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EFFECTIVE WETLAND MITIGATION SITE MANAGEMENT: PLANT ESTABLISHMENT TO CLOSEOUT

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Abstract: Wetland mitigation projects in Washington State are developed using well-defined and documented guidance in the design, permitting and construction phases. Traditionally, there has been little guidance for post construction management of these sites. Post-construction management has largely been left to the discretion of the permit holder. There were no methods in place to effectively determine when regulatory requirements were achieved, or a standard to certify that the site was considered complete. Over the last decade, the Washington State Department of Transportation (WSDOT) has developed standardized mechanisms and processes for site management, reporting, and closeout procedures. These include establishment of site management crews, predictable funding sources for management activities, monitoring and reporting methods, and inter-disciplinary adaptive management teams that develop strategies for short and long-term site management. Recently, WSDOT partnered with local U. S. Army Corps of Engineers staff to develop a process for closing out mitigation sites with fulfilled permit requirements. These process improvements provide predictability for our mitigation efforts and long-term budget requirements to support site management activities. They also increase our credibility with the resource agencies by demonstrating the effectiveness of our adaptive management. These overall improvements also benefit future mitigation project proposals. We intend to use our monitoring data to increase the scientific knowledge about mitigation site development and management practices, and to continue the process of fine-tuning ecologically meaningful performance measures for future mitigation projects.

Introduction

Creating, restoring, and enhancing wetland functions to compensate for impacts are a major component of the Washington State Department of Transportation's (WSDOT) environmental efforts. More than twenty years of minimizing the loss of wetlands while maintaining and improving state highway infrastructures has provided significant experience in successful wetland mitigation site establishment.

When a WSDOT project may impact a wetland area, our planning process seeks ways to avoid or minimize how the wetland is affected. As responsible environmental stewards, and as required by federal law, state law, and WSDOT policy, we mitigate for lost wetland acreage and function when unavoidable impacts occur. The resulting mitigation sites are a long-term environmental commitment for the agency.

Elements of a Successful Mitigation Program

Our wetland mitigation approach includes three distinct phases. To start, WSDOT has strong organizational commitment to environmental stewardship, and providing appropriate funding to support environmental efforts. Our headquarters office provides guidance and policy support to region staff with the intent of improving our mitigation performance on an ongoing basis. During mitigation site establishment, we use an adaptive management paradigm that includes a statewide monitoring program, rapid feedback and coordination with site managers, several types of site management work crews, and a strategy for dealing with problematic sites. And finally, when a mitigation site is well established and we have met our commitments, we progress through a closeout process into long-term management.

Organizational Support

Our monitoring capabilities are a reflection of the agency's high level of environmental commitment. Executives and managers support mitigation efforts and receive an annual update on the status of our mitigation sites. This information is shared with the public and agency executives in The Gray Notebook, WSDOT's quarterly performance report. This executive level scrutiny of our mitigation helps in securing the resources needed to monitor and manage our mitigation sites.

Funding

While strong organization support is necessary to successfully design and construct effective sites, sufficient financial resources are necessary to sustain them. After WSDOT mitigation sites are built, they are managed by a contractor under a one-year plant establishment contract as part of the project construction budget. When the one-year contract is completed, management funds are provided from the agency general operating budget. As part of the biennial budgeting process, each region and mode requests an allocation for mitigation site management funds. Generally, regional site managers anticipate routine weed control, and low levels of replacement plantings. Those requests are reviewed by a Headquarters wetland biologist, and are ultimately submitted to the state legislature as part of the agency biennial budget request. Recently, our budget for normal site management for mitigation, roadside and riparian sites has been about \$1 million per year.

WSDOT is organized into seven geographic regions and two modes that operate autonomously. State headquarters provides general oversight, policy and guidance development, and direct project support as needed. One unique service provided by headquarters is the Wetland Assessment and Monitoring Program. This program operates with its

own budget, which reduces demand on regional budgets, and helps to maintain objectivity in our monitoring efforts. Typical resource allocation to provide monitoring services is slightly more than \$0.5 million per year.

Feedback to policy and guidance

There are internal and external feedback mechanisms throughout the WSDOT mitigation process. WSDOT biologists from each region and mode meet quarterly to discuss emerging issues, current problems and potential solutions. Another venue, the Wetland Mitigation Technical Group, provides a more focused discussion on technical issues. These groups provide a forum to disseminate information on ideas that are not working, new ideas that may improve mitigation success, and contributes to WSDOT guidance and policy development. These groups provide a broader viewpoint to reflect on the longer-term consequences of implementing our ideas. By providing agency resources for WSDOT wetland staff to develop dependable methods for producing mitigation proposals, we make ongoing contributions to the knowledge of the mitigation community in Washington.

Partnerships with resource agencies

One key to our efforts has been our ability to create proactive partnerships with resource agencies to improve mitigation results. As proponents of development, Departments of Transportation may find themselves in an adversarial relationship with those agencies charged with protecting natural resources. By sharing our knowledge of site development, including resource agency staff in our training activities, proactively participating in regional guidance and policy development, we have provided appropriate leadership as a state agency.

As an example, WSDOT recently provided information and data for resource agencies to use in preparing model performance standards and permit requirements for individual mitigation sites. We provided direct input to the Army Corps of Engineers (Corps), the Environmental Protection Agency, and the Washington State Department of Ecology in drafting *Wetland Mitigation in Washington State* (Washington State Department of Ecology 2006). This document provides written guidance for how mitigation proposals and permit conditions should reflect all six required elements of a complete performance measure.

After several years of using statistically valid monitoring methods, we now have a substantial data set that includes hundreds of monitoring events. This gives us solid information on how the vegetative characteristics of mitigation sites develop over time. We provided this information to the resource agencies so they better understand how sites develop, and have empirical data to inform discussions about achievable performance measures. For example, it used to be common for permits to require 80% aerial cover by woody species in a wetland within five years of planting. We now know that 50% aerial cover is a reasonable goal after 5 years (figure 1), and that 80% woody cover is attainable in 8 to 10 years after planting (Celedonia 2002).

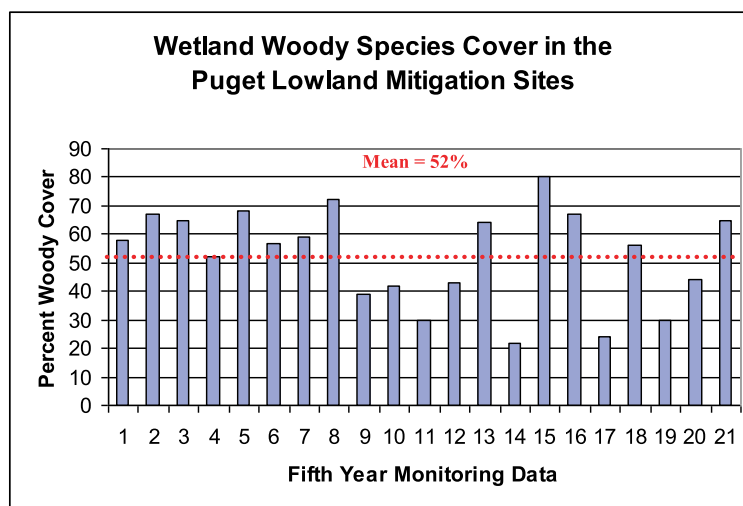


Figure 1. Fifth year estimated cover values for wetland trees and shrubs for 21 mitigation sites in the Puget Lowlands (data source: WSDOT Environmental Services Office).

The combination of our rigorous monitoring program, objective reporting of mitigation site conditions, and consistent site management activities, helps establish the credibility of our environmental commitment.

Mitigation Site Establishment

Prior to construction of mitigation sites, we determine impacts, develop site plans, and coordinate permits. Then the mitigation sites are constructed, and after initial plant acceptance, we monitor them throughout the establishment period. WSDOT utilizes the concepts of adaptive management to increase the likelihood of mitigation site establishment.

Adaptive Management

In our model of adaptive management, there are four steps (modified from Elzinga et al. 1998):

1. *Describe the desired condition* - this is provided by the appropriate mitigation plan, permit condition, or performance measure.
2. *Monitor the resource* - we use statistically valid methods of data collection that allow use of confidence intervals.
3. *Determine if the desired condition has been achieved* - have we met our goals, or is the site developing as intended?
4. *Adjust desired condition, or change management to achieve desired condition* - in this step, we may decide that the desired condition is unachievable, such as an unrealistic target for a plant species, or that the planned management action is not effective.

Monitoring Program

The foundation of our adaptive management process is our statewide monitoring program. A part of the Wetlands Assessment and Monitoring Program, the monitoring group completes a variety of activities, including vegetation assessment, hydrology monitoring, soil assessments, bird point-count and amphibian surveys. This information is used on two critical pathways for successful site establishment. One pathway is to document site conditions and track site development. This helps us to understand how sites develop over time, and can lead to early identification of poor mitigation performance. The other important pathway is to provide statistically valid monitoring data to guide site management decisions.

Performance Measures

We have learned the importance of clearly written performance measures. There are six elements of a complete management objective or performance measure: species, location, attribute, action, quantity/status, and time frame (Elzinga et al. 1998). When one or more of these required elements are missing, the intent of the performance measure may be ambiguous. As a result, monitoring data may be inconclusive for the purposes of guiding management activities, or not relevant to determining compliance with permit conditions.

Summer Internship for Wetland Monitoring

An integral part of WSDOT's Monitoring effort is our internship program. This internship program, a partnership between WSDOT and The Evergreen State College, began in 1997. Every summer we select 12 to 16 interns to work as monitoring field staff, while they also earn college credits. After a week of training, the interns assist our staff in collecting field data on our mitigation sites. These data are used to determine how the sites are developing, if they are on a satisfactory trajectory to meet success criteria, and if undesirable species are out-competing desirable plant species. Most data are collected using statistically valid methods that allow values to be reported with a confidence interval. This provides reliable information to guide site management decisions, and adds credibility to our annual reports on how individual sites are meeting permit conditions. Table 1 is an example of final year monitoring results summarized in an annual monitoring report for one mitigation site. Estimated cover values are presented with their corresponding statistical confidence interval.

Table 1: Example of final year monitoring results in an annual monitoring report

Final Year Success Standards	2006 Results	Management Activities
At least 60% cover of woody vegetation in the wetland	66% (CI _{90%} = 59-74% cover)	
At least 30% cover of woody vegetation in the buffer	16% (CI _{80%} = 12-20% cover)	Replanting and supplemental watering
Less than 20% cover of reed canarygrass or other invasive species in the wetland	6% (CI _{80%} = 1-11% cover)	Weed control
Less than 20% cover of reed canarygrass or other invasive species in the buffer	2% (CI _{90%} = 1-3% cover)	Weed control
Hydrology (within 12 inches of the soil surface) must be present for at least 12.5% of the growing season	Present	

Feedback to Site Managers

Another important element of our mitigation effort is the feedback loop between monitoring staff and regional site managers. Management activities are often time sensitive, such as removing invasive plants before they go to seed. Others require lead time for planning purposes, such as ordering planting stock from a nursery.

To address both long and short term planning needs, we have three mechanisms for communicating site conditions to site managers. First, if monitoring staff determine that a site needs an unanticipated management action, they notify the site manager of the issue within one week of the visit, usually by email. This timeframe generally accommodates

required scheduling actions. Second, monitoring staff holds yearly meetings with each region and mode, where the present conditions at each mitigation site in the region is discussed, and appropriate management activities are identified. Third, an annual monitoring report is written and distributed for each mitigation site. This report is used to communicate site conditions to regional staff, and to document permit compliance to resource agencies.

Numerous studies have indicated that mitigation frequently is unsuccessful, and does not result in the desired outcome (National Research Council 2001). WSDOT makes a concerted effort to learn from the work of others. While many factors may contribute to poor mitigation, it is recognized that sites that are actively managed tend to perform better (Johnson et al. 2002). Recognizing the validity of this observation, we report to senior staff and the public on how many recommended management activities are completed by regional site managers (table 2). WSDOT devotes significant resources to ensuring that our mitigation sites are actively managed to meet their objectives.

Table 2: WSDOT's Site Management Activities by Region, 2006

Region	Sites	Recommendations	Completed	Scheduled
NW	8	9	9	0
SW	8	13	11	2
Olympic	5	8	8	0
Eastern	0	0	0	0
SC	3	4	4	0
NC	3	6	6	0

Source: WSDOT Environmental Services Office, Gray Notebook

Regional Coordination and Site Management

With over 150 sites in our system, the decentralized relationship between monitoring and multiple site managers requires coordination to be effective. Experience has shown us that we need to coordinate monitoring activities with planned management activities. Our solution to this problem is the use of electronic calendars that are commonly available in computer network systems. This enables interested parties to see potential schedule conflicts that can contribute to lost field time and re-scheduling headaches. Another advantage with this system is that the activities can be scheduled electronically using meeting invitations. This automatically updates individual staff's schedule, and identifies other resources that will be required. This increases the efficiency of resource planning and simplifies staff oversight.

We use two main strategies to complete the management activities on our mitigation sites. The most common method is to contract specified work out to private firms specializing in plant establishment. This works well for anticipated activities, like routine plantings, weed control, and irrigation. WSDOT has established a Small Works Roster, comprised of contractors who are pre-qualified to submit bids on specific types of contracts. The other method is use of regional restoration crews, staffed by WSDOT employees. This work best for unanticipated management activities, or small projects that are uneconomical for private contractors to complete.

WSDOT presently manages 749 acres of wetlands at 137 mitigation sites (figure 2). These sites include those that are in the monitoring process and those that are no longer monitored.

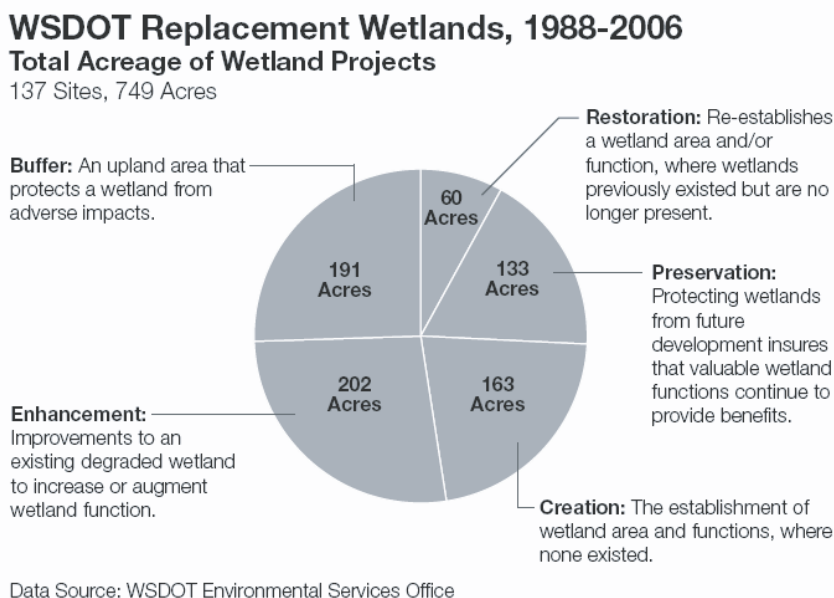


Figure 2. Acreage by type of WSDOT wetland mitigation.

Effective Mitigation

WSDOT has been very successful at establishing functioning wetlands at mitigation sites. At the end of the monitoring period we delineate wetlands, conduct a functions assessment and score the wetland using the Washington State Wetlands Rating System (Hruby 2004). Based on a broad suite of attributes, we provide replacement wetlands that function at equal or higher levels than those that we impacted. In a recent study, we found that our mitigation efforts often minimize impacts to higher value wetlands and replace the required wetland area (Bergdolt et al. 2005).

We typically conduct an interim delineation at each wetland mitigation site about three years into the monitoring period. If a problem is noted, there is time to develop and implement remedial activities before the end of the initial monitoring period. If needed, we extend the monitoring period to ensure that the desired conditions are being closely approached.

Non-conforming Sites

Sometimes, regardless of thorough planning, painstaking design, and timely management, a mitigation site can fail to develop into an acceptable condition. These sites generally exhibit different hydrology than anticipated, or develop into significantly different plant communities than intended. Finding solutions for “big misses” can be technically challenging, often requiring extensive new data collection and planning processes. This can cause undue stress on regional resources and staff that are already fully committed to meeting ambitious project schedules. At the same time, correcting these deficiencies is crucial to meeting agency environmental commitments and maintaining credibility with resource agencies.

WSDOT’s response to this challenge is to assemble a multidisciplinary team of technical experts from regional and headquarters staff to provide a detailed review of the site, and recommendations for appropriate remedial actions. This approach provides a high level of technical expertise to support regional staff, and can generate remediation options that may be otherwise overlooked. If the selected corrective action results in a significant deviation from the original proposal, resource agency staff is consulted prior to implementation.

Close-out Process

In 2005, the General Accountability Office (GAO) issued a report criticizing the Corps for having poor oversight on mitigation activities resulting from CWA section 404 permits. Incomplete files were cited as the main cause of the deficiency. In response to this need, WSDOT and Corps staff worked together to identify what information was typically missing from their files, and to develop a systematic process for providing this required information.

Agency Coordination

Through this effort, we identified three things that were consistently missing from Corps files: a deed restriction or surrogate, an as-built drawing of the mitigation site, and monitoring reports or other documentation of current site conditions. Two of those, monitoring reports and a right-of-way plan to serve as a deed restriction, were readily provided from our files. An as-built drawing for each site was more problematic, and has required some discussion with contract specialists, construction staff, and environmental offices. Long-term solutions are still being considered to meet this need.

Finding solutions to this file maintenance problem led to a solution for another problem; how to close out established mitigation sites. After some consideration between WSDOT and Corps staff, we agreed to identify a small list of sites that WSDOT staff felt were good candidates for close-out, and conduct a trial on how to reach agreement on acceptable condition for these sites.

Closeout Reports

As a result of this effort, we have developed a systematic process for closing out mitigation sites with CWA section 404 permits issued by the Corps. In this process, we consider three parameters in determining if our mitigation effort has been successful. They are: wetland acreage provided, functions provided by the mitigation site, and achievement of success standards.

Wetland acreage. The area of wetlands provided is a relatively simple and accurate measure of mitigation success. WSDOT staff performs delineations on wetland mitigation sites in year three of the monitoring period, and at the completion of the monitoring period. The wetland boundaries are recorded as GPS data, which are used to determine the acreage provided. Provided acreage is compared to intended acreage as recorded in the mitigation plan or permit. The GPS data are loaded into our GIS system, enabling us to overlay the wetland boundary onto an aerial photograph of the site. This presents a powerful communication tool for demonstrating an important aspect of site establishment.

WSDOT has performed 45 delineations on mitigation sites that have completed their monitoring period. For these sites, 93 wetland acres were intended, and 100 wetland acres have been provided, an excess of 7% (Figure 3). As noted in the Corps Regulatory Guidance Letter 02-02 (USACE 2002), no-net-loss of wetland acreage is intended to be considered on a program scale, rather than a site-by-site scale. With this program-level information on the performance of our mitigation sites in preventing the loss of wetland area, resource agency staff have been able to determine individual mitigation site success even when the provided acreage is less than intended acreage.

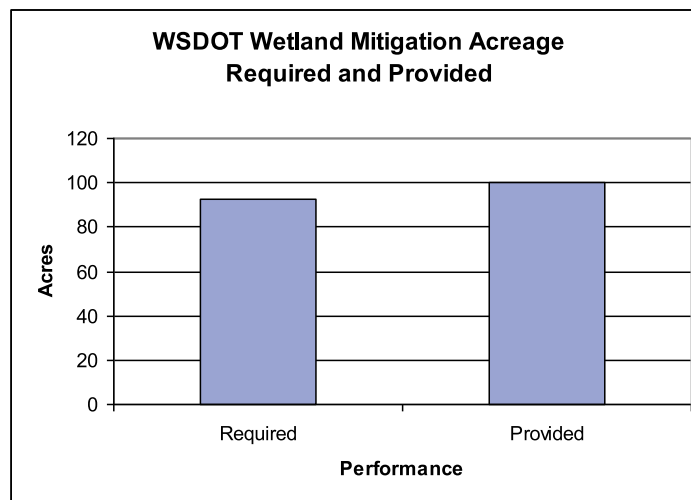


Figure 3. WSDOT wetland mitigation acreage required and provided (data source: WSDOT Environmental Services Office).

Functions provided. Evaluating the functions provided by a mitigation site, and comparing those to the lost functions or intended functions, provides information required for the second key consideration of the no-net-loss policy; no net loss of wetland function. Our experience has been that for some older sites, there is poor documentation of what functions were provided by wetland that have been lost. When possible, we prepare a clear comparison of functions lost (or intended) to functions provided. In most cases, we have been able to show that our sites provide lost functions, or an improvement in function. In one WSDOT study of our established mitigation sites, we demonstrated an overall increase in score using the Western Washington Rating System (Washington State Department of Ecology 1993) comparing mitigation sites to pre-impact sites (Bergdolt et al. 2005).

Achieving success standards. The final parameter we consider for potential closeout sites is a review of how success standards have been achieved. As wetland scientists and mitigation specialists are aware, there has been a steady paradigm shift in how success standards have been written over the last 20 years. What were once routinely accepted as realistic success criteria, such as zero presence of invasive plant species, or developing 80% woody cover in 5 years, are now recognized as ecologically irrelevant or unachievable. By providing resource agencies with an objective explanation of how the site has developed, and by considering practical expectations for mitigation site development, we have been able to reach agreement of reasonable ecological success, despite antiquated success standards.

The level of effort expended to achieve the desired site condition is an important consideration for some sites with aggressive performance measures. For example, in an effort to establish native herbaceous vegetation, it is common for our permits to require low levels of reed canarygrass (*Phalaris arundinacea*), a common invasive grass species in western Washington. In some landscape settings, the adjacent plant community is 100% reed canarygrass. On those sites, aggressive weed control allows the establishment of a desirable woody plant community, but reed canarygrass is generally a dominant plant in the herbaceous layer. When the woody species become established further management would only incrementally change the overall site condition.

Long-term Management

Once WSDOT mitigation sites have been closed-out, we plan for long-term site management. For some sites, transfer of ownership to another agency or non-profit group, such as The Nature Conservancy, is a viable option. We feel this is a particularly attractive alternative consider when the initial mitigation effort was a partnership, or based on watershed needs identified by area stakeholders. However, sites without any connection to natural areas, especially where the mitigation was located in the right-of-way, are unlikely to be attractive to other groups. For these sites, WSDOT provides long-term management of established mitigation sites through our Maintenance Program. This management includes control of noxious weeds, fence repair, removal of dumped material, and other actions to protect the public safety.

Feedback to the Design Process

Experience gained at the site level and program level through the monitoring, site management and close out activities provides insight into what is needed for mitigation site success. The information gained is applied back to the mitigation development process for future projects. This can have applications in site selection, development of performance measures, planting plans, and site management activities, so that our knowledge and success with mitigation improves over time.

The combination of a rigorous monitoring program, objective reporting of mitigation site conditions, consistent implementation of site management activities and feedback from practical experience has also helped establish the credibility of our environmental commitment with resource agencies.

Conclusion

The ultimate objective of compensatory wetland mitigation is to produce a site that functions appropriately to offset the losses of impacted wetlands. While there are challenges in putting this into practice, wetland mitigation can be successful. As much as good site selection and planning, this success also relies on post construction follow-through with monitoring and site management. The efficient establishment of wetland mitigation sites requires high level of organizational commitment. Executive leadership and resource allocation are needed, as well as proactive in partnering with the resource agencies to improve the knowledge and products of the mitigation community. A robust monitoring program focuses resource use, and establishes credibility with resource agencies. Monitoring information provides the basis for guiding site management activities and for evaluating the effectiveness of those management activities. With proper attention to site design as well as the follow through of monitoring and site management, mitigation sites can demonstrate success, fulfill regulatory requirements and perform as functional wetlands over the long term.

References

- Bergdolt, F.S., C.A. Prehmus, and J.B. Barham. 2005. An Evaluation of Wetland Mitigation Site Compliance at the Washington State Department of Transportation. Washington State Department of Transportation, Olympia, WA.
- Celedonia, M. T. 2002. Establishing appropriate benchmarks for site development by documenting successional characteristics, Phase 2. Washington State Department of Transportation, Roadside and Site Development Unit, Olympia, WA.
- Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.
- Hruby, T. 2004. Washington State wetland rating system for western Washington – Revised. Washington State Department of Ecology Publication #04-06-025.
- Johnson, P. A., D. L. Mock, A. McMillan L. Driscoll, and T. Hruby. 2002. Washington State wetland mitigation evaluation study phase 2: Evaluating success. Washington State Department of Ecology, Lacey, WA.
- National Research Council (NRC). 2001. Compensating for wetland losses under the Clean Water Act. National Academy Press, Washington, D.C.
- United States Army Corps of Engineers (USACE). 2002. Regulatory Guidance Letter No. 02-2, December 24, 2002, Washington, D.C.
- Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10. March 2006. Wetland Mitigation in Washington State - Part 2: Developing Mitigation Plans (Version 1). Washington State Department of Ecology, Publication #06-06-011b. Olympia, WA.
- Washington State Department of Ecology. 1993. Washington State Wetlands Rating System for Western Washington, second edition. Publication No. 93-74, Olympia, WA.

Links to Resources

- <http://www.wsdot.wa.gov/Environment/Biology/Wetlands/reports.htm>
- <http://www.wsdot.wa.gov/Environment/Biology/Wetlands/wetlands.htm>
- <http://www.wsdot.wa.gov/accountability/default.htm>
- <http://www.wsdot.wa.gov/eesc/design/roadside/pdf/mitigationbenchmark.pdf>
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