Oregon

DIVISION OF
STATE LANDS

WETLAND COMPENSATORY MITIGATION IN OREGON: A PROGRAM EVALUATION WITH A FOCUS ON PORTLAND METRO AREA PROJECTS

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Joel A. Shaich[1] and Kenneth T. Franklin[2]

[1]Environmental Protection Agency, Region 10, Oregon Operations Office, 811 SW Sixth Avenue, 3rd Floor, Portland, OR 97204 (Formerly with DSL 1989-1993)
[2]Oregon Division of State Lands, 775 Summer Street NE, Salem, OR 97310

EXECUTIVE SUMMARY

This report is based on a 1991 field evaluation study of Portland metropolitan area freshwater wetland compensatory mitigation (WCM) projects permitted through the state Removal-Fill Law (ORS 196. 800 - 196.990) and the federal Clean Water Act Section 404 permit program. We also attempt, where possible, to update critical WCM data to the present through agency computer database queries and permit file reviews. The project was initially funded by the Corps of Engineers (Corps) through a cooperative agreement between the Corps and the Division of State Lands (DSL).

In Oregon, and, generally, throughout the United States, there has been a lack of information to answer even the most basic questions about WCM—such as, "Are we gaining or losing wetland acreage as a result of federal and state permit decisions?" "What percentage of WCM projects used wetland creation as opposed to wetland enhancement?" "Where are these sites located?" While such information is insufficient to determine project and program success, it is necessary information to begin to do so.

We developed a WCM project evaluation methodology primarily designed to assess compliance with permit conditions. An in-depth evaluation of the effectiveness of these permit requirements was beyond the scope of our study. We sought data on the activities being permitted in wetlands, agency requirements for WCM, the cumulative effects on the resource (in terms of changes to wetland surface area and wetland types), and whether the differences between the Corps and DSL regulatory approaches were a factor in these outcomes.

The field study focused on WCM projects in the Portland metropolitan area (Clackamas, Multnomah, and Washington counties) that were permitted from 1980 to 1990. Most of the reviewed projects are located within the Tualatin River basin, which drains to the Willamette River. Data was collected from DSL permit files and from field inspections of the WCM sites during the summer of 1991. We reviewed 78% (72/90) of the projects in the Portland Metro area completed as of 1990. (We only looked at projects completed by 1990 so that they would have at least one growing season by the time of the site visit.) Field inspections of the WCM project sites were then conducted to assess compliance with the permit conditions as well as acquire data about the overall WCM program. Detailed project and program assessment procedures are described in appendices to the report.

We also made an attempt to update WCM data from DSL's computer database. Due to a lack of database maintenance by the agency, however, we could only compile permitted net wetland change data and statistics for compensatory mitigation types for most of the permits issued in 1993 and about half of the 1994 permits; data for the years 1990-1992 was too time consuming to compile for this report. As-built data (i.e. what was actually constructed) cannot be updated to the present, as this data is not recorded in the agency database.

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The Portland Metro Area Projects (72 permits issued from 1980-1990)

1. Total permitted impact acreage was 52 acres of wetland area. Commercial and industrial building pads and roads dominated permitted impacts. Most of the projects were small, less than one acre in size (with a small cumulative impact acreage); most of the cumulative impact acreage was due to a smaller number of larger projects.

2. The net result of the permitted impacts and required WCM was an exchange of emergent wetlands for open water wetlands (35 acres of emergent wetlands were permitted to be lost while 29 acres of open water wetlands were to be gained).

3. Wetland enhancement and wetland creation dominated the types of compensatory mitigation used, and were approximately equal in frequency; there were no wetland restoration projects used for compensation among these permits.

4. Cumulative permitted net change in wetland acreage for the projects was a loss of 14.5 acres of wetland. 54% of the projects were to result in a permitted net loss of wetland area, primarily due to the use of enhancement as a WCM technique.

5. All of the required WCM projects reviewed by the study team had been constructed. This is a higher rate of success than has been reported for other programs from across the U.S.

6. Critical factors for WCM project implementation, however, were less successful:

   a. 64% (46/72) of projects had one or more compliance violations, with non-compliance with buffer vegetation requirements as the most common violation. Few, if any, of these violations have been followed-up by DSL;

   b. An overall discrepancy of -15.7 acres between proposed net change and as-built net change in wetland area (i.e. actual WCM acreage created was 15.7 acres less than required). A large fraction of this acreage discrepancy (13.3 acres) was attributed to 9 projects; a much smaller fraction of the acreage discrepancy (3.2 acres) was attributed to 25 projects.

   c. Cumulative as-built net change in wetland acreage was -30 acres. That is, the total net change in wetland acreage, as determined by field inspections, for the 72 projects reviewed, was a loss of 30 acres, mostly in the Tualatin River basin.

7. The ecological significance of these WCM project outcomes for the Tualatin Basin (where most of the reviewed projects are located) remains unstudied and unknown.

DSL's WCM Program

8. The evaluation factors noted above are not monitored by DSL on a consistent basis. There are no quantitative targets, or goals, established for these or any other so-called success factors. Therefore, evaluation of the "success" of the program (from a compliance-based perspective) is problematic.

9. The DSL WCM computer database is rarely used and therefore its quality and functionality have become deficient.

10. Because of staffing inadequacies and other agency priorities, namely permit processing, DSL's WCM project monitoring and evaluation backlog has grown to over 480 WCM projects as of the end of 1994. Only through consistent project monitoring and evaluation can the agency learn whether its project and program goals are being met and just what such performance means to the integrity of the waters of the state and the citizens of the state of Oregon.

11. The 1995 Legislature established a permanent mitigation specialist position at DSL to address some of the above issues.

Recommendations

The following recommendations are primarily directed toward DSL. We only refer to the Corps program based on the findings from review of the Portland area projects with federal individual permits (as opposed to those with nationwide permits and little federal involvement); issues of WCM information management, and management in general, were only studied for DSL. Nonetheless, we hope these recommendations will be of benefit to the Corps wherever they are applicable. Detailed recommendations are provided in the report.

Recommendations To Improve WCM Program Management For Existing Regulatory Programs

1. Assign Agency Staff Responsibility For WCM As A Primary Duty

Only specially designated staff, with WCM as a primary duty, can focus enough attention on the program to enable agency performance improvement. For the 1995-97 biennium DSL has been authorized to hire a mitigation specialist position. In order to initiate and carry forward recommendations listed in this report, this individual's time must be allocated to developing the monitoring and evaluation aspects of the WCM program.

2. Develop A Consistent Compliance Program For WCM Projects

The current compliance and follow-up enforcement efforts are minimal for WCM projects; at the least, the agency should focus efforts on the projects with the largest wetland impacts.

3. Review And Improve Enforceability Of Permit Conditions

Vague and difficult to enforce permit conditions need to be eliminated. An improvement in this area, if only for the larger projects, may improve the likelihood of project implementation success.

4. Develop And Maintain More Effective, Accessible Information Systems

WCM information management for the agency must be improved if overall program performance improvement is to occur. Consistent data entry with quality control procedures needs to be implemented; periodic review of WCM data to check program performance relative to program goals could drive these needed changes.

5. Institutionalize WCM Project Monitoring And Evaluation

Systematic monitoring and evaluation of WCM projects has languished due to the pressures from the permit processing side of the program. A large backlog of projects to monitor and evaluate (ca. 500) has accumulated. The agency needs to prioritize projects, perhaps according to size, or, perhaps using a statistically valid sampling design, in order to focus limited staff resources most effectively. How the agency does this, whether internally or in partnership with other agencies and/or volunteers, is less important than making this aspect of program management a higher priority than it has been, the staffing problems notwithstanding.

6. Develop And Implement More Rigorous Requirements For Alternatives Analysis, Avoidance And Minimization For Large Proposed Impacts (> 1 acre)

Because most of the cumulative net loss of wetland acreage tends to be associated with a relatively small number of larger projects, the agency should, at minimum, develop detailed guidance for avoidance and minimization for larger projects.

7. Develop Accountability For Program Performance

A process for formal program performance accountability is part of the recently adopted Freshwater Wetland Compensatory Mitigation Administrative Rules—a triennial report is required; this should be viewed as an means for improving the WCM program. A recommended approach is suggested and is based on identification of critical WCM program success factors.

Recommendations To Move Beyond Existing Regulatory Programs

8. Continue To Support Comprehensive Wetland Planning

While wetland planning is not yet watershed-based, current comprehensive planning approaches offer numerous advantages over the limitations of the removal-fill permitting process. DSL should vigorously work to continue and expand these efforts.

9. Develop And Implement Alternative Compensatory Mitigation Options

The large majority of WCM projects permitted are small projects; alternative compensatory mitigation options (such as the "payment to provide" and mitigation banking options) have the potential to improve upon problematic aspects of the current WCM program.

10. Continue To Seek Out And Participate In Partnerships To Evaluate Aquatic Ecosystem Health At Watershed And Regional Scales.

Wetland functional loss due to indirect and cumulative environmental impacts is not accounted for through the existing permit process. The agency needs to participate in interagency/university/ private sector cooperative research efforts focusing cumulative impact assessment at watershed and regional scales. The results of such evaluations would likely have policy implications for existing environmental laws and governmental structure, including the Removal-Fill Law. (For example, DSL is using EPA funding to conduct an independent evaluation of wetland losses in the Willamette Valley.) These types of broad scale evaluations are necessary to provide a context for assessing the watershed or ecosystem effects of the permit program.

PREFACE

In 1991 the Oregon Division of State Lands (DSL) undertook a field evaluation study of Portland metropolitan area freshwater wetland compensatory mitigation (WCM) projects permitted through the state Removal-Fill Law (ORS 196. 800 - 196.990). The evaluation also included projects permitted through the federal Clean Water Act Section 404 permit program. This study is the first effort in Oregon by regulators to monitor freshwater wetland mitigation projects in a systematic fashion. The study was initially funded by the U.S. Army Corps of Engineers, Portland District (Corps) as part of a cooperative agreement between DSL and the Corps.

This is not a policy oriented study—DSL's recently adopted Freshwater Wetland Compensatory Mitigation Administrative Rules now establish agency WCM policy (OAR 141-85-aaa-qqq). Our report does not provide a comprehensive view of the wetland resource base in the Portland Metro area; questions about wetland resource dynamics, such as rates and levels of change in acreage and functional attributes, are beyond the scope of this study. Neither does our study provide much in the way of descriptive details on individual project success or failure.

Instead, our study is a start at obtaining an *aggregated* view of the wetland compensatory mitigation program administered by DSL, a perspective several steps removed from project-oriented details to look at some actual data about program *outcomes*. The data we have compiled and analyzed can serve as "reference performance" with which to gauge the present and future state of the program.

Acknowledgments

This report would have not been completed without the contributions of a number of people. The Portland District of the Corps of Engineers provided initial funding to get the project started. Lynn Putnam and Janice Martin joined the project as interns, helped us develop and refine the field methods, and did the bulk of the field work. Lynn Putnam also did an outstanding job in conducting all of the interviews and did the initial number-crunching of raw data. Emily Roth helped develop the methodology and conduct the field work. Mary Kentula, Stephanie Gwin, Cindy Holland, Jean Sifneos, and Paul Shaffer of EPA's Wetland Research Program provided input into the study approach and methodology development. The interviewees participated willingly and were refreshingly candid in their views. Ken Bierly did what he does best by providing a much needed reality check and reorientation of our early drafts. Jane Le Blanc formatted and proofed the final draft. We are especially indebted to Larry Potter, Gene Free, Pat Thompson and LeDonna Shuman for taking on DSL's enforcement caseload as Professional Skills Program (PSP) trainees and making it possible for the authors to reallocate work time to get the project done. Finally, and most importantly, we thank Steve Moser, our enforcement program colleague, who handled an inordinate share of DSL's enforcement caseload during this project, and, perhaps because of it, created the PSP training program at DSL.

I. INTRODUCTION

Wetland compensatory mitigation—the creation, restoration or enhancement of wetlands to offset permitted wetland losses—has been an increasingly common and controversial component of wetland regulatory programs in the United States since the late 1970s. The Corps and DSL have consistently required WCM for permitted dredge and fill impacts to wetlands in Oregon since the early 1980s[3]. The number of permits issued annually with WCM requirements has steadily increased over the last 15 years (Figure 1). By the end of 1994 wetland impact permits with WCM requirements had been issued by DSL for ~ 586 projects.

Oregon's initial WCM projects, in the early 1980s, were primarily associated with fills in estuaries. From the mid-1980s to the present the number of issued permits for estuarine fills has dropped to near zero. One reason for this is the adoption of state mandated local land use plans by coastal city and county jurisdictions during the mid 1980s that placed over 93% of estuarine wetlands in natural or conservation classifications, which significantly limit development (Cortright et al. 1987). Starting in the mid-1980s and continuing to the present there has been a substantial increase in freshwater WCM projects in the Portland metropolitan area, especially in Washington County. Along the coast, declining estuarine fills have been replaced with approximately equal numbers of fills in coastal freshwater wetlands. In the 1990s, freshwater WCM projects in the mid and upper Willamette Valley—the Interstate 5 corridor—have increased as well (Figure 2).

The Regulatory Basis For WCM

Before we review the Portland area project evaluation, it is important to briefly outline the regulatory context in which this study has taken place.

The Federal Regulatory Program

Authorization for use of WCM in the Section 404 permit program stems from the Clean Water Act Section 404(b)(1) Guidelines (40 CFR §§ 230.1-230.80), first issued by EPA in interim form in 1975 and in final form in 1980. The Guidelines are the environmental criteria that the Corps uses in reviewing permit applications. The Guidelines require that

[3]DSL regulates fill and removal activities in waters of the state, including wetlands, under the Removal-Fill Law (ORS 196.800 - 196.990). The Corps regulates discharges of dredged and fill material in waters of the United States, including wetlands, under Section 404 of the Clean Water Act (33 U.S.C. Section 1344).

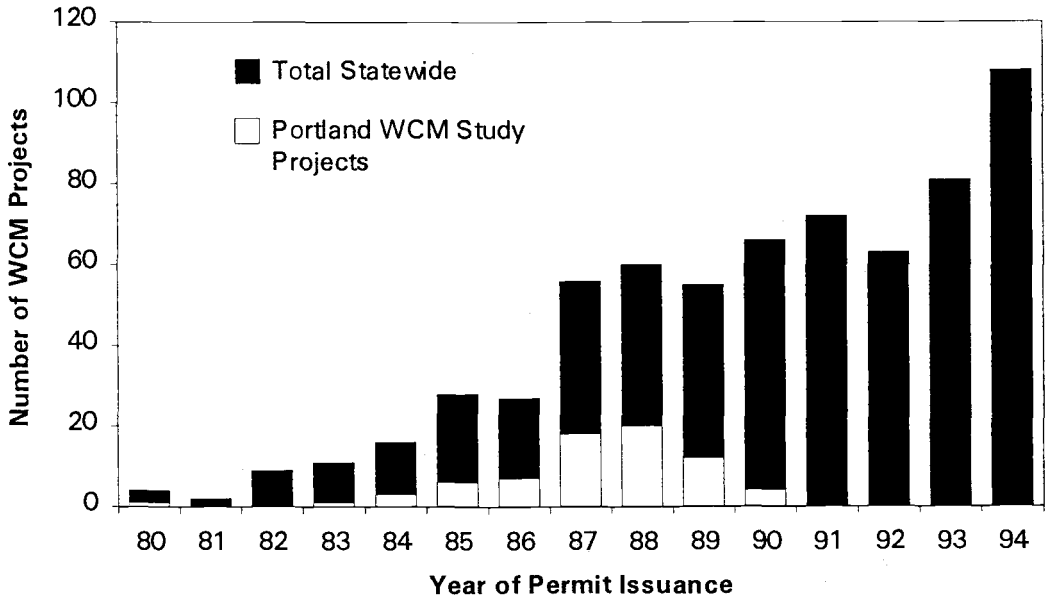

Figure 1: Numbers of wetland compensatory mitigation projects in Oregon required by federal and/or state permits through 1994. A total of 586 permits issued with compensatory mitigation as of the end of 1994. Source: DSL permits database and permit files.

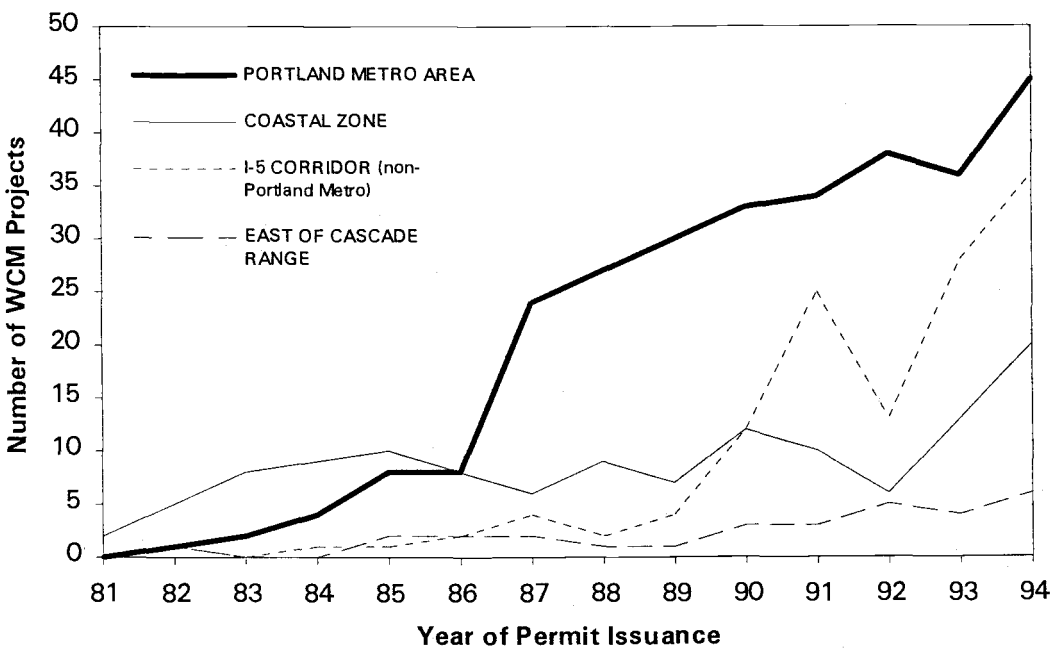

Figure 2: Regional locations of wetland compensatory mitigation projects in Oregon required by federal and/or state permits, 1981-1994. Source: DSL permits database and permit files.

"appropriate and practicable steps...[be] taken which will minimize potential adverse impacts." Subpart H of the Guidelines identifies potential actions to minimize adverse impacts, including "habitat development and restoration techniques [which] can be used to minimize adverse impacts and to compensate for destroyed habitat."

The U.S. Fish and Wildlife Service (USFWS) provides comments to the Corps on Section 404 permit applications. In 1981 USFWS adopted a mitigation policy that included a compensation component[4]. EPA also comments on Section 404 permit applications. EPA's Region 10, which includes Oregon, adopted a mitigation policy in 1985 that also included compensation (unpublished EPA Region 10 mitigation policy: "U.S. Environmental Protection Agency, Region 10. 404 Mitigation Policy").

The USFWS and EPA Region 10 mitigation policies were based on the Council on Environmental Quality (CEQ) definition of mitigation, which requires a sequential review of proposed adverse impacts beginning with impact avoidance, then impact minimization and finally requiring compensation for remaining impacts (40 CFR 1508.20). In 1990 a Corps/EPA Memorandum of Agreement (MOA) on mitigation was signed ("Memorandum of Agreement Between the EPA and the Dept. of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404 (b) (1) Guidelines"). It was also based on the CEQ definition of mitigation and was generally consistent with the USFWS and EPA mitigation policies. The MOA required "compensatory mitigation...for unavoidable adverse impacts." It stated that "the determination of what level of mitigation constitutes 'appropriate' mitigation is based solely on the values and functions of the aquatic resource that will be impacted." The MOA also stated that every individual permit action need not meet the goal of no net loss of function and value due to practicability limitations, "however it remains a goal of the Section 404 regulatory program to contribute to the national goal of no overall net loss of the nation's remaining wetland base." The MOA also included preferences for on-site compensation, in-kind replacement of functional values, restoration over other methods and a base ratio for acreage replacement of 1:1.

The State Regulatory Program

For the state of Oregon, explicit requirements for compensatory mitigation began in 1979 when the Removal-Fill Law was amended to require replacement of wetlands and aquatic habitats for permitted fills in estuaries. DSL adopted administrative rules under the Removal-Fill Law for estuarine fills and estuarine mitigation in 1984. DSL also began requiring WCM for permitted fills in freshwater wetlands in the early 1980s based on language in the Removal-Fill Law that allowed the conditioning of permits to meet the statute's goal of "protection, conservation and best use of the water resources of the state." Under a 1974 Attorney General's Opinion, DSL jurisdiction over freshwater wetlands only included wetlands with herbaceous vegetation, excluding those dominated by woody vegetation. Jurisdiction was expanded in 1985 when DSL amended its administrative rules to include the Corps/EPA definition of wetlands, which includes all types of vegetated wetlands, including those with woody vegetation.

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[4]Fed. Register, Vol. 46, No. 15: 7644 - 7663

In 1989 Oregon adopted the state's first comprehensive wetlands legislation, commonly referred to as Senate Bill 3. Senate Bill 3 contained legislative findings regarding wetland values and management concerns and set state policies of promoting wetland protection, conservation and best use (ORS 196.668, 196.672). A key aspect of Senate Bill 3 regarding WCM was a policy to, "maintain a stable resource base of wetlands through the mitigation of losses of wetland resources and the adoption of the procedural mitigation standard currently used by federal agencies." To implement this policy the legislation amended the Removal-Fill Law to require mitigation for all permitted waterway projects and defined mitigation consistent with the CEQ definition.

Evaluations Of WCM As A Management Tool

In Oregon, and, generally, throughout the United States, there has been a lack of regulatory program data with which to adequately answer even the most basic questions about WCM—such as, "Are we gaining or losing wetland acreage as a result of federal and state permit decisions?" or "What percentage of WCM projects used wetland creation as opposed to wetland enhancement?" or "Where are the sites located?" While such data may be insufficient to determine the ultimate "success" of wetland compensatory mitigation projects, either individually or collectively, it is necessary information to begin to do so.

There have been 4 major reviews of WCM projects in Oregon (Table 1). The Fishman Environmental Services (1987) and Gwin and Kentula (1990) studies evaluated as-built project conditions versus permit requirements. Recommendations were made in both studies to correct program deficiencies at DSL and the Corps, but few were implemented by the agencies. Only the Kentula et al. (in progress) review considers quantitative assessment of wetland functions of WCM project sites relative to natural "reference" wetlands. A deficiency of all these studies (including ours) is that they are limited to project-by-project assessment, not evaluating indirect and cumulative impacts to wetland resources in more appropriate geographic units (i.e. watersheds).

A review of the Oregon studies and several other studies that have been done around the nation reveals a striking convergence of results (Table 2). In the discussion and conclusion sections we explore the causes of these persistent, pervasive problems and offer recommendations to begin to improve upon them.

TABLE 1: Summary of major wetland compensatory mitigation project reviews in Oregon.

REVIEWERS	FIELDWORK DATE	REPORT DATE	PROJECT TYPES	STUDY LOCATION
Fishman Environmental Services (for DSL/DLCD)	1987	1987	ca. 35 Estuarine Projects	Oregon Coast
Gwin and Kentula (EPA Wetlands Research Program)	1987	1990	11 freshwater projects	Portland area
Shaich and Franklin (this report)	1991	1995	72 freshwater projects	Portland area
Kentula et al. (EPA Wetland Research Program)	1993	in progress	ca. 49 freshwater projects	Portland, primarily same sites as DSL study

TABLE 2: Common program problems identified by selected evaluation studies from Oregon and the U.S. (Fishman et al. 1987; Kunz et al. 1988; Gwin and Kentula 1990; Kentula et al. 1992; Kusler and Kentula 1990; Erwin 1991; Lewis 1992; Storm and Stellini 1994).

- o Project design and permit decisions made without a "landscape" or "watershed" context;
- o Ill-defined project goals and success criteria stated in permit files/permit conditions;
- o Poor project/program information management: incomplete project files with inadequate information and data quality control; illegible or difficult to interpret permit drawings and maps;
- o Lack of baseline surveys limiting the ability to evaluate the success of a project;
- o Inadequate, inappropriate, or unstandardized monitoring efforts;
- o Process of gathering the information for evaluation very labor intensive;
- o "As built" surveys not required and rarely available in permit site and permit files;
- o "Problematic" plant species colonization, with no management;
- o Few sites with long-term management plans;
- o Viability, or "success," of most sites in question or unknown because of a combination of poor location, design inadequacies, and inappropriate long-term management, or simply a lack of data to draw any definitive conclusions.

Background Of The Portland WCM Study

DSL entered into a cooperative agreement with the Corps in order to develop more coordinated enforcement programs between the two agencies; it was also thought such an effort would provide an opportunity to evaluate some aspects of permitting, namely, wetland compensatory mitigation. A study was proposed by DSL and funded by the Corps; the cooperative agreement between the Corps and DSL initially defined the study as follows:

> Description: Develop a listing of wetland mitigation sites associated with all Corps permits issued prior to 1 April 1990 and prepare consolidated data sets for each. Data to be included will be established in coordination with the Corps so as to facilitate complete data sets for the Corps data base management system. Task also includes the preparation of a list of factors to be utilized in the evaluation of the mitigation sites listed above, and the evaluation of selected sites. The sites to be evaluated will be selected by the Corps in consultation with the State. The purpose of such evaluation would be to provide information to the Corps with regard to the level of success at each site, and the reasons for success or failure. Recommendations for increasing success rates at mitigation sites will also be provided as a part of this task.
>
> Products: Mitigation Site Listing, Mitigation Site Data Sets, List of Evaluation Factors, Mitigation Site Evaluations, and Recommendations for increased success for consideration and evaluation by the Corps.

It was necessary to expand the study in scope and focus. We developed a WCM project evaluation methodology primarily designed to assess compliance with permit conditions (i.e. project "success"), but also to provide a limited evaluation of the overall WCM program in Oregon by attempting to answer some basic management questions. These included inquiries into the activities being permitted in wetlands, agency requirements for WCM, the cumulative effects on the resource (in terms of changes to wetland surface area and wetland types), and whether the differences between the Corps and DSL regulatory approaches were a factor in these outcomes.

II. APPROACH AND METHODS

Study Area

The study focused on WCM projects in the Portland metropolitan area (Clackamas, Multnomah, Washington counties) that were permitted from 1980 to 1990. Virtually all of reviewed projects were with in the Portland metropolitan area urban growth boundary. Sixty-nine percent of the projects are located with in the Tualatin River basin, which drains to the Willamette River (Figure 3). The remaining projects are in the Lower Willamette River basin. The metro area was chosen because over fifty percent of all

permits in Oregon with compensatory mitigation have been issued in that area, the projects were located in a small geographic area that allowed us to efficiently visit them within our time and resource constraints, and because an earlier review of projects statewide by Shaich (1989) indicated that the projects in the metro area were representative of freshwater mitigation projects statewide.

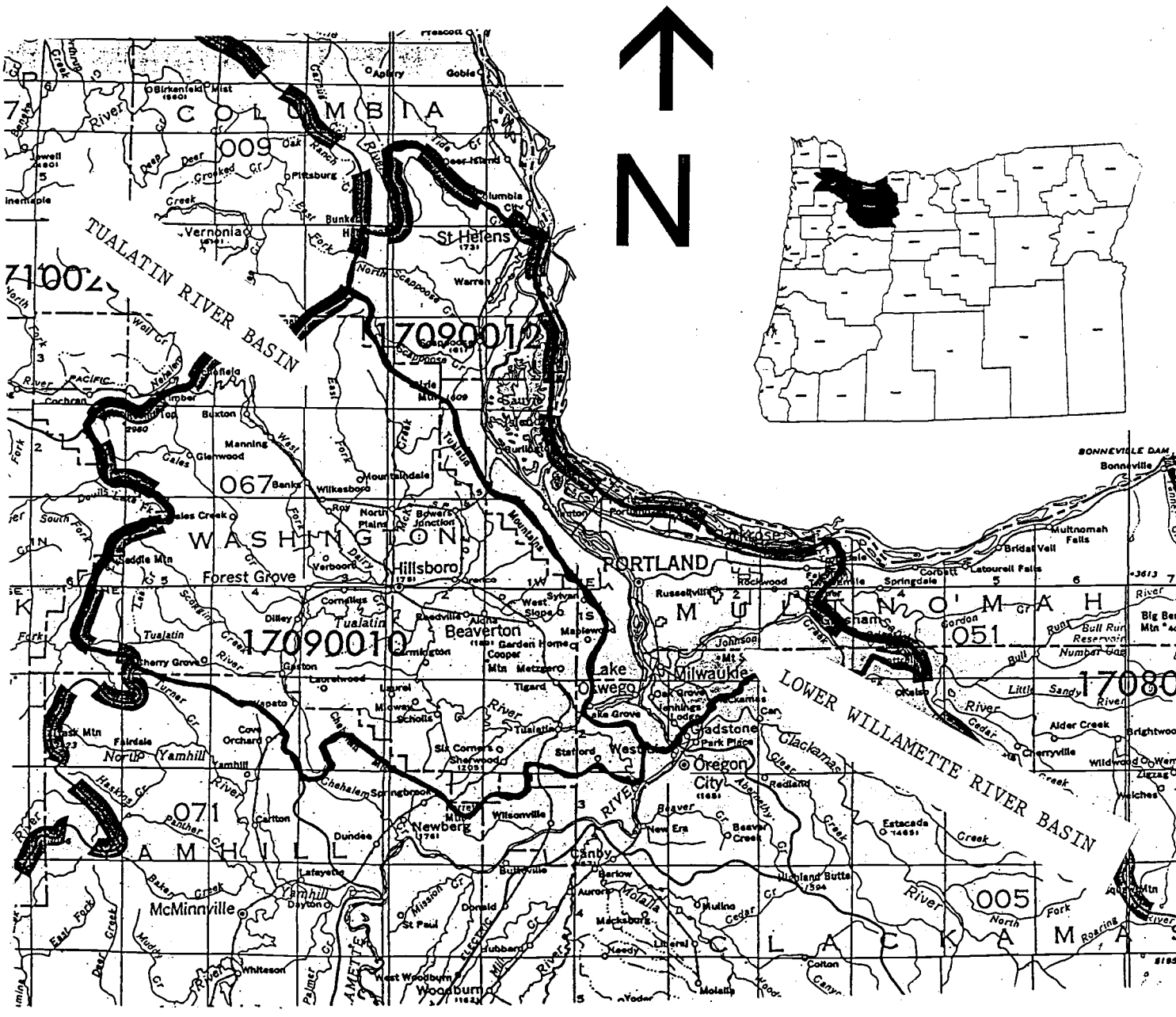

Figure 3: Map of Study Area

Project Selection

An initial survey of permit files in June 1991 and follow-up telephone inquiries with permit holders indicated that 90 permitted wetland impact and associated WCM projects had been completed in the metro area as of 1990. An additional 50 permits for wetland impacts with required WCM had been issued in the study area from 1980 - 1990; however, our survey indicated that these permits had either expired with no wetland impacts occurring or that the permits were still active and the impacts and associated WCM projects had either not happened or were in progress. Our intent was to review all 90 of the completed projects, but we managed to only review 78% (72/90) of the projects during the time available to us.

Data Collection

Data was collected from Division of State Lands permit files and from field inspections of the WCM sites during the summer of 1991. All of the permit files contained a copy of the joint federal/state permit application and attachments (maps, drawings, mitigation plans), permit review process correspondence and copies of the Removal-Fill and Section 404 permits. Some files also contained monitoring photos and notes by DSL staff and monitoring reports submitted by permittees.

Evaluating Compliance

For each WCM project the permit files were reviewed and DSL permit conditions were noted. Field inspections of the WCM project sites were then conducted to assess compliance with the permit conditions. Detailed assessment procedures are described in Appendix B.

We evaluated projects for compliance with DSL permit conditions only. All 72 of the projects had DSL individual permits with some level of specific WCM requirements, while only 27 of the projects had Corps individual permits with specific WCM requirements. The remaining projects were authorized under Corps General permits or were not regulated by the Corps. Also, the permit requirements differed little between the Corps and DSL when both agencies issued permits with specific mitigation requirements for the same project.

Permit Program Review Methodology

Detailed assessment procedures for the program review methodology are in Appendix B. For each of the 72 reviewed projects the following program parameters were reviewed:

- o Types of development projects requiring permits
- o WCM methods used as compensation
- o Wetland acreage: Net Change
- o Wetland types: Net Change
- o Comparison of DSL and Corps roles
- o Spatial relationship of WCM project to impact project (on-site or off-site)

III. FINDINGS

WCM PROJECT REVIEW RESULTS

First, we report the findings of the Portland Metro area projects evaluated by fieldwork in 1991; we then update some of this data, where possible, to the present. Unfortunately, there is not much in the way of as-built project conditions that can be reported since 1991.

What Regulated Activities Are Impacting Wetlands?

The permit data were analyzed to identify the stated causal factors for permitted wetland impacts.

Commercial and industrial building pads and roads dominate permits in the urban area

Permit records indicate a total of 52 acres of permitted wetland impacts for the Portland area projects evaluated in this study. Urban and suburban development for commercial, industrial, and residential purposes and for public roads accounted for nearly all of the wetland impact acreage. Commercial, industrial and public road projects included nearly all of the projects with large impacts (greater than one acre wetland impacted) while residential project impacts were generally less than one acre. Classifying projects by the specific activities causing the wetland impacts shows that building pads and roads (public and private) were the predominant impact activities (Table 3).

What Impacts To Wetlands Are Being Permitted?

Many small projects (small cumulative acreage) and few large projects (most of the cumulative acreage)

Wetland impacts permitted ranged from less than 0.01 acres to 3.73 acres. Most of the projects (75%, 55/72) were small involving impacts of 1 acre or less (Figure 4). Combined impacts for these small projects was 28% (15 acres/52 acres) of the total wetland area impacts. A total of 17 projects with impacts greater than 1 acre accounted for 72% (37 acres/52 acres) of the total acreage impacted. Consideration of permitted wetland impacts on a yearly basis does not reveal any significant trends, although to some extent the trend in wetland permitting for the period 1985-89 was to smaller projects (Figure 5).

TABLE 3: Wetland impacts by types of development activity.

GENERAL PURPOSE	PROJECT ACTIVITY	INCLUDES ALL IMPACT SIZES		IMPACTS LARGER THAN ONE ACRE ONLY	
		NUMBER	ACRES	NUMBER	ACRES
Commercial	Building pads	20	19.96	6	14.24
Public Roads	Roads	12	11.21	5	9.61
Industrial	Building pads	4	4.44	2	4.10
Residential	Building pads	5	3.54	1	2.70
Industrial	Roads	1	3.40	1	3.40
Residential	Roads	7	2.42	0	0.00
Subtotals		49	44.97	15	34.05
Other	Other	23	6.98	2	3.11
Total for study area		72	51.95	17	37.16

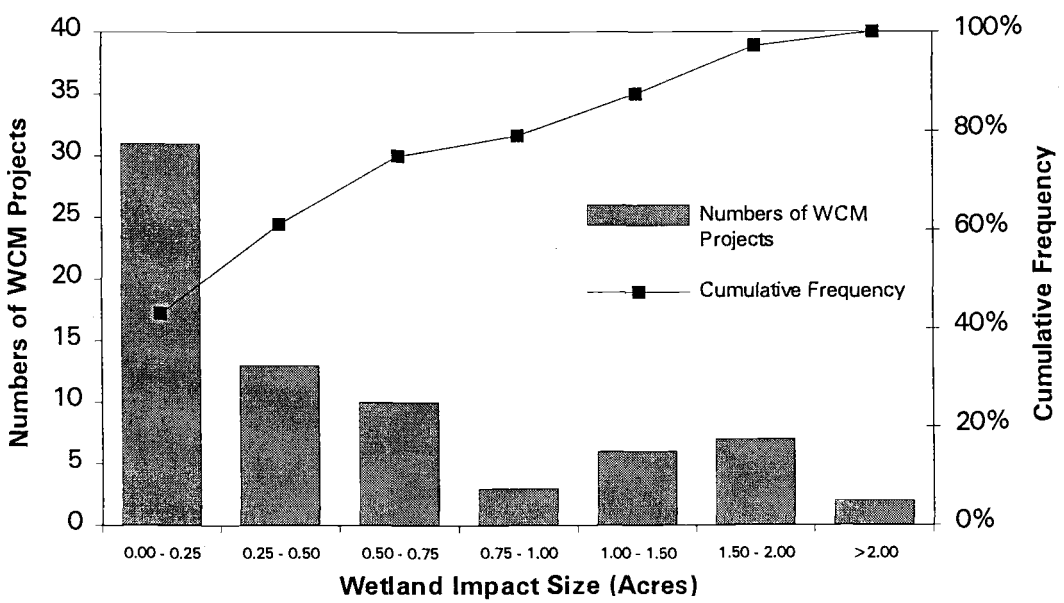

Figure 4: Wetland impacts permitted under federal and/or state permits for Portland, OR area projects evaluated in this study. Data lumped into bins of impact sizes.

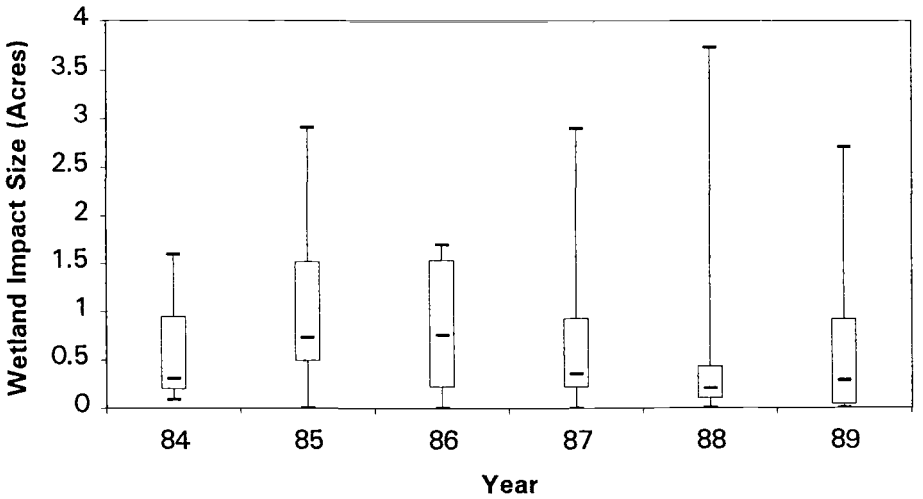

Figure 5: Wetland impacts permitted under federal and/or state permits for Portland, OR area projects evaluated in this study. Reported as quartiles per year (the upper horizontal line is the maximum value; the middle is the median; the lower is the minimum value). There were only three projects for 1984 (the minimum, median, and maximum values represent all three projects).

Emergent wetlands receive the bulk of impacts

Permits were issued predominantly for impacts to emergent wetlands (41 acres); forested (7 acres) and scrub-shrub (3 acres) wetlands were impacted less in the permit process (Figure 6). Impacts to other wetland types were negligible . We noted during our field work that many of the impacts were to streams and not vegetated wetlands. Our determination of pre-impact wetland classification was based in many cases on National Wetland Inventory (NWI) maps which often identified streams in the study area as palustrine emergent, scrub-shrub, or forested wetlands. However, in the field we observed that many of the wetland impact sites identified as palustrine wetlands on the NWI maps were actually unvegetated stream channels that should be classified as riverine wetlands or deepwater habitats. This was particularly true for impact sites identified as palustrine forested wetlands on the NWI maps. Most of these were actually unvegetated stream channels with upland riparian tree canopies.

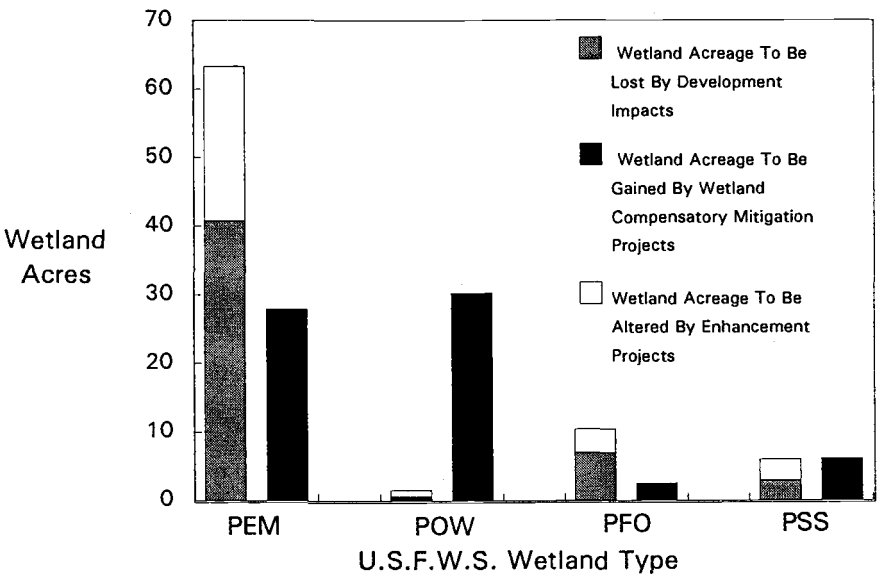

Figure 6: Permitted gains and losses of wetlands authorized under federal and/or state permits for Portland, OR projects evaluated in this study. Reported by USFWS wetland type: PEM = palustrine emergent; POW = palustrine open water; PFO = palustrine forested; PSS = palustrine scrub/shrub. Acreage for other wetland types was negligible.

What Is Being Required For Compensatory Mitigation?

Cumulative net losses in wetland acreage

To compensate for the 52 acres of authorized wetland impacts, federal and/or state permits required that 37.5 acres of wetlands be created and that 31 acres of wetlands be enhanced. Therefore, cumulative net change in wetland acreage based on permit requirements was a loss of 14.5 acres. Based on permit requirements, 33 % (24/72) of the projects were to result in a net gain in wetland area, 12.5 % (9/72) were to result in no net change and 54 % (39/72) were to result in a net loss.

Replacement of emergent wetlands with ponds

The net result of the permitted impacts and required WCM was an exchange of emergent wetlands for open water wetlands. This included the conversion of 22.6 acres of emergent wetlands to other wetland types, primarily open water, through enhancement (Figure 6). Overall, emergent wetlands were to be reduced by 35 acres while 29 acres of open water wetlands were to be gained; 8 acres of forested wetlands were also to be lost (Figure 7). Changes to other wetland types were negligible.

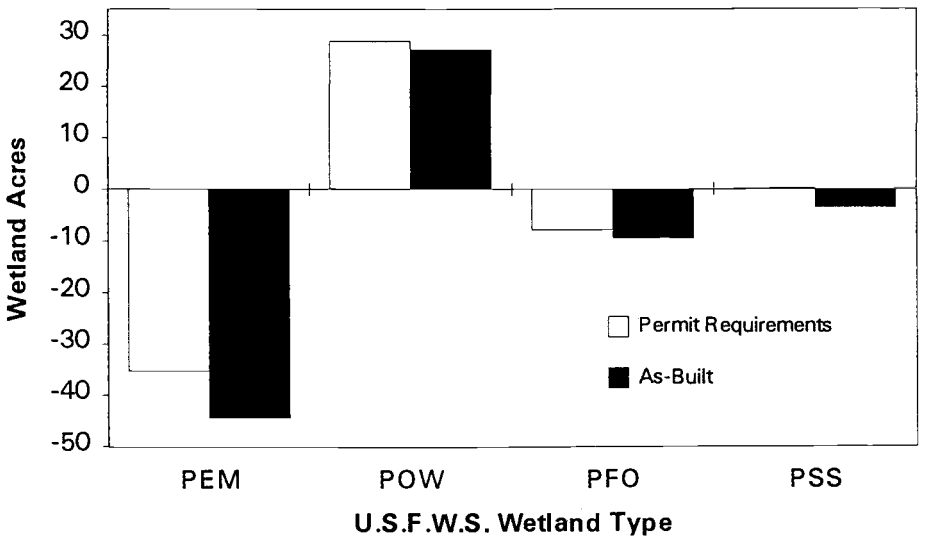

Figure 7: Comparison of cumulative net changes in wetland types based on federal and/or state permit requirements and as-built conditions for Portland, OR projects evaluated in this study. Acreage for other wetland types was negligible. PEM = palustrine emergent; POW = palustrine open water; PFO = palustrine forested; PSS = palustrine scrub/shrub.

In-kind ≅ Out-of-kind compensation; mostly on-site compensation

The projects were reviewed to determine if they involved in-kind compensation (providing replacement wetlands of the same wetland type as those lost) or out-of-kind compensation. There was close to an even split between these types: 33 % (24/72) of projects provided in-kind compensation for permitted impacts; another 15 % (11/72) of projects included a mix of in-kind and out-of-kind compensation; 39 % (28/72) of projects involved out-of-kind compensation; and 12.5 % (9/72) of projects involved wetland alterations without compensation or had other characteristics that precluded a meaningful distinction for this parameter.

Most of the WCM projects, 92 % (66/72), were located in the immediate vicinity of the impact (same or adjacent parcel) and were defined as "on-site" compensation*.

No restoration projects; creation and enhancement used equally

We also classified the projects by the methods used for compensation into three types: restoration*, creation*, and enhancement*. There were no projects in the data set that involved wetland restoration. Creation or enhancement or a combination of the two were used for 92 % (66/72) of the projects, and were used with approximately the same frequency (Figure 8). A relatively small number of projects, 8% (6/72), involved wetland alteration without compensation (storm water detention basins, etc.).

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* See Appendix A

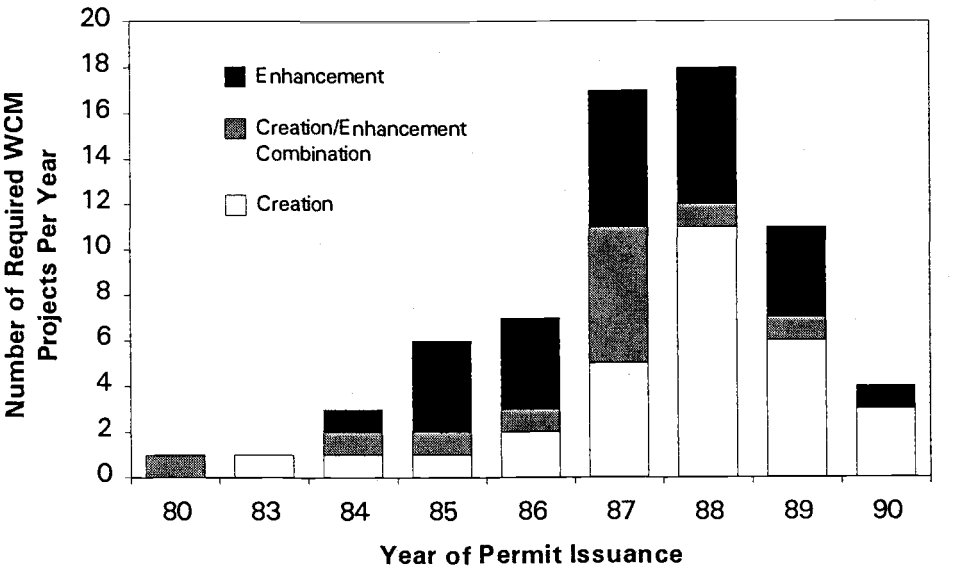

Figure 8: WCM method used for Portland, OR area projects evaluated in this study. Creation is defined as creating wetland out of an upland area, enhancement as the modification of an existing wetland in order to improve, or enhance, its functional attributes; the creation/enhancement combination used both methods but relative value of each was not determined. 6 of 72 projects involved wetland alteration without compensation; they are not included in the graph. There were no permits with WCM requirements issued in the study area in 1981-82.

Are The Requirements Being Complied With?

Nine general categories of permit conditions were identified for compliance assessment. Below, each category is followed by the percentage of projects with listed permits conditions in the respective category.

- o Compensation Requirement (the specific language requiring the compensatory mitigation) (100)
- o Upland Buffer Area/Vegetation (95)
- o WCM Construction Timing (53)
- o Wetland Vegetation (42)
- o Hydrology (35)
- o Water Control Structures (24)
- o Fencing (8)
- o Monitoring (not assessed)
- o Contingency Requirements (not assessed)

Due to the limited nature of the study, we were unable to evaluate compliance with the categories of WCM construction timing, monitoring requirements, and contingency requirements.

Almost all WCM projects are being constructed

All 72 of the projects reviewed had been constructed. Based on the initial survey of permits in the study area and additional data collected while preparing for the field work we determined that 89 of the 90 WCM projects reviewed actually had been constructed.

Violations of permit conditions are common

A majority of projects (64 %, 46/72) had one or more compliance violations as determined by the study team. Of those 46 projects, 12 had two violations and 6 had three violations. Non-compliance was observed with upland buffer requirements, wetland area required for the compensatory wetlands, herbaceous vegetation requirements in the compensatory wetlands and a small number of violations of requirements for weirs and fencing. The most common type of non-compliance was with upland buffer requirements (40%, 29/72); violations included failure to plant or maintain the required numbers of plants, substitution of alternative species and/or inappropriate management of the buffer area (mowing, herbicide use, use as storage area, etc.).

The other common type of non-compliance noted was with requirements for establishment of herbaceous plant species within the compensatory wetland area. Only 30 projects had detailed wetland vegetation requirements, and of those, 15 were identified as non-complying, generally because few or no plants of the required species were found in the wetlands.

Cumulative as-built net losses in wetland acreage

The 72 projects resulted in a cumulative as-built net loss of 30.2 acres of wetlands; permit requirements had authorized a net loss of 14.5 acres, resulting in a compliance discrepancy of 15.7 acres (Figure 9). Based on field observations of as-built conditions, only 17% (12/72) of the permits resulted in a net gain of wetlands, 10% (7/72) resulted in no net change and 73% (53/72) resulted in a net loss of wetlands. Figure 7 shows how these net losses were distributed among different wetland types.

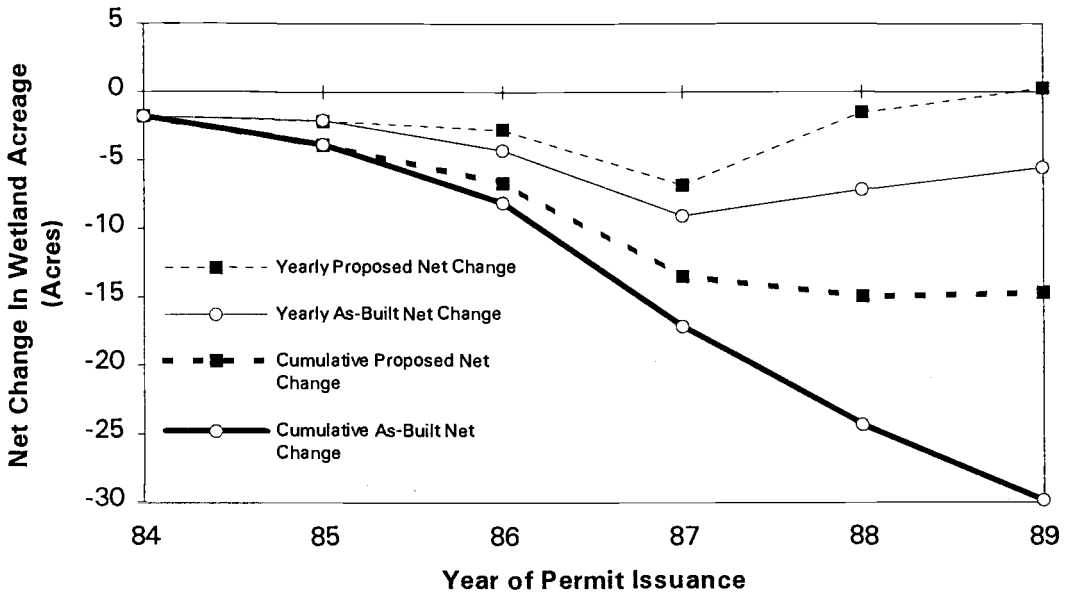

Figure 9: Proposed and as-built net changes in wetland surface area (yearly and cumulatively) for Portland, OR permits evaluated in this study. Data for years 1980-1983, and 1990 are not included due to small numbers of projects.

Proposed versus as-built net change in wetland acreage: most of the acreage discrepancy due to a small number of projects

A measure of compliance with respect to wetland area is the difference between proposed (or permitted) net change in wetland area and as-built net change in wetland area (Figure 10). Only 9 projects of the 72 could be classed as "big losers" (with a proposed vs. as-built net loss discrepancy greater than 0.5 acres). These 9 projects, however, accounted for 13.3 acres of the 15.7 acres noted above. The "small losers" (discrepancy less than 0.5 acres), of which there were 25 permits, only accounted for 3.2 acres of the total discrepancy; 29 permits had no discrepancy between proposed and as-built net change, and were labeled as permits with "exact compliance." Nine permits resulted in an actual net gain of wetland area relative to that which was permitted; the total acreage gain, however, was minor—only 0.74 acres.

For the big loser category there was no consistent pattern of problems that could be identified, the problems being somewhat unique for each project. These included inadequate area at the site to accommodate the required mitigation project; a few cases of simply not enough wetland area being constructed; and a complicated enforcement case.

We did not characterize the reasons for acreage discrepancies for the "small loser" group or the "gainers." The "exact compliance" group consisted almost entirely of enhancement projects.

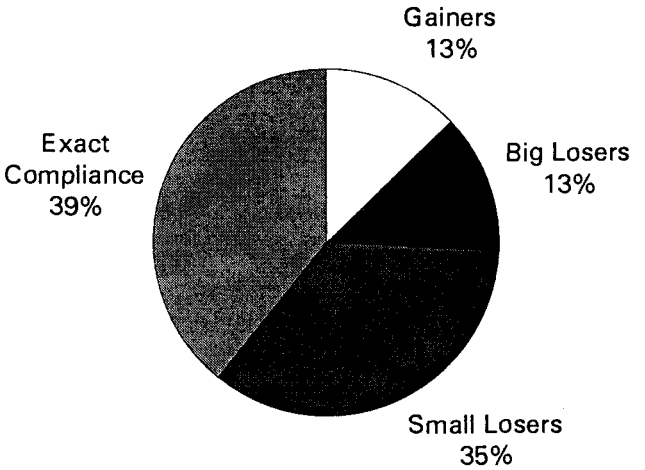

Figure 10: WCM project compliance summary for net changes in wetland acreage: proposed vs. actual (as-built); for Portland, OR area projects evaluated in this study.

Does Federal Involvement Change Project Outcomes?

Both DSL and the Corps regulate wetland impacts with a permit system. The two programs share many common features but are not identical. During the period when permitting occurred for the projects reviewed in this study, 1980 - 1990, there were two primary regulatory differences: (1) DSL required an individual permit for all wetland impacts involving 50 cubic yards or more of both fill and removal; the Corps only regulated fill and not removal activities. All 72 projects in this study had a DSL individual permit. There were four projects in the study that did not require any type of Corps permit because they involved removal; and, (2) the Corps authorized certain categories of projects under various general permits, which usually do not include project specific WCM requirements. There were 41 projects in the study that were authorized by the Corps under general permits, nearly all under nationwide 26 permit[5]. The Corps required individual permits for the remaining 27 projects.

To determine if the involvement of the Corps and the federal reviewing agencies (through the individual permit process) resulted in different project outcomes than when only DSL was directly involved, the projects were divided into two groups: projects requiring a Corps individual permit (27 projects) and all other projects (45 projects). These other projects included those with a Corps general permit and those that did not

[5]Nationwide permit number 26 allows wetland fills of up to 10 acres in headwaters and isolated wetlands. See 33 CFR 330, Appendix B for details.

require any type of Corps permit—in both cases the Corps was not involved in project specifics such as WCM requirements.

Removal-Fill Law compensates for more wetland impacts than the Section 404 program

Impacts to 20 acres of wetlands were authorized by the Corps under Nationwide 26 with no required compensation. State permits for those impacts required 20 acres of wetland creation and 13 acres of wetland enhancement as compensation. The Corps lack of regulation for removal impacts was insignificant. Only 4 permits were issued by DSL for removal in wetlands with a total of 0.19 acres of permitted wetland impacts.

As-built outcomes generally similar regardless of federal role

There were few other substantial differences between the two groups of permits. Projects with Corps individual permits were generally larger, averaging 1.17 acres of permitted wetland impact. Forty-eight percent (13/27) of permitted impacts were larger than one acre. The other permits average 0.45 acres of permitted wetland impact with 78% of the impacts less than 0.5 acres and 87% less than one acre.

The only other substantial difference between the two groups of permits was in terms of permitted net change in wetland area: a majority (74%, 20/27) of the Corps individual permits authorized net losses of wetlands while only 42% (19/45) of the other permits authorized net losses. Cumulatively the 27 projects with Corps individual permits permitted the net loss of 14 acres of wetlands. The 45 other projects as permitted were to result in approximately no net loss of acreage, allowing only 0.14 acres of cumulative loss. While the DSL permit process acting alone may require more WCM than when the federal individual permit process is involved, the as-built data indicates similar problems with project implementation resulting in cumulative net losses of wetland acreage for both sets of projects. The as-built cumulative net loss for the Corps individual permits was 20 acres, 7 more than permitted. For the other permits it was 10.5 acres, over 10 acres more than permitted.

A DATA UPDATE

The only data we are able to update (again only through very labor intensive efforts) is that of permitted net wetland impacts and required compensation acreage for permits with WCM issued in 1993, and a smaller subset of permits issued in 1994 (Tables 4 and 5). With respect to acquiring basic information about DSL's WCM program little has changed since we initiated this study in 1990—DSL's compensatory mitigation database is still not of sufficient completeness and quality to provide meaningful analysis. However, we will discuss this information management problem in the discussion and conclusion sections. Note that this is state-wide data, not just limited to the Portland Metro area.

Methods Permitted

Table 4 shows the breakdown by WCM method for the sample set of permits issued in 1993-94. Relative to the Portland area projects of this study, the bulk of which were issued between 1984 through 1989, there is a far greater percentage of creation projects than enhancement projects; there are also several restoration projects as compared to a total of zero in the Portland data set.

TABLE 4: WCM methods used, 1993-94. For project impacts or mitigation projects greater than 1/4 acre in size. State-wide data obtained from the DSL database and permit files.

ISSUE YEAR	C	CE	E	R	CR	CER	Not ✓'d	Total No. Reviewed (> 1/4 acre)	Total No. Reviewed/Total No. Issued
1993	27	8	3	1	1	1	4	45	72/81
1994	11	12	4	3	0	0	4	34	56/108

C = Creation, CE = Creation/Enhancement Combination, E = Enhancement, R = Restoration, CR = Creation/Restoration Combination, CER = Creation/Enhancement/Restoration Combination

Net Change In Wetland Area

For 1993 permits, there appears to be a substantial net gain of 17.6 acres for permitted net change in wetland area (Table 5). Unfortunately, there is no as-built data to determine actual net change. One can, however, make some assumptions and calculate an estimate of net change. The Portland area study projects averaged the following compliance discrepancies per project: -0.35 acres/creation project; -0.26 acres/creation-enhancement combination project; and, -0.08 acres/enhancement project. We have no data for restoration projects. Multiplying these average compliance discrepancies by the number of projects for each respective mitigation type (for projects greater than 1/4 acre in size) yields a potential compliance discrepancy of -11.8 acres of wetland. If one generously assumes exact compliance for restoration projects then the estimated total net gain for 1993 would decline to +5.8 acres (17.6 - 11.8). A similar approach for the subset of 1994 projects yields an estimated net change of wetland acreage of -4.3 acres (-7.3 acres (compliance discrepancy) +3 acres total net permitted change). WCM is required for projects less than 1/4 acre in size but the net change in wetland acreage due to these projects is probably quite small. These net change estimates assume that compliance discrepancies for Portland area projects from 1980-89 are representative for 1993-94 and across the state.

The data also points to a defacto priority for WCM methods based on total acreage required: 1. creation, 2. enhancement, and 3. restoration. The recently adopted freshwater wetland compensatory mitigation rules lists the priorities as: 1. restoration, 2. creation or enhancement (OAR 141-85-eee (1)).

TABLE 5: Permitted wetland impacts for permits issued for 1993-94. State-wide data obtained from the DSL database and permit files.

WCM PARAMETERS	1993	1994
# Permits Issued With WCM	81	108
# Permits Reviewed for Permitted Impact Data	72	56
# Reviewed Permits < 1/4 acre in size†	27	22
# Reviewed Permits > 1/4 acre in size†	45	34
Total Permitted Wetland Impact (acres)*	72.7	51.2
Total Required Created Wetland Area (acres)*	82.1	41.6
Total Required Wetland Enhancement Area (acres)*	23.4	29.7
Total Required Wetland Restoration Area (acres)*	8.2	12.6
Total Permitted Net Change In Wetland Area (acres)*	**+17.6**	**+3.0**

†Detailed acreage and wetland type data is not required of permit applicants for projects (impact and WCM) < 1/4 acre in size.

*Recorded only for reviewed projects > 1/4 acre in size (impact area or WCM area)

WCM Project Monitoring Backlog

Every permit issued with WCM becomes a project pending monitoring/evaluation. By the end of 1994 there were ca. 480 WCM projects pending monitoring and evaluation (Figure 11). Many WCM projects are monitored informally: project coordinators take photographs and record observations in the permit files; environmental consultant reports, required by permit conditions, are reviewed by agency staff as time and other priorities allow. Few of these monitoring efforts, however, are systematic and standardized; very little of this information actually makes it into the agency's WCM computer database.

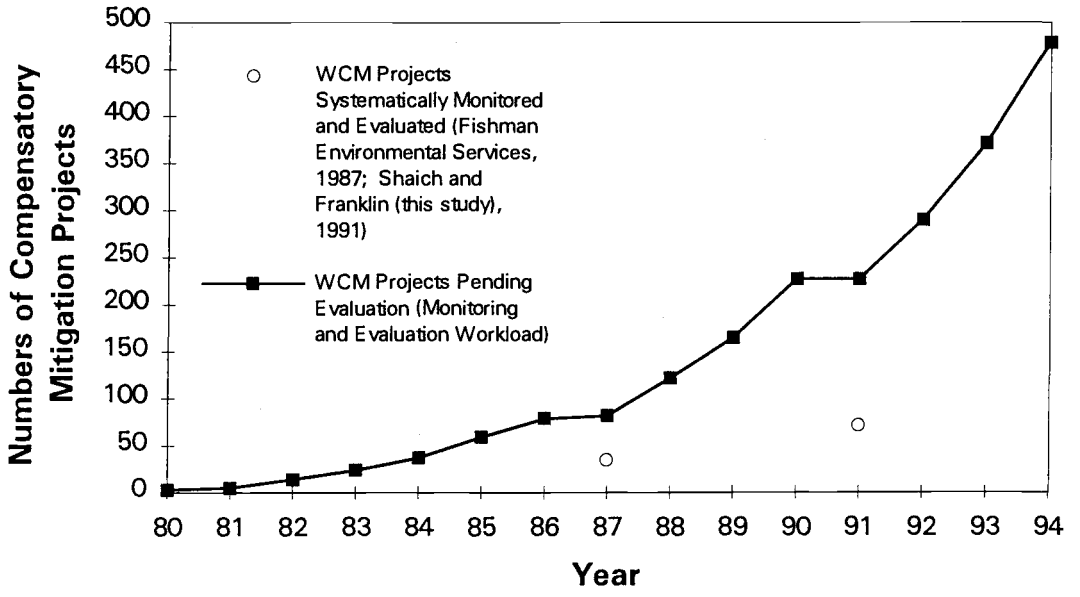

Figure 11: Pending DSL workload for wetland compensatory mitigation project monitoring and evaluation. Statewide totals by year of permit issuance. Source: DSL Databases.

IV. DISCUSSION OF FINDINGS

The most frequent questions we are asked about the Portland area projects, or the concept of WCM in general, are "Does it work?" "Is it successful?" These questions are often entries into a debate that usually fractures into two bipolar positions—"Yes!" and "No!" Rarely, however, is actual program data used to support arguments made by any side of the debate. As we have argued, the data are not often recorded, or have not been compiled, for even the most basic questions.

In the interest of contributing to more credible discourse on the topic of WCM success, we organize the discussion of the study findings within the context of two types of success: compliance-based success and ecological success. Compliance-based success concerns the degree of compliance with permit conditions and project goals, applicable laws and rules; ecological success, however, is broader and concerns how and to what extent the projects and program affect the integrity of aquatic ecosystems, with permitted removal-fill projects and associated WCM projects being only one set of factors among a complex, interacting mix of factors which affect ecosystem health. It is our experience that these two categories of success are often implicitly confused in many of the debates about WCM project and program success.

COMPLIANCE-BASED SUCCESS

One of the original charges for this study, listed in the Corps/DSL cooperative agreement, was to determine the level of success for each project reviewed and develop a list of evaluation factors for project success. Such a requirement is implicitly "compliance based." That is, project success means degree of compliance with the conditions of an issued permit. An effective program from this perspective is important not only because of legal requirements but also because of the considerable amount of time and money expended on WCM by agency staff and the regulated public.

In this section we summarize and discuss the key findings of the field evaluation of the Portland area projects in the following areas: overall project implementation (relative to permit requirements); compliance with wetland area requirements; enforceability of permit conditions; and, federal versus state program performance. Finally, based on the attempt to update WCM data to the present, we consider the success of DSL's overall WCM program from a compliance-based perspective.

The Portland Area Projects

Project Implementation

We found that all of the reviewed WCM projects had been constructed. This finding differs from other areas of the U.S. where similar studies have been done. A Florida Department of Environmental Regulation study reported that for 34% (22/63) of permits reviewed no WCM had occurred (Lewis 1992). Erwin (1991) reported that no WCM had occurred for 60% (60/100) of permits reviewed for the South Florida Water Management District. A 1985 study reported 44% (14/32) of projects had not been constructed in the San Francisco area (Quammen 1986).

Less successful, however, was WCM project implementation, where a majority of the WCM projects were in violation of permit conditions. Reasons for the violations reside with both permit holders and the regulatory agencies, and include flawed project designs, vague permit conditions, minimal monitoring by the regulatory agencies as well as out-right non-compliance with permit conditions.

Our observations of widespread failure to establish required wetland herbaceous vegetation species were similar to other studies (Gwin and Kentula 1990, Erwin 1991). Causes were not quantitatively assessed; however, they appeared to include fringe wetland designs that called for wetland species on slopes too steep to have wetland hydrology or in permanently inundated areas for species that are found in seasonally or intermittently flooded wetlands. Another cause may have been sites that were excavated into subsoils and then planted without adding topsoil or soil amendments to provide adequate soil texture and nutrients for plant survival and growth. There were some reports in the permit files of herbivory problems. Failure to do the required plantings in some cases is also probable, but this could not be determined from field observations or permit files.

Compliance With Wetland Area Requirements

We determined that for the 72 reviewed projects, there was an acreage shortfall of 15.7 acres from what was required by permit conditions. Non-compliance with wetland area requirements had a variety of causes, with the bulk of the acreage shortfall mostly due to 9 projects (13.3/15.7 acres). We have not quantified these causes, but instead base the following qualitative observations based on field visit notes and through the effort of determining permitted and as-built wetland acreages.

A common cause of inadequate wetland area was steep slopes (2:1 - 5:1 horizontal to vertical) around the edge of WCM wetlands that were included on paper as part of the wetland area in many WCM designs. Other freshwater wetlands (i.e. non WCM wetlands) in the study area rarely have steep slopes, in fact, most wetlands in the area are characterized by relatively flat ground surfaces. (In other words, while natural wetlands may have steep banks, the banks are recognized as uplands. WCM designs tend to include the banks in the area identified in the design as wetland.) The steep slopes observed at the WCM projects rarely exhibited wetland characteristics except for a narrow fringe of wetland vegetation adjacent to the lowest portions of the sites that had wetland hydrology. This was the case, though it was not quantified, even in wetland areas that had undergone "enhancement." The adjacent slopes, lying on the perimeter of the sites, often made up a substantial portion of total site area. The cumulative area of these non-wetland slopes was a significant portion of the shortfall in wetland acreage; however, we did not quantify the problem.

Another cause of insufficient wetland area was upland islands. Based on our initial review of permit files we did not subtract upland islands from our calculations of required wetland area because we did not expect them to be a significant factor. Islands in the permitted designs were generally very small components of WCM projects. However, our field observations showed that upland islands were a significant portion of the sites in some cases, especially for the many small projects.

A less significant cause of insufficient wetland acreage was constructed sites that failed to develop into wetlands. Only three of the smaller projects did not have any indicators of wetland hydrology or vegetation and did not meet the study criteria for wetlands.

Just what these net changes in wetland area mean for the aquatic ecosystems of the Tualatin River basin is unknown and was beyond the scope of our study.

Enforceability of Permit Conditions

Even though this study was conducted by DSL's compliance unit staff, determining compliance with the permit requirements was a frustrating challenge. Permit requirements in some cases were so general, or there was so little documentation, that determining what was legally required was not possible. Some permits had a simple plan drawing of a pond and little else. Others directed permit holders to develop planting plans or an entire wetland design with the Oregon Department of Fish and Wildlife (ODFW). In many of these cases there was no documentation in the file to indicate if the permit holder had contacted ODFW or what plans or designs had been developed. Permit

conditions and/or approved WCM designs for some projects included specifications that made compliance unlikely or impossible. For example, many of the older projects required creation of permanently flooded wetlands yet also required establishment of wetland plant communities found in wetlands that are rarely or only intermittently inundated.

While the new WCM rules substantially improve permit application review standards and project plan documentation requirements, it is too early to see whether such front-end improvements will translate to improved enforceability of permit conditions.

Federal Versus State Programs

The most significant difference between the two programs is that the federal program did not require compensation for 20 acres of wetland impact authorized under Nationwide 26. Although there were two other substantial differences noted, in impact area and permitted net change, these differences had little to do with as-built outcomes as cumulative net losses were consistent for both programs. This is not surprising considering that both state and federal permits were based on the same permit application, had nearly identical permit conditions, and had limited compliance monitoring or enforcement follow-up.

The data on impact size could be interpreted to suggest that a result of the Nationwide 26 permit is smaller impacts in general. This is based on the fact that impacts below one acre are pre-authorized and require no interaction with other federal reviewing agencies. Impacts of one to ten acres can also be authorized under Nationwide 26 but requires notification of the Corps by the applicant and a subsequent review by federal resource agencies. The potential delays and modifications that can result from the notification and review process are substantial disincentives for many applicants. However, there are many other possible causal factors not considered here, such as project types, site characteristics or applicant efforts to avoid and minimize impacts.

DSL's WCM Program

Above we have noted some deficiencies associated with WCM within the existing regulatory program of DSL (and to a more limited extent, the Corps) based on review of 72 permits issued primarily from 1980-1989 in the Portland metro area. These problems include a high percentage of projects with permit violations and limited to agency follow-up; the WCM database is obsolete and is not used to manage the program; and, until this biennium, adequate staffing has not been available. How do these compliance-based factors measure up for other areas of the state? To what extent have these compliance-based factors improved since we conducted our field study in 1991? We do not know. One cannot query the agency WCM database to obtain the answers because of data quality problems and the large number of incomplete or missing permit records. In addition, no other as-built surveys of WCM projects have been conducted since 1991; none are planned as of this report date. As it was in 1991, any attempt to generate useful data for these factors must still be done by labor intensive file reviews and staff interviews.

Our limited update of data for 1993-94 does, however, indicate some improvements since 1991: proposed net change in wetland area is a positive number (i.e. more wetland

area is to be gained than lost through permitted impacts); there are some restoration projects as opposed to none; permit conditions (clarity, ambiguity, and organization) have improved, though there are still problems, which could be readily fixed given sufficient attention. Finally, the 1995 Legislature approved funding for a permanent mitigation specialist position at DSL.

Despite these improvements, ensuring "quality" WCM projects has not been a top priority for regulatory or resource agencies due to the pressures that shape agency priorities. Expedient permit review, and, to a lesser extent, expedient enforcement for unpermitted activities, are the top priorities, for the simple reason that permit applicants awaiting project approval, landowners with land impacted by illegal activities and those accused of illegal activities all exert continual pressure on regulatory agencies to act. There is no such group with a vested interest in high quality WCM projects. Consequently, agency activities such as WCM project monitoring or enforcement have generally been lower priorities than permit review or enforcement for unpermitted activities.

These problems can and should be improved. As noted earlier, these problems are not unique to DSL but are common to most WCM programs across the country (Table 2). However, even if these problems are improved there is no assurance that it implies "ecological success." Therefore, in addition to the compliance-based notion of success, a broader concept of success is needed and is considered in the following section of the report.

ECOLOGICAL CONSIDERATIONS FOR WCM PROJECT AND PROGRAM SUCCESS

Despite our emphasis on WCM program problems, we do not intend to imply that all 72 reviewed projects were "failures." During our field study, for example, we observed some projects that certainly appeared to improve upon some rather degraded wetland habitat. The problem, however, is that while there may be a lot of strong opinions about the ecological success of these projects, there is very little hard data about such matters. WCM projects have not been systematically assessed for their ecological effectiveness. Just what makes a WCM project, and the program as a whole, ecologically effective has yet to be defined by DSL or the Corps.

Assessment of ecological success, however, is beyond the data available from permitted WCM projects. Ecological success concerns the integrity or "health" of aquatic ecosystems and must necessarily be assessed at multiple spatial/temporal scales, generally broader and longer than obtain in permit regulation. All human activities affecting ecological health must be accounted for in aggregate. This, of course, transcends any single agency's jurisdictional boundaries and authority, and, consequently, is not generally accounted for in agency policies and individual project reviews.

As a specific example related to the Portland area projects, consider the enhancement projects reviewed in this study. Most of these projects resulted in open water ponds (Figure 6) by excavating palustrine emergent wetlands dominated by Phalaris arundinacea (reed canarygrass). Enhancement projects, which do not provide any new wetlands to compensate for those lost, will always result in wetland acreage losses. The justification for allowing this net loss of wetland surface area is based on the assumption that enhanced wetlands contribute to net gains of wetland function, at least for selected attributes, despite the loss in acreage. A review of the scientific literature suggests caution in making such an assumption. Wetland functions depend in part on total wetland area and on the types of wetlands within regions. As wetland acreage declines in a watershed, some functions will also be impaired, such as water quality maintenance or waterfowl populations (Preston and Bedford 1988). Many WCM projects are also located in rapidly urbanizing areas and therefore subject to alterations in hydroperiod and water quantity and quality, as well as habitat fragmentation. All of these cumulative impacts impair wetland functions.

Constructed in-channel and side channel ponds (in effect what many of the WCM sites classed as palustrine open water are) have been reported to cause numerous direct adverse environmental effects both upstream and downstream: increased stream temperatures, changes in invertebrate assemblages, stream bed load transport interception, etc. (Schueler et al. 1992). There was little evidence in the permit files that these potential adverse effects were considered as part of the review and design processes for any of the enhancement projects in question.

From interviews conducted in 1991[6] and through permit file records, the justification for many of these pond-type wetlands has been based on more narrow perspectives: (1) to increase waterfowl habitat (one function); (2) to achieve potentially longer project survival times due to a greater sedimentation assimilative capacities (as compared to shallow, emergent wetlands); and (3) they are easier to construct, with greater margins of error, than shallow emergent type wetlands. There has not been a single study that has been conducted in Oregon to assess the relative benefits and costs to local aquatic ecosystems of this pond-for-emergent tradeoff. Permit monitoring requirements and the agency database are totally inadequate to address these issues.

[6]We interviewed representatives of federal regulatory agencies (Corps, EPA), DSL, resource agencies (ODFW and USFWS), and private consultants. These interviews were tape recorded and transcribed but are not included in this report.

A continuing, fundamental problem illustrated by the wetland enhancement example is that wetland function modification (through permitted wetland impacts and WCM projects) is treated as solely a local design problem, and can safely ignore the indirect and cumulative effects of non-jurisdictional land use activities on wetland functions. Existing statutes, however, limit the agency's jurisdiction and its ability to broaden its scope of impact assessment for individual projects.

Broader environmental impact assessments require interagency/university/private sector cooperative research efforts focusing on watershed and regional scales. The results of such evaluations would likely have policy implications for existing environmental laws and governmental structure, including the Removal-Fill Law. (For example, DSL is using EPA funding to conduct an independent evaluation of wetland losses in the Willamette Valley.) These types of broad scale evaluations are necessary to provide a context for assessing the watershed or ecosystem effects of the permit program.

WCM INFORMATION MANAGEMENT

WCM information management is critical to the achievement of program improvements. Collecting data for this study was extremely labor intensive. DSL's computer database could only supply the most basic administrative data relevant to this study such as permit applicant name and address, the county where the impact was located and dates of permit issuance and expiration. For all other data (besides field data) we had to go to individual permit files. These files are organized to facilitate a single purpose: to document the processing of a permit application by DSL. They are not organized to facilitate WCM project and program evaluation. Consistent and efficient extraction of data on WCM project specifics such as wetland types and acreages involved, construction methods, changes during construction, WCM project locations and other basic data was not possible. Instead, extensive review of the entire file contents was required. In many cases not all of the necessary data was available in the files.

In 1992, DSL attempted to improve its WCM information management by requiring all DSL permit applicants to submit summary wetland data sheets for all permits requiring WCM. However, there has been no systematic maintenance of this database. As a result, the current agency WCM database is essentially unusable due to a high percentage of permit record omissions and data entry errors.

Given the significant fraction of staff time and agency expense devoted to permit review and WCM projects, such a state of affairs may seem surprising. However, there are multiple reasons why DSL has such poor information management, a situation that appears to be common across the nation (Table 2). We believe that a fundamental reason is a general state of complacency about the lack of data and information on program performance and resource condition. Staff and managers often see data entry in database management as simply "more work." This is due, in part, to statutory requirements that structure agency programs around administrative actions such as permit issuance or high profile enforcement cases. The valued data for the legislature and agency managers tends to be focused on numbers of agency actions taken. Quantity versus quality. Additionally, this cultural norm has evolved and been reinforced by a lack of agency technical expertise in information management technology, generally unsatisfactory past and current experiences with database development, continual increases in agency workload and the fact that agency personnel have little or no experience operating programs based on regular analysis and use of performance and resource data. In the absence of such information, policy and programmatic decisions are principally based on personal experience, peer input, and reaction to outside pressures.

A result of this situation is that DSL's regulatory program often operates in a vacuum of objective information about program performance, resource condition, resource trends and "customer satisfaction." Information is more often based on personal experience and biases based on individual projects. Feedback on a particular outcome of the program, such as as-built net change in wetland area (much less what it means), is infrequent and limited, leaving DSL with no effective, timely means of ensuring if it is "on track." Moreover, clear program-level goals are not well defined, so that it is also unclear what "on track" means.

We believe that maintaining a reliable, reasonably up-to-date, user-friendly information system for agency decision-making would support improved program performance far more effectively than the current situation of minimal information and sporadic, labor intensive, sometimes frantic, data gathering efforts.

V. CONCLUSIONS

The Portland Metro Area Projects (72 permits issued from 1980-1990)

1. Total permitted impact acreage was 52 acres of wetland area. Commercial and industrial building pads and roads dominated permitted impacts. Most of the projects were small, less than one acre in size (with a small cumulative impact acreage); most of the cumulative impact acreage was due to a small number of larger projects.

2. The net result of the permitted impacts and required WCM was an exchange of emergent wetlands to open water wetlands (35 acres of emergent wetlands were permitted to be lost while 29 acres of open water wetlands were to be gained).

3. Wetland enhancement and wetland creation dominated the types of compensatory mitigation used, and were approximately equal in frequency; there were no wetland restoration projects used for compensation among these permits.

4. Cumulative permitted net change in wetland acreage for the projects was a loss of 14.5 acres of wetland. 54% of the projects were to result in a permitted net loss of wetland area.

5. All of the required WCM projects reviewed by the study team had been constructed. This is a higher rate of success, at least for this factor, than has been reported for other programs from across the U.S.

6. Critical factors for WCM project implementation, however, were less successful:

a. 64% (46/72) of projects had one or more compliance violations, with non-compliance with buffer vegetation requirements as the most common violation. Few, if any, of these violations have been followed-up by DSL;

b. An overall discrepancy of -15.7 acres between proposed net change and as-built net change in wetland area (i.e. actual WCM acreage created was 15.7 acres less than required). A large fraction of this acreage discrepancy (13.3 acres) was attributed to 9 projects; a much smaller fraction of the acreage discrepancy (3.2 acres) was attributed to 25 projects.

c. Cumulative as-built net change in wetland acreage was -30 acres. That is, the total net change in wetland acreage, as determined by field inspections, for the 72 projects reviewed, was a loss of 30 acres, mostly in the Tualatin River basin.

7. The ecological significance of these WCM project outcomes for the Tualatin Basin (where most of the reviewed projects are located) remains unstudied and unknown.

DSL's WCM Program

8. The evaluation factors noted above are not monitored by DSL on a consistent basis. There have been no quantitative targets, or goals, established for these or any other so-called success factors, other than the legislative goal to "maintain a stable resource base." Therefore, evaluation of the "success" of the program (from a compliance-based perspective) is problematic.

9. The DSL WCM computer database does not have consistent data entry; it is also rarely used for management purposes and therefore its quality and usefulness is quite limited.

10. Because of staffing inadequacies and other agency priorities, namely permit processing, DSL's WCM project monitoring and evaluation backlog has grown to over 480 WCM projects as of the end of 1994. Only through consistent project monitoring and evaluation can the agency learn whether its project and program goals are being met and just what such performance means to the integrity of the waters of the state and the citizens of the state of Oregon.

11. The 1995 Legislature established a permanent mitigation specialist position at DSL to address some of the above issues.

VI. RECOMMENDATIONS

The following recommendations are primarily directed toward DSL. We can only refer to the Corps based on the findings from review of the Portland area projects with federal individual permits (as opposed to those with nationwide permits and little federal involvement); issues of WCM information management, and management in general, were only studied for DSL. Nonetheless, we hope these recommendations will be of benefit to the Corps wherever they are applicable.

RECOMMENDATIONS TO IMPROVE WCM PROGRAM MANAGEMENT FOR EXISTING REGULATORY PROGRAMS

1. Assign Agency Staff Responsibility For WCM As A Primary Duty

For program improvements to occur DSL has to make WCM monitoring and enforcement higher priorities than they have been. It will be difficult to do this without designated staff for these duties. If no staff has WCM as their primary responsibility, or if all staff are "responsible," then other duties, primarily permit processing will take precedence over monitoring and evaluation of WCM projects.

It will be important that such staff are not absorbed into full-time permit production; some significant fraction of their time must be allocated to development of the monitoring and evaluation aspects of the WCM program.

2. Develop A Consistent Compliance Program For WCM Projects

Currently DSL does very little systematic compliance monitoring and even less actual enforcement follow-up for WCM projects. This is a problem due to the nature of the regulatory transaction—permit recipients, generally, have little incentive to ensure the quality of their projects beyond the minimum necessary.

A limited but consistent compliance presence, particularly for the larger projects, might pay significant dividends in addressing the persistent permit violations identified in this study.

2a. Given the finding that nearly all of the WCM acreage compliance shortfall was associated with the largest projects, DSL should prioritize WCM projects for compliance monitoring by size. A punch-list compliance inspection form could be developed based on specific permit requirements and general project implementation success factors.

3. Review And Improve Enforceability Of Permit Conditions

DSL should review existing standard WCM permit conditions from an enforcement perspective and make modifications to improve enforceability (this may also improve the likelihood of their successful implementation). Conditions that are vague, ambiguous or otherwise difficult to enforce should be modified. A roundtable discussion by DSL, Corps and EPA staff with experience in enforcement, and DSL's legal counsel, could probably accomplish this in a few structured sessions.

4. Develop And Maintain More Effective, Accessible Information Systems

The technical and organizational problems with DSL's information systems must be improved if the agency is to conduct regular and meaningful WCM program performance evaluations and improve performance.

The technical side appears promising: DSL's proposed Land Information System (an "open system" computer environment with GIS capabilities) will be funded for the 1995-97 biennium; the agency will have the potential for major improvements in its technical and staff resources for information management.

However, even with these new technical resources the agency will still need to make major changes in the way it does business. Cultural changes regarding the importance of data and information in management decisions and organizational changes that assign adequate staff resources to information systems management are required to take full advantage of the capabilities of a new Land Information System. It will also require that staff have adequate training and time for self-education into the use and potential of computer software for information management.

4a. The newly adopted Freshwater Wetland Compensatory Mitigation rules now require that the agency develop and maintain a database on the WCM program that is accessible to the public. DSL should immediately begin redesign of the existing WCM database, as well as current policies and procedures regarding such data, to comply with the new rules. The agency should not wait to the eleventh hour to pull it together for the required triennial review. The redesign should include permit procedures to incorporate watershed location data to enable compilation and analysis of critical environmental data by watershed.

4b. Once the design process of the Land Administration System becomes a reality, DSL should convene a broad, interdisciplinary technical advisory group to help identify the critical administrative and environmental data needed to properly monitor and evaluate WCM program performance.

5. Institutionalize WCM Project Monitoring And Evaluation

DSL's newly adopted Freshwater Wetland Compensatory Mitigation rules are designed to institutionalize the collection of data from permit applicants and permit holders. The rules specify the information on proposed WCM projects that must be included in wetland impact permit applications. The rules also specify the information that must be submitted in post-construction monitoring reports on WCM projects. There are existing mechanisms, such as a wetland data sheet (for permit applications) and permit holder monitoring reports, that could provide DSL with the majority of the data needed for compliance monitoring and program evaluation. Though these mechanisms are already in place they have not been used to their full potential. We note that nearly all of the data collected in this study could be obtained through these mechanisms.

5.a. (1) DSL should make full use of the new rules by developing the necessary forms and ensuring that they include needed data for cumulative impact assessment (from a compliance-based perspective).

(2) DSL should also develop these forms to provide required data for periodic program evaluation reports.

(3) The forms must be formatted to facilitate data entry into an agency computer database. This is an iterative, trial and error process and should not be expected to be done in a single try.

The new rules also require the agency to conduct a triennial review of the WCM rules and program. If the agency were to fully implement the data gathering mechanisms as recommended the future time demands for WCM program evaluation would be shifted to more data analysis (which should also be greatly simplified by use of pre-designed report formats) versus labor intensive data collection and computer data entry.

Although the mechanisms above can address future projects, DSL currently has a pending workload of approximately 480 permitted WCM projects that have not been systematically monitored/evaluated. As a matter of policy the agency might decide not to pursue compliance reviews of WCM projects permitted more than five or more years ago. However, approximately 400 of the 480 unreviewed WCM projects were permitted since 1990. Other than four 1990 projects reviewed in this study, none of the comprehensive monitoring studies of WCM projects in Oregon have reviewed projects permitted since 1990. There is currently no viable organizational mechanism in place, other than required permittee project monitoring, to systematically assess these projects or to ensure compliance rates better than the projects reviewed in this study.

The agency must determine the level of compliance monitoring and performance evaluation that is appropriate. An efficient means to obtain the needed data would be to use a statistically valid sampling approach to conduct post project audits on a representative sample of these WCM projects. The methodology used in this study is an efficient approach for data collection. An alternate approach would be to focus primarily on the largest projects, with perhaps a random sample of a small set of smaller projects. This approach would focus limited agency resources on the most significant projects with the greatest potential for wetland loss.

6. Develop And Implement More Rigorous Requirements For Alternatives Analysis, Avoidance And Minimization For Large Proposed Impacts (> 1 acre)

Nearly all of the permitted wetland impacts were associated with a few permits with large impacts. More rigorous efforts to reduce impacts for the small number of large proposed impacts could significantly reduce overall impacts to wetlands. No agency has detailed guidance for alternatives analysis, avoidance or minimization. We recommend that DSL, in cooperation with other resource and regulatory agencies, develop guidance for large proposed impacts.

7. Develop Accountability For Program Performance

Formal accountability for removal-fill program performance (meaning the monitoring, periodic reporting and evaluation of program performance, subject to public review) is not currently an organizational norm; it is left up to the responsibility of individual staff members, and varies from region to region, based on individual norms and abilities. This is not necessarily bad. It is, however, incomplete. What has been missing is an in-depth, regular review of program performance as a whole. The required triennial program review should be designed accordingly.

We recommend the following general approach:

(1) DSL and the Corps should, with expert, independent assistance, identify a compact[7] set of compliance-based performance metrics (or measures) that can be used to monitor agency and natural resource "performance." In this report we have reported on a number of these, for example, permitted net change in wetland surface area, as-built net change in wetland surface area, % of issued permits with compliance violations, etc.

(2) The agencies should, upon identification of these metrics, develop realistic quantitative (and where more appropriate, qualitative) performance improvement targets.

(3) The agencies should conduct and report the results of WCM program evaluations on at least a triennial basis.

(4) The draft report should be made available for public review and comment.

(5) Adjustment, or total revision, of desired targets, success factors, metrics, and performance improvement initiatives should be made following public review/comment in 4.

It should be noted that this suggested approach must be integrated with other agency programs and strategies—not viewed as some set of recommendations that are independent of what is going on elsewhere in the agency (for example, see the recommendations for DSL concerning gravel removal in Oregon Water Resources Research Institute (1995)). Note too that this general accountability process is applicable regardless of what the latest mitigation policy might be; in fact, it is the means to assess performance relative to the policy goals.

[7]Important to keep it to a short list, in order that at least some progress is made on critical problems. Incremental learning can be used to expand efforts elsewhere.

RECOMMENDATIONS TO MOVE BEYOND EXISTING REGULATORY PROGRAMS

8. Continue To Support Comprehensive Wetland Planning

Though not yet on a watershed or eco-region basis, current wetland comprehensive planning offers an opportunity for wetland evaluation, impact assessment, compensation planning, and restoration at larger spatial and longer temporal scales than regulatory permit programs. Planning processes also generally rely on more and better quality information than the permit process. In addition, these approaches often involve partnerships with organizations such as local governments or conservation organizations that are more interested in high quality WCM projects than permittees. DSL's wetland conservation planning program, after substantial birthing pains, is now refined with detailed procedures for wetland inventory, assessment, alternatives analysis and wetland designation. However, the program is not widespread, with only a handful of local governments participating, primarily due to the problems encountered as the program developed. There are also other, less comprehensive, planning efforts occurring, such as mitigation banking by the Oregon Department of Transportation. DSL should continue to support wetland planning approaches and work to make them more widespread.

9. Develop And Implement Alternative Compensatory Mitigation Options

DSL is developing a new program that will allow permit applicants in certain situations (small impacts, no viable WCM sites available) to provide compensation for wetland impacts by paying into a trust fund an amount equal to the cost of providing WCM for the permitted impacts. The accumulated funds would then be used to construct and maintain larger WCM projects. This program has several advantages over the current approach. It can replace many of the small, isolated, functionally limited WCM projects with larger and potentially more valuable projects and it removes the responsibility for WCM from generally disinterested permit holders and can rely instead upon interested third parties such as The Wetlands Conservancy, Oregon Joint Venture or the Oregon Department of Fish and Wildlife. We recommend that DSL develop the administrative rules for this program and provide the necessary staff resources to effectively implement it.

10. Continue To Seek Out And Participate In Partnerships To Evaluate Aquatic Ecosystem Health At Watershed And Regional Scales.

Proposed wetland impacts and associated WCM projects are reviewed and considered principally from a local, direct impact perspective. Therefore, wetland functional loss due to indirect and cumulative environmental impacts will not likely be accounted for through the existing permit system, regardless of how well the problems noted above are improved upon. DSL should initiate and participate in partnerships to define the broad ecological and social context for removal-fill permit decisions and policies.

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VIII. APPENDICES

APPENDIX A: GLOSSARY

Creation—conversion of an area that has never been a wetland to wetland conditions

Enhancement—alteration and/or active management of existing wetlands for improvement of particular functions and values

In-Kind Compensation—replacement of a particular Cowardin wetland class with the same Cowardin wetland class

Off-Site Compensation and On-Site Compensation—imprecise terms that refer to the proximity of the compensatory mitigation site relative to the impact area, or development site. On-site usually means the compensation site is within the same drainage as the development site; off-site in another drainage. In practice, however, these terms are not clearly defined.

Out-Of-Kind Compensation—replacement of a particular Cowardin wetland class with a different Cowardin wetland class

Restoration—rehabilitation a previously drained area by providing wetland hydrology or removing fill material or other means of reestablishing freshwater wetland features

APPENDIX B: DETAILED WCM STUDY METHODOLOGY

WCM PROJECT EVALUATION

Air Photo Base Reference

Scaled air photos of each site were used as a base reference for acreage calculations. We used true color photos taken in March 1991 by WAC Corporation of Eugene, OR. The photos were enlarged to 1:1200 scale (1" = 100'). A fixed object visible in the photo (such as a building) was measured at the site to calibrate the photo scale.

The late winter/early spring timing of the air photos was found to be ideal for wetland determination/delineation purposes. Water levels were generally at their highest, deciduous tree and shrub canopies were leafless and transparent, and annual plants had not started growing. This made it relatively easy to observe diagnostic features such as changes in herbaceous vegetation type and edges of inundated areas. Also, in the Tualatin Basin, many local wetland areas are dominated by plants such as Phalaris arundinacea (Reed Canary grass) and Alopecurus pratensis (Meadow Foxtail); the distinctive photo signature of the dead foliage was a reliable wetland indicator. We also tested false color infrared photos and found the true color photos to be easier to interpret for our purposes.

Compliance Assessment

Wetland Area

Compliance was determined by comparing the compensatory area required in the permits with the as-built area of wetland observed in the field. Permit files were reviewed to determine the compensation area requirements. Specific acreage figures contained in permit conditions or in WCM plans were used when available. For the files without specific acreage information permit drawings of the compensation area were measured by scaling the project boundaries and then calculating the area.

Determinations of the as-built area of wetland at WCM project sites was done using a modified version of the methodology in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation 1989). Vegetation and hydrology criteria were retained; the soil criteria was not. Soils were ignored for the following reasons:

- little or no site specific pre-construction data on soils was available. Without pre-construction data for comparison, post-construction soil morphology data cannot be reliably interpreted;

- an initial review of the sites established that most had distinct wetland/upland boundaries which could be easily delineated using only the vegetation and hydrology criteria.

A wetland determination key for WCM projects was developed and used. Over 90% of the determinations were simple and straightforward. Decisions about the remaining sites were made by the study team using best professional judgment.

The identified wetland areas were delineated on a mylar overlay on the air photo base. The overlays were then digitized using an ARCINFO Geographical Information System (GIS) and areas computed in acres using the GIS.

Our wetland determination scheme is as follows:

The area is a WETLAND if:

a. it is dominated (50% or more) with obligate wetland vegetation, or

b. it is dominated by facultative or wetter vegetation and has direct indicators of wetland hydrology, or

c. it is dominated by facultative-wet or wetter vegetation, does not exhibit direct indicators of wetland hydrology, but has other indicators of wetland hydrology, i.e., drift lines, etc.

The area is of UNCLEAR status if:

d. it is dominated by facultative-upland or "not indicated" vegetation and has wetland hydrology, or

e. it is dominated by facultative or drier vegetation, does not exhibit direct indicators or wetland hydrology, but has indirect indictors of wetland hydrology, i.e., drift lines, etc.

The area is UPLAND if:

f. it is dominated by facultative-upland or "not indicated" vegetation and does not exhibit any direct or indirect wetland hydrology indicators.

A test of the precision of our method for determining the wetland area of the WCM as-built projects was done by comparing the results for six sites with areal calculations done previously for those sites using the compass traverse method (Gwin and Kentula 1990). The results of the comparison are shown in Table 6. The two methods produced similar results. Indeed, we believe the air photo delineation method to be more accurate (but needs testing) and surely more efficient (with respect to staff, time, and budget resources). A digitized polygon will have many more line segments than polygons generally produced using the compass traverse method and will be a more accurate representation of the actual wetland boundary. The air photo method is also very time and labor efficient; a single individual can complete the delineation in minutes as opposed to a team laboring for hours conducting a compass traverse.

TABLE 6: Comparison of WCM area determination methods: Compass traverse versus DSL air photo delineation method; Compass traverse delineation method by Gwin and Kentula (1990). (Figures are in acres of wetland)

PERMIT #	COMPASS TRAVERSE	AIR PHOTO	DIFFERENCE
3062	0.5	0.44	0.06
3849	0.6	0.41	0.19
4130[1]	0.7	0.56-0.66	0.04-0.14
4275[2]	1.7	0.9-1.35	0.35-0.8
4310	0.4	0.4	0
4379	2.4	2.78	0.38

[1] Comparison of results for this project complicated by differences in determination of WCM project boundary locations for the two methods. Range shown for air photo method captures area measured by compass traverse method.

[2] Air photo delineation of wetland area resulted in calculation of 0.9 acres of wetland. However, air photo delineation of area of excavation, which we believe to be area measured during compass traverse, resulted in calculation of 1.35 acres for project area.

Net change in wetland acreage for each project as required by permits was determined by the following formula:

Net Change (Per Permit) = $A_{RCW} - A_{PI}$, where

A_{RCW} = Required Created Wetland Area (Wetland area required in permit to be created),

and A_{PI} = Area of Permitted Impact

The Required Created Wetland Area was determined by identifying the compensation area requirements as described above and then determining the fraction that would involve wetland creation (described in part B. of the WCM Program Evaluation section of the Appendix).

The area of permitted impact was determined by reviewing permit files. For some files an acreage figure was given, for the remaining files permit drawings were planimetered and areas determined; this was relatively easy as most fills were designed as simple geometric shapes such as rectangles, triangles, and circles.

Net Change in wetland acreage for each project as-built was determined by the following formula:

Net Change (As-Built) = A_{ABCW} - A_{PI}, where

A_{ABCW} = As-Built Created Wetland (field data), and

A_{PI} = Permitted Impact

As-built created wetland was determined by field observations of WCM sites as described above and then determination of the portion that would involve wetland creation. Permitted impact was determined as described above. We did not field check the impact areas.

Hydrology

Sites were checked for field indicators of wetland hydrology (inundation, saturation, and secondary indicators) as part of the wetland determination process. Determinations of compliance with permit requirements were not done for the following reasons:

- Only 35% of the permits reviewed had specific hydrology requirements
- Detailed hydrologic information was rarely encountered in permit files
- The limited budget and staff capacity of our study team prevented a more rigorous assessment (such as hydroperiods for project sites).

Wetland Vegetation

Vegetation data was compiled for the wetland determinations using visual estimates of species cover for the wetland as an overall unit or, for larger and/or more complex sites, for sub-units containing similar species. Permits for 30 of the WCM projects (42%) contained a planting plan map and/or species list for the wetland portion of the site. For those projects with wetland vegetation requirements compliance was determined by comparing the permit requirements with the field observations of the as-built site.

Accuracy of the visual estimation method was checked by re-sampling vegetation at 6 sites using a fixed transect method and 1 square meter quadrat frame. A comparison of the visual estimation method with the transect method revealed no significant difference in results. However, since we have not reported much in the way of site vegetation data in this report, we have not reported these comparative data.

Upland Buffer Area/Vegetation

Permit requirements for upland buffers ranged from boilerplate statements such as "plant trees, shrubs and herbs as recommended by the Oregon Department of Fish and Wildlife," to detailed drawings showing locations and density of plant species. Thirty of the projects (42%) had permit requirements with listed species, densities, and specific planting locations. Compliance was determined by counting the number of plants per species and comparing the results with the permit requirements, and/or by visual estimates of percentage cover per species.

A small number (7%) of the permits specified a width of upland buffer to be created/maintained. Compliance with these requirements was determined by comparing permit requirements with ground measurements at the WCM project sites.

Fencing

For permits specifying fencing (8%), on-site fencing was visually inspected for compliance with permit requirements.

Water Control Structures

For permits requiring weirs, berms, overflow outlets or other control structures (24%) the on-site location, condition and functioning of these structures was visually checked and compared with permit requirements.

WCM PROGRAM EVALUATION

Wetland Type Trend Determinations

For each wetland type the following formula was used for determining net changes in acreage:

Net change in wetland area for a specific wetland type = $A_C + A_E - A_{ME} - A_{PI}$, where

A_C = Wetland area created of the specified wetland type
A_E = Wetland area that was enhanced to result in the specified wetland type
A_{ME} = Wetland area of the specified type prior to being changed to a different type by enhancement
A_{PI} = Wetland area of the specified type lost by permitted impact

For determinations of net changes in wetland type as authorized by permits the wetland type was determined from the permit file when possible. If the information was not available then other sources were reviewed. For A_{PI} and A_{ME} sources included site descriptions attached to permit applications, mitigation plans, file photos of the site, USFWS National Wetland Inventory (NWI) maps and the air photos in the county soil surveys. For A_C and A_E sources included permit conditions, mitigation plan narratives and mitigation site plan drawings and planting plans.

For determinations of net changes in wetland type as-built the same values were used for A_{PI} and A_{ME} as determined above. For A_C and A_E the wetland types were determined during field inspections using a method adapted from Cowardin, et al. (1979) (Figure 12). If there was more than one type, we delineated the areas of each type on the overlay using a solid line. We then labeled the wetland types on the overlay using the same symbols and conventions as used on NWI maps.

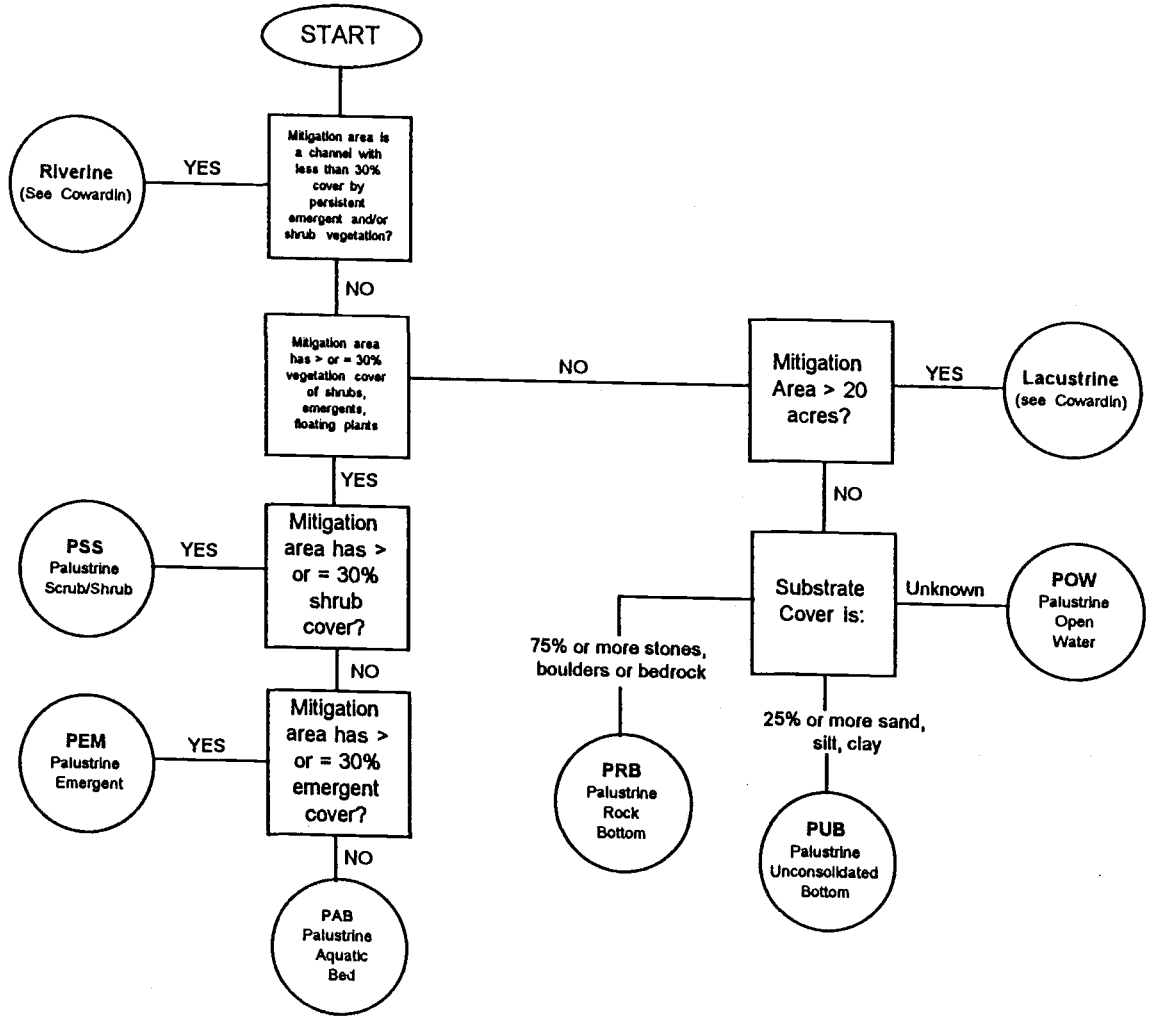

Figure 12. Identification of wetland types using the Cowardin classifications. (Adapted from Cowardin et al. 1979)

WCM Methods Used

The method used to compensate for the impacted wetlands was determined for each project. Available methods include creation, enhancement, and restoration as defined in Appendix A. To make the determination each permit was reviewed to determine if the WCM site had been an existing wetland, or converted wetland or upland prior to WCM project construction. This was based on file documents such as mitigation plan site descriptions, file photos, county soil surveys, NWI maps, aerial photos and field observations of the site.

Impact Project Types

Impact projects were classified by two parameters. "Project activities" describe the structures that were to result from the impact. These included building pads, roads, ponds, storm water detention basins, parking areas, sewer lines, and miscellaneous structures. "General project purposes" describe the broader purpose for which a specific structure was constructed. These included industrial development, commercial development, residential development, sewerage, public and private roadways. Each type is defined as follows:

Industrial = Manufacturing, Wholesale Sales and Service
Commercial = Retail Sales and Service
Residential = Subdivisions, apartments, assisted care facilities
Sewer = Collector line installation
Public Road = Public streets, highways