

Land Uses

Within 1 km of the wetland mitigation areas the land uses were as follows: 63% developed (21% high density residential, 16% low density residential, 26% urban/commercial), 17% undeveloped areas (8% undeveloped forests, 9% other undeveloped areas) and 20% agriculture.