PART 2

Environmental Analysis

Washington State Department of Transportation Wetland Monitoring Program

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The Washington State Department of Transportation (WSDOT) is subject to federal, state, and internal directives that require the protection of wetlands. The department has responded to these requirements by examining alternatives to construction in wetlands and by following standard mitigation sequencing. For times when affecting wetland is unavoidable, WSDOT has created replacement wetlands. Compensatory mitigation sites are constructed to develop wetland characteristics and provide designated functions such as food chain support, ecosystem diversity, and wildlife habitat. Documenting the development of wetland characteristics and the performance of designated functions is the best way to assess the success of a mitigation project. A monitoring program was established to evaluate wetland mitigation sites and examine their progress toward achieving stated objectives. These objectives include the successful development of hydrologic characteristics of a wetland, hydric soils, and wetland vegetation. The monitoring program began with the development of the *Guide for Wetland Mitigation Project Monitoring*. This document details several monitoring tasks designed to assess important wetland characteristics. Currently, 10 wetlands are being monitored. Sites are monitored for 5 consecutive years, and some are now in their 4th monitoring year. The monitoring results have confirmed that WSDOT's created wetlands are developing wetland characteristics and are performing some wetland functions. Knowledge gained through monitoring has also helped to refine and improve site design and construction techniques.

The Washington State Department of Transportation (WSDOT) is subject to federal, state, and internal directives that require the protection of wetlands. These include the Presidential Executive Order 11990, *Protection of Wetlands*, issued on May 24, 1977; Section 404 of the Clean Water Act, which stresses wetland avoidance along with compensatory mitigation for unavoidable impacts; and the Washington State Governor's Executive Orders of December 1989 and April 1990, relating to the protection of wetlands. By asking all state agencies of Washington to use their "substantive authority" in enforcing a no-net-loss policy, the governor's orders have added even more impetus to the department's work in wetland avoidance and mitigation for nearly all projects.

WSDOT has tried to carry out the state and federal mandates during project development by examining alternatives to construction in wetlands. A standard five-step mitigation sequence followed on all projects with potential wetland involvement is to avoid, minimize, restore, compensate, and monitor results in cases in which affecting wetland is unavoidable. WSDOT has created, enhanced, and restored wetlands on many projects as a result.

Compensatory mitigation sites are intended to develop into functioning, sustainable wetland systems. Permits have been approved on the basis of detailed mitigation plans and the trust that WSDOT will create a fully functional replacement wetland. The purpose of this report is to describe a methodology used by WSDOT to attempt to establish and maintain an atmosphere of trust among the resource agencies, as well as to fulfill regulatory obligations.

PROCESS

When there is a project that has unavoidable wetland impacts, WSDOT proceeds with developing substitute wetland resources. Substitute resources can be the creation of a new wetland or the restoration or enhancement of an existing wetland. The emphasis in WSDOT's wetland mitigation project design is to develop a site that will have wetland hydrology and develop recognized and measurable wetland characteristics such as hydrophytic vegetation (plants adapted to saturated conditions) and hydric soils.

The primary objective for most projects is to provide food chain support, ecosystem diversity, wildlife habitat, and water quality benefits—things a little more difficult to measure, but nevertheless essential to the success of a site. These functions are expected to develop over a period of time that is agreed upon, in advance, with resource agencies in the development of a wetland mitigation plan. This document is prepared after the highway design is complete; it provides the details of the proposed mitigation plan. It is coordinated with and approved by agencies before the project permit approvals.

Maintaining positive expectations at this point in the permit approval process is very important to the timely issuance of permits that allow WSDOT to proceed with the highway project.

WSDOT has developed a systematic wetland monitoring technique that is task-oriented and that gives the department an opportunity to examine past performance along with the current status of the mitigation sites. A status report on past mitigation projects provides a feedback mechanism for reviewing agencies and is a valuable tool for developing a positive attitude on new projects.

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WETLAND MONITORING

The definition of wetland monitoring is as follows: the periodic evaluation of a wetland mitigation site to assess the progress toward achieving established objectives relative to the development of wetland characteristics and functions. WSDOT anticipates this to normally be a 5-year process.

Monitoring Manual

WSDOT's monitoring manual, entitled *Guide for Wetland Mitigation Project Monitoring* (2), was the result of a 2-year cooperative research project between WSDOT, FHWA, and the University of Washington. It was completed in October 1989 as an operational draft document.

In this manual, wetland monitoring is divided into five major areas that set up the framework for the monitoring task:

- Area A: mapping and hydrologic,
- Area B: water quality,
- Area C: soil and sediment,
- Area D: primary producer, and
- Area E: consumer monitoring.

For each section, an introduction and description provides background information and lists all of the equipment, supplies, and the procedural steps needed to obtain, record, and interpret data.

For example, Task A1 is the first task in Area A; Task A1 is wetland mapping. It is divided into objective, background, equipment and supplies, and data interpretation. This is typical of most of the tasks. The objective of the mapping task is to produce a map that can be used to locate sampling transects and plant communities and to assist with the overall evaluation of the mitigation plan. The background section states that the purpose is to quantify the areal extent of the created wetland and coverage by the different wetland classes (i.e., open water, emergent, scrub-shrub, etc.), to note changes that have occurred over time, and to use the data for comparison with the wetland mitigation plan.

Task A2 in this section is called transect establishment, and the methodology is given for determining the number and location of permanent transects at the wetland mitigation site. Transects are used as points of reference in several monitoring tasks. Both field and office procedures are described for laying out these reference points.

Task A3, photographic record, has the objective of producing a visual record of the development of the created wetland over time in a logical and meaningful fashion. The appropriate methodology is described.

Task A4 is water level gauging; its objective is to define the hydrologic fluctuation of the wetland over time by installing a staff gauge. Equipment and supplies, equipment installation, sampling program design, and data interpretation are included in the write-up. Related to this task is Task A5, which has to do with crest stage gauging, which amplifies the information that was obtained from the previous task.

The manual continues in this way through the other four sections—water quality monitoring tasks, soil and sediment, primary producer, and consumer monitoring tasks. Task D, primary producer, involves looking at the plant community. Several plant sampling techniques are described to evaluate the occurrence and influence of the plants on the mitigation site. Task E, consumer monitoring, deals with fish, wildlife, and invertebrate surveys, and a considerable amount of detailed information is given on types of sampling equipment, analytical procedures, and data interpretation. Samples of data collection sheets are provided for most procedures.

Not all tasks are done on every site; the monitoring protocol will be based on the wetland mitigation plan objectives and the determination of what is appropriate for the site.

Task Sequence

The appropriate sequence of monitoring tasks is described in the context of a typical field season (May through September).

Initial Site Visit and Installation of Transects—May

After construction and planting are completed at a new mitigation site, WSDOT visits the area during the first spring and permanent markers (steel fenceposts) are installed to establish sampling transects. The site is roughly mapped, showing the major features of topography, hydrology, and vegetation. A staff water gauge is installed in an appropriate area of the site.

Plant Community Mapping and Photography—Once Each Field Season

A rough map of plant communities is drawn, allowing biologists to note major shifts in vegetation patterns over several years. Color photos are taken from established points, including at least one panoramic series of the site.

Vegetation Sampling—July 15–August 31

Plants are sampled systematically along permanent transects. A typical sampling strategy uses quadrat sampling for the herbaceous layer and a line-intercept for trees and shrubs. Quadrats are sampled at an interval of every 3 or 6 m depending on baseline length.

Wildlife Surveys—June 1–July 15

Each site is visited three times to count wildlife (primarily birds) seen or heard from designated sampling points. Usually four stations are established per site with 5-min observation bouts at each station.

Water Quality Measurements—May–September

During every site visit throughout the field season, water temperature, pH, and dissolved oxygen are measured at des-

ignated points (e.g., inflow and outflow). This can be expanded considerably to meet special needs.

Invertebrate Sampling—June 15–July 15

Aquatic invertebrate samples are collected at several preestablished points at each site. Sample composition is analyzed later in the lab. A minimum of three stations per site are sampled, and a variety of equipment may be used. Results are expressed in grams per square meter for an estimate of productivity.

Soil Description—Once Each Field Season

The soil profile near the water's edge is characterized. Also, soil texture and organic content are analyzed during the 1st and 5th monitoring years.

Annual Monitoring Report—September–December

After all data are analyzed and interpreted, an annual monitoring report is written. The report discusses each site separately, comparing the current year's data with those from previous years (when available). The progress of each site is discussed. Special note is given to the development of wetland characteristics and to evidence of any problems. This report is sent to all pertinent resource agencies and satisfies wetland monitoring requirements that were part of the project approval.

DISCUSSION OF RESULTS

In the past 6 years, WSDOT has created about 25 acres of wetland to compensate for unavoidable wetland losses due to highway projects. These mitigation sites include freshwater emergent marshes, stream channel relocations, and estuarine wetlands. Monitoring of some of these sites began in 1988; as of 1991, 11 sites were being monitored. They are required to be monitored for at least 5 years.

The monitoring results demonstrate that the mitigation sites are developing into functioning wetlands. All monitored sites have met standards of wetland vegetative cover. Good invertebrate species productivity has been shown to occur at most sites. Wildlife that uses wetlands as primary habitat has been observed at all sites.

In addition to documenting WSDOT's overall progress with compensatory mitigation, wetland monitoring has also provided a means to evaluate the success of specific concepts and techniques used in the creation of mitigation sites and determine if and where improvements need to be made. Some lessons learned follow.

Need for Biological Expertise During Site Construction

Sometimes design plans are subject to interpretation by construction personnel. They may not understand the concepts and purposes behind the project design. To have sufficient wetland hydrology, which is the driving force, site contours and drainage control features must be correct. A wetland biologist should visit the site during construction to ensure that the end product will possess adequate wetland hydrology and appropriate substrate to support hydrophytic vegetation.

Substrate-Soils

Vegetation takes longer to establish on soils compacted by heavy machinery or previous fills. Soils lacking sufficient fine sediments and organic material are also undesirable. The best success comes when hydric soils are stockpiled from the affected wetland and later spread on the surface of newly constructed wetlands.

Vegetation Establishment

The success rate for planting is relatively low for many wetland species. For trees and shrubs, wattling (or brush layering) is an effective technique for rapidly establishing some shrub species (e.g., willows) along wetland edges or stream channels. Natural recolonization by adjacent vegetation communities is an effective method of vegetating new sites that are near existing wetlands if one can create good growing conditions. Also, stockpiled wetland soils can supply a ready seed source of wetland plants. Natural recolonization will be slow if the substrate is poor, and weed species may become established if a seed source is located nearby.

Potential for Disturbance

Urban and suburban sites are prone to disturbance by people and domestic animals. Since this will decrease the desired function of providing wildlife habitat, such sites may best be fenced to limit access.

CONCLUSION

The WSDOT wetland monitoring program has provided useful information about creating wetlands. Using that information, the department has been able to improve wetland design and construction techniques. The results of monitoring have also demonstrated to resource agencies that WSDOT is complying with their permit requirements.

In the past, wetland replacement was viewed simplistically in terms of the size, type, and location of a mitigation site. Increasing emphasis is being placed on the importance of a variety of wetland functions as attributes that should be evaluated independently. In the future, WSDOT expects to develop a larger number of specific goals to be met by compensatory mitigation sites. To measure success in meeting these goals, new monitoring techniques must be developed, and monitoring may have to be extended to cover a longer period of time at each site. With the foundation of the present program, these adaptations should be readily incorporated.

REFERENCES

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