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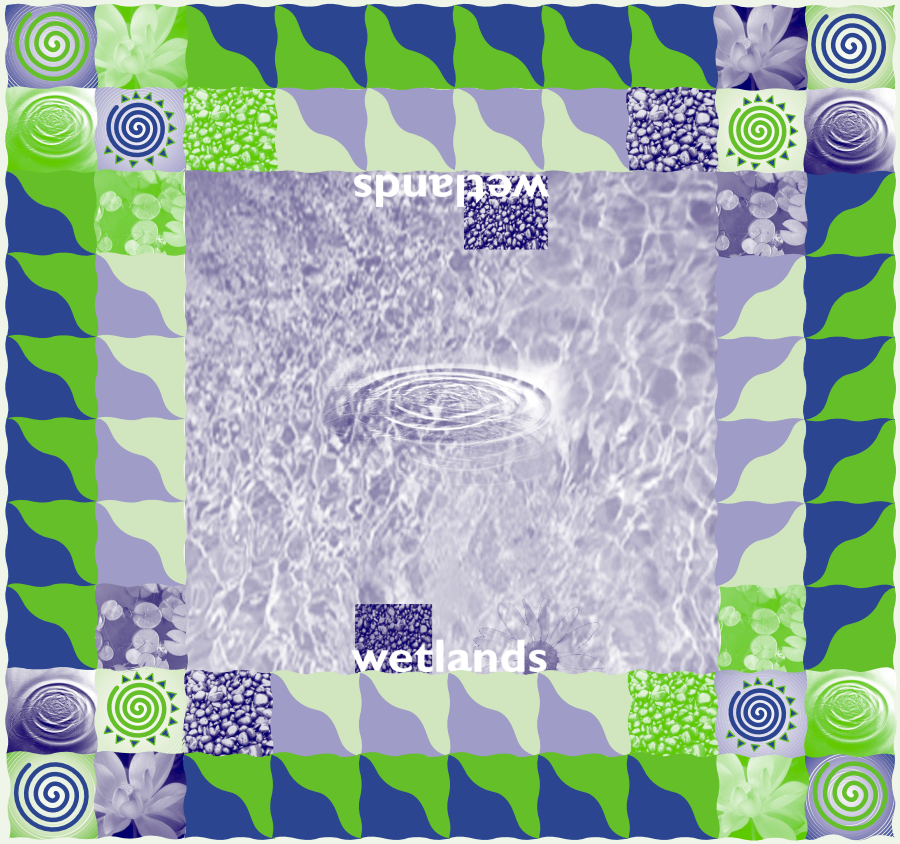
GUIDING PRINCIPLES FOR CONSTRUCTED TREATMENT WETLANDS:

Providing for Water Quality and Wildlife Habitat



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Environmental Protection Agency

Natural Resources Conservation Service

U.S. Fish and Wildlife Service

National Marine Fisheries Service

U.S. Bureau of Reclamation

U.S. Army Corps of Engineers

Guiding Principles for Constructed Treatment Wetlands: Providing for Water Quality and Wildlife Habitat

DEVELOPED BY THE INTERAGENCY WORKGROUP ON CONSTRUCTED WETLANDS

Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, National Marine Fisheries Service, and U.S. Bureau of Reclamation

** This is a guidance document only - it does not establish legally binding requirements or regulations*

This User's Guide Provides:

- Guiding principles for planning, siting, design, construction, operation, maintenance, and monitoring of constructed treatment wetlands.
- Information on current Agency policies, permits, regulations, and resources.
- Answers to common questions.

Acknowledgements

This document is the result of the collective efforts of many individuals. All members of the Interagency Workgroup on Constructed Wetlands, listed in Appendix V, worked extremely hard reviewing multiple drafts to make these Guiding Principles a reality. The Environmental Protection Agency's Wetlands Division extends its heartfelt gratitude to all Workgroup members for their contributions. The Wetlands Division would like to make special recognition of Bob Bastian and Fran Eargle, who led the efforts of the Workgroup from its inception, and of Matt Little, who worked tirelessly to develop the document and incorporate the comments of the members. It is the hope of the Workgroup that this guidance will help improve the planning, siting, design, construction, operation/maintenance, and monitoring of constructed treatment wetlands that aim to provide water quality and wildlife habitat.

Considerable insight into the design, construction, and operation issues facing treatment wetlands that support valuable wildlife habitat was gained by many members of the Workgroup during a Wetlands Roundtable meeting and field trip to Phoenix and ShowLow, AZ, in November 1997. The Workgroup greatly appreciated the input and assistance provided by Paul Kinshella and Roland Wass from the City of Phoenix and others associated with the Tres Rios Project, as well as the insights provided by many others, especially Bob Knight, Bob Kadlec, Sherwood Reed, Bob Gearheart, Brad Finney, Jim Kreissl, and Mel Wilhelm, all of whom shared many examples of interesting situations from their extensive personal experiences working with constructed wetlands projects in various parts of the country.

Disclaimer

This document provides guidance to Environmental Protection Agency (EPA) Regions, States, Tribes, Local Governments, and other organizations and individuals involved in the planning, siting, design, construction, operation/maintenance, monitoring, and legal oversight of constructed treatment wetlands. It also provides guidance to the public and the regulated community on how EPA intends to exercise its discretion in implementing the Clean Water Act as it relates to constructed treatment wetlands. The guidance is designed to implement national policy on these issues. The document does not, however, substitute for the Clean Water Act or EPA's regulations; nor is it a regulation itself. Thus it cannot impose legally binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA and State decision-makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

Guiding Principles for Constructed Treatment Wetlands

Table of Contents

I. Introduction

A. Purpose and Background

Purpose: *To promote the development of environmentally-beneficial constructed wetlands for water treatment systems by providing information on the legal, policy, and technical issues associated with these systems as well as guidelines for those developing and managing constructed treatment wetlands.*

Background: The number of constructed treatment wetland projects receiving wastewater from municipal and industrial treatment sources as well as agricultural and storm water sources has increased to more than 600 active projects across the United States. If planned properly, these treatment wetlands offer opportunities to regain some of the natural functions of wetlands and offset some of the significant losses in wetland acreage. In arid regions and communities reaching the limits of water availability, water reuse via these systems is an attractive option that may help achieve water conservation and wildlife habitat goals. With appropriate siting, design, preapplication treatment, operation, maintenance, monitoring, and management, these manmade systems can often emulate natural wetlands by providing integrated ecological functions within the watershed and landscape.

Constructed treatment wetland project proponents and regulators have expressed a desire for more efficient and consistent policy guidelines for the development and permitting of such projects, especially those providing both water quality and wildlife habitat benefits. An initial effort to develop this guidance was funded by Environmental Protection Agency (EPA) Environmental Technology Initiative (ETI) Program. A Workgroup[1] was formed to identify general policy and permitting issues for a constructed treatment wetlands project, the Tres Rios Constructed Wetlands in Phoenix, Arizona. The Tres Rios Constructed Wetlands project is a wildlife habitat and treatment wetland proposed by the City of Phoenix, the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and other organizations. For more information on the Tres Rios Constructed Wetlands Demonstration Project see their website at http://www.tresrios.net .

In September 1997, EPA convened a Federal Interagency Workgroup consisting of the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Natural Resources Conservation Service, and the U.S.

[1]The ETI Project Workgroup that participated in this effort included active participation by representatives from the City of Phoenix and their contractor, CH_2M-Hill (and Wetland Management Services); EPA and its contractor, SAIC; U.S. Bureau of Reclamation; U.S. Army Corps of Engineers; U.S. Fish and Wildlife Service; AZ Dept. of Water Resources; AZ Dept. of Environmental Quality; AZ Game & Fish Dept; along with extensive input from many local organizations interested in the proposed Tres Rios Project.

Bureau of Reclamation to evaluate the technical and policy issues identified by the ETI project team (see their final report entitled *Wetlands for Water Quality Management and Habitat Enhancement: Policy and Permitting Issues*, January 1997) in order to provide a starting point for a national policy dialogue and for analysis of the issues associated with these wastewater treatment systems and the wildlife habitat they may be able to provide. Common factors in successful constructed treatment wetland projects and lessons learned from less successful projects provided, in part, the basis for development of the technical and policy recommendations in these guidelines.

The process of writing and reviewing the guiding principles was highly educational, collaborative, and iterative. The Workgroup decided to ***focus upon and encourage those projects that not only provide water treatment, but also strive to provide water reuse, wildlife habitat, and public use benefits.*** While this document focuses on municipal wastewater treatment wetlands, many of the principles can be used to help guide other treatment wetland projects, such as those treating acid mine drainage, agricultural and urban storm water runoff, livestock and poultry operations, and industrial wastewater. Information from specific case study projects, and scientific literature was used to develop these principles, along with technical information provided by constructed wetlands experts and dialogue during the Workgroup meetings. We hope this document will facilitate the establishment of future projects, while improving compliance with the Clean Water Act (CWA).

B. What are Constructed Treatment Wetlands?

For the purposes of these Guiding Principles, constructed treatment wetlands are defined as engineered or constructed wetlands that utilize natural processes involving wetland vegetation, soils, and their associated microbial assemblages to assist, at least partially, in treating an effluent or other water source. In general, these systems should be engineered and constructed in uplands, outside waters of the U.S., unless the source water can be used to restore a degraded or former wetland (see II.B "Opportunities for Restoration of Degraded or Former Wetlands").

The degree of wildlife habitat provided by constructed treatment wetlands, or sections of these wetlands, varies broadly across a spectrum. At one end of the spectrum are those systems that are intended only to provide treatment for an effluent or other water source, in order to meet the requirements of the CWA, and that provide little to no wildlife habitat. At the other end are those systems that are intended to provide water reuse, wildlife habitat, and public use,

while also providing a final polishing function for a pretreated effluent or other water source. This guidance primarily addresses the latter end of this spectrum.

C. What Are the Guiding Principles?

The Guiding Principles are intended to:

- provide a framework for promoting sustainable, environmentally safe constructed treatment wetland projects.
- be usable nationally under a variety of settings and circumstances.
- educate and inform public and private decision makers, Federal, State, Tribal and Local regulatory and resource agency personnel, and the general public.
- provide guidance for environmental performance, especially for projects which are intended to provide water reuse, wildlife habitat, and public use, in addition to other possible objectives.
- highlight opportunities to restore and create wetlands.
- be applied, when appropriate, to any effluent or other source water treatment system as long as the source is adequately treated to meet applicable standards, protects the existing beneficial uses, and does not degrade the receiving waters.
- create opportunities for beneficial uses of dredged material, if feasible.
- minimize risks from contamination, toxicity, and vector-borne disease.
- be applied in a watershed context.
- be flexible enough to accommodate regional differences in climate, hydrogeomorphology, wildlife habitat needs, etc.
- complement Federal, Regional, State, Tribal, or Local authority, rules, and regulations and policies.

II Guidelines for Siting Constructed Treatment Wetlands

A. Waters of the U.S. and Floodplains

Constructed treatment wetlands should generally be constructed on uplands (outside waters of the U.S.) and outside floodplains or floodways (unless the next section, II.B, applies) in order to avoid damage to natural wetlands and other aquatic resources. Also, wetlands constructed on uplands may be somewhat more predictable than natural wetlands in terms of pollutant removal efficiency and in structural soundness. This is believed to be due to the engineering of constructed wetlands to provide favorable flow capacity and routing patterns (excerpted from Strecker, et al., 1992). Consequently, siting may include consideration of such factors as flood control, hydraulic routing, flood damage potential, and wetland hydrology. (For more information on waters of the U.S., see VII.A "Clean Water Act and 'Waters of the U.S.,'" Appendix I: "Waters of the U.S.," and Executive Order 11988, *Floodplain Management*.)

B. Opportunities for Restoration of Degraded or Former Wetlands

Opportunities exist to use pretreated effluent, or other source waters, to restore degraded wetland systems. In general, you should only locate constructed treatment wetlands in existing wetlands, or other waters of the U.S., if (1) the source water meets all applicable water quality standards and criteria, (2) its use would result in a net environmental benefit to the aquatic system's natural functions and values, and (3) it would help restore the aquatic system to its historic, natural condition. Prime candidates for restoration may include wetlands that were degraded or destroyed through the diversion of water supplies, a common occurrence in the arid western U.S., and in heavily farmed or developed regions. You should avoid siting in degraded wetlands if the functions and values of the existing wetland will be adversely affected or water quality standards will be violated. The appropriate Regional/District or State authorities will make these determinations on a case-by-case basis. (Note: Many degraded wetlands are still considered waters of the U.S.)

C. Watershed Considerations

When developing a constructed treatment wetland, you should consider its role within the watershed, as well as within the broader ecosystem context of the region. Aspects of this role include: potential water quality impacts (physical, chemical, biological, thermal) to surface waters and groundwater; surrounding and upstream land uses; location of the wetland in relation to wildlife corridors or flyways; potential threats from the introduction of non-native plant or animal species; and local citizens' perception of the appropriateness of constructed treatment wetlands in their watershed. Whenever possible, your constructed treatment wetland project should be planned in the context of a community-based watershed program.

D. Water-Depleted and Effluent-Dependent Ecosystems

Constructed treatment wetland projects may provide valuable ecological benefits in regions where water resources, and especially wetlands, are limited due to climatic conditions and human-induced impacts, such as in the arid western U.S., heavily farmed regions, and developed areas. For example, in the arid west, there are often historic (now degraded) wetlands that no longer have a reliable water source due to upstream water allocations or sinking groundwater tables. Pretreated effluent from wastewater treatment plants and seasonal return irrigation flows may be the only sources of water available for these areas and their dependent ecosystems.

Please note that water quality standards and permitting requirements apply if these areas are still considered waters of the U.S. EPA has developed regional guidance to assist dischargers and regulators in demonstrating a net ecological benefit from maintenance of a wastewater discharge to a waterbody (*Guidance for Modifying Water Quality Standards and Protecting Effluent-Dependent Ecosystems*, U.S. EPA Region 9 Interim Final Guidance, 1992).

E. Other Site Selection Factors

The suitability of a site for constructing a treatment wetland may depend on the condition of one or more of the following factors: substrate, soil chemistry, hydrology/geomorphology, vegetation, presence of endangered species or critical habitat, wildlife, cultural/socioeconomic impacts including environmental justice issues, the surrounding landscape, land use/zoning considerations, and potential impacts to safety and health, such as impacts from major flooding events and vector-borne disease. Project proponents and permit applicants should carefully examine these factors and consult with applicable agencies in determining the most appropriate site(s) for their projects, and should follow the necessary environmental impact review procedures or other requirements in selecting the final project location and characteristics.

III Guidelines for Design of Constructed Treatment Wetlands

A. Minimal Impact

Adverse impacts to waters of the U.S. should be avoided. Potential adverse impacts may include, but are not limited to: disruption of the composition and diversity of plant and animal communities; alteration of the existing hydrologic regime of natural wetlands or adjacent surface water bodies; introduction and spread of noxious species; threats to fish and wildlife from toxins and/or pathogens; and degradation of downstream water quality and groundwater sources.

B. Natural Structure

Constructed treatment wetland designs should avoid rectangular basins, rigid structures and straight channels whenever possible (See Mitsch and Gosselink, 2000; Kusler and Kentula, 1989; National Research Council, 1992). The use of soft structures, diverse and sinuous edges in design configuration, and bio-engineering practices that incorporate the existing natural landscape and native vegetation in constructed treatment wetlands is encouraged. Use landform and gravity to your advantage and design your project for minimal maintenance. For example, sites, slopes, and grades can be used to create depth variability and diversity. Site planning should avoid conditions conducive to stagnant water and "short circuiting" and problems such as avian botulism and vector production.

C. Buffer Zones

Design the margins of your constructed treatment wetland system as natural transition zones, including woody vegetated buffer areas around the site. Where appropriate, integrate the facility with other natural resource features to provide wildlife corridors and open space.

D. Vector Control

Where necessary, design your facilities to minimize mosquito problems by minimizing the potential formation of stagnant water, facilitating vegetation management, and by using natural biological control mechanisms, such as mosquito fish, stickleback, etc. (where native), bats, and purple martins. Local mosquito abatement districts and local codes may provide valuable assistance in designing your project to minimize mosquito habitat. In some cases, it may be important to consider providing access for active vector control.

E. Hazing and Exclusion Devices

Hazing or wildlife exclusion devices, such as noise-making devices or netting and fencing, should be used if the effluent or other water source being treated is toxic or presents a significant threat to wildlife. Such devices may be necessary in facilities that are designed only for treatment, but their need should be decided on a case-by-case basis.

Using these wildlife control methods may also be necessary if excessive wildlife use is causing water quality problems. In some circumstances, excessive use of wetlands by wildlife can result in: (1) wildlife stress and disease problems, (2) degradation of water quality due to high loadings of nutrients, solids, and fecal coliform, and (3) erosion resulting from loss of vegetation due to over-grazing and trampling.

F. Dedicated Water Source

Plans should be made for maintaining the wetland habitat during periods of drought. Projects that are intended to provide wildlife habitat should have a dedicated water source for the life of the project and, if possible, beyond the life of the project to meet the long-term hydrological needs of the desired aquatic and terrestrial communities. When doing this, be sure that adequate water supplies remain in adjacent streams for aquatic use and if ground water is used, be sure that its mineral content is not toxic to plant species (for example, excess iron can kill some plants).

G. Biological Diversity and Physical Heterogeneity

Where appropriate, design your constructed treatment wetland to provide habitat with a diversity of native species comparable to similar wetlands in the region. Maximize vegetative species diversity, where appropriate, without increasing the proportion of weedy, nonindigenous, or invasive species at the expense of native species. Project plans should include mechanisms to control or eliminate undesirable species. The biological diversity of your project may be linked to, or dependent upon, physical heterogeneity. This could include having both surface and subsurface flow while providing some areas of open water, creating nesting islands for waterfowl, and leaving some upland and buffer areas for other nesting species. Developing a wide variety of wetland types will provide a range of diversity for different types of wildlife. Considerations may include seasonal hydroperiods, depth-flow changes, vegetative succession, and accumulation of sediments.

H. Seasonality and Capacity Exceedences

Your project design should be able to accommodate extremes in meteorologic conditions and temporary exceedences of water storage and treatment capacity. Considerations should be made for extremes in temperature and precipitation which can impact normal operations.

I. Forebays

Utilize sediment collection/settling forebays for treatment of storm water inflows and for additional treatment of wastewater. Design and locate the forebays for ease of maintenance and to achieve greatest protection of wetland habitat and receiving waters. Monitor forebay sediments, wetland vegetation tissues, and water quality to ensure the system is functioning properly and not becoming an attractive nuisance problem to wildlife. Identify an upland disposal site to dispose of accumulated sediments that is consistent with sediment disposal requirements and monitoring criteria and standards. Note that special disposal requirements may be applied for sediments containing hazardous waste materials.

J. Multiple Cells

The use of multiple cells may allow for residuals clean-out, repair of flow control structures, and specialized management of specific effluents without disruption of the overall systems operations. They also facilitate the flexibility of the system to manage different portions of the system (i.e., individual cells) for different purposes, such as the use of cells nearest the influent source to settle out sediment, final cells to strip out algae produced within the system, and other cells used to encourage the development of habitat and food production for specific wildlife species, etc. From a wastewater treatment standpoint, multiple cells often provide better treatment in part because "short circuiting" is minimized.

K. Maintenance Access

Design your constructed treatment wetland so that maintenance vehicles and personnel can safely and easily access the site with a minimum of disturbance. Proper access design will facilitate proper operation and maintenance of the wetland so that it performs as designed.

L. Public Acceptance

Consider the public's perception of your constructed treatment wetland project and its effects on neighboring populations and adjacent land uses. Take into account potential concerns like drinking water contamination, unpleasant odors, mosquitos, access by small children and other safety and health issues. By planning your project with community involvement early in the process, you will help ensure public support and approval for your goals and objectives while developing a safe project for everyone to enjoy.

M. Public Use

When appropriate, encourage public access and use, work with local educators to design informative displays to install at your project, and help foster community education programs, especially for projects developed for water reuse and wildlife habitat. In some cases, public access may need to be prevented due to safety and health concerns.

N. Pilot Projects and Design Criteria

A pilot project may be necessary for designing your full-scale project. If a pilot is not utilized, then design considerations should be fully described and made available to future operators and regulatory staff. To assist in project design, see the reference, *Constructed Wetlands Treatment of Municipal Wastewater Process Design Manual* (EPA 625-R-99-010), as well as other technical references such as those listed in Appendix IV. Planning, design, and construction information is available from Natural Resources Conservation Service (NRCS) offices nationwide; technical assistance may also be available from NRCS offices based on local priorities and workloads. EPA's North American Treatment Wetland Database is a good avenue for networking by owners and their designers. Information is generally not complete enough for design, as most of the data is not quality assured and key parameters may be missing.

IV Construction Guidelines for Constructed Treatment Wetlands

A. Construction Practices/Specifications/Drawings

Good construction practices should be followed during construction of your treatment wetland. Examples include properly evaluating the site, limiting damage to the local landscape by minimizing excavation and surface runoff during construction, and maximizing flexibility of the system to adapt to extreme conditions. Construction specifications and drawings should be utilized that clearly convey procedures to be used and required quality of final product. Note that a general construction storm water CWA Section 402 (NPDES) permit must be obtained for any projects 5 acres in size or greater (or 1 acre expected to begin in 2002). This permit requires development and implementation of a Storm Water Pollution Prevention Plan including best management practices to minimize pollutant loading during construction.

While designs should generally be kept as simple as possible to facilitate ease of construction and operation, the use of irregular depths and shapes can be highly beneficial to enhancing wildlife habitat value. Proper construction is best ensured by the involvement of experienced inspectors and equipment operators who are knowledgeable about wetlands creation and the goals of the project. Careful construction inspection is essential to ensuring that the project is constructed as designed.

B. Soils

If possible, avoid soil sources that contain a seed bank of unwanted species. Carefully consider the soil's permeability and the implications for ground water protection. Highly permeable soils may allow infiltration and possible contamination of groundwater and could prevent the development of hydrological conditions suitable to support wetland vegetation. You may need to use an impermeable barrier in some instances. Dredged material may be useful to help create a base substrate layer, however you may need to test it to ensure that it doesn't contain unwanted contaminants or materials. Matching a local dredging project's disposal need with a beneficial use solution such as creating a constructed treatment wetland is likely to be more practical, cost-effective, and environmentally advantageous when made as part of a broad, watershed-level planning effort. Contact your local U.S. Army Corps of Engineers office to see if there are any dredging projects in your area. For detailed guidance on beneficial uses of dredged material, please see the *Beneficial Use Manual - Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material* (EPA 842-B-98-001).

C. Vegetation Selection

Vegetation selection needs to accommodate the hydraulic operations of the wetland system and still support habitat objectives. In general, use a diversity of native, locally obtained species. You should obtain seeds from a local seed bank or seedlings from a local nursery, whenever possible. Native plants from existing wetlands may be harvested provided that removal of the plants does not result in damage to the existing wetland or violate any applicable Local, State, or Federal regulations. Species should be chosen both for water quality and wildlife habitat functions, if that is the intent of the project. The use of weedy, invasive, or non-native species should be avoided. Also consider the plants' abilities to adapt to various water depths and soil and light conditions at your site.

V. Guidelines for Operation and Maintenance of Constructed Treatment Wetlands

A. Management Plan

Designers or managers who decide to create a treatment wetland must factor in long-term maintenance costs and needs to provide for the proper functioning of the wetland over time. Factor in these maintenance needs by creating a long-term operations, maintenance, monitoring, and funding plan that identifies the party or parties responsible for maintenance and monitoring of your project, their responsibilities, and the funding mechanisms. Some funding sources are listed in Appendix III, "Federal Funding Sources." The management plan needs to ensure maintenance of the functions the project is designed to provide. Where vector control is likely to be a concern, provisions to control vegetation will be an important component of the management plan. In some cases, you may need to secure performance bonds prior to facility approval.

B. Regular Inspections and Maintenance Activities

You will need to make regular inspections of your constructed treatment wetland. The definition of "regular" is case-specific and will depend on the design and operation of your treatment wetland. These considerations should be described in your maintenance plan. Examples of maintenance activities that you should conduct during these inspections include checking weir settings and the inlet and outlet structures, cleaning off surfaces where solids and floatable substances have accumulated to the extent that they may block flows, removing nuisance species and maintaining the appearance and general status of the vegetation and wildlife populations, and removing sediment accumulations in forebays. Save time and energy by conducting your routine monitoring activities, such as sample collections and wildlife counts, at the same time as your inspections.

C. Operator Training

Train and/or certify your operators in the operation and maintenance of constructed treatment wetlands. Where available, this may be done in cooperation with your State regulatory agencies, the facility engineer, and public or private training centers, as directed by the certifying entity. Seek assistance from regulators and local experts and attend constructed treatment wetland seminars and conferences for additional technical assistance.

D. Contingency Plan

Project designers and operators should jointly develop a contingency plan to address problems that could develop during facility operations. Such problems may be due to: unrealistic or unattainable goals; design, construction, or operational errors; or unpredictable events. The first situation can be addressed by revising project goals or regulatory criteria (e.g., water quality standards), the second by reducing system capacity, increasing its area, or changing operational practices, and the third by anticipation through conservative design. Contingency plans should include measures for determining and remediating nuisance conditions, addressing any toxicity observed in the wetland, and dealing with upstream treatment plant failure or bypass. Auxiliary storage basins can be helpful for dealing with many of these situations.

VI Guidelines for Monitoring Constructed Treatment Wetlands

A. Reference Wetland

Reference sites may be useful as a basis of comparison to identify various changes and impacts to your constructed treatment wetland ecology and to evaluate its success. Where feasible and appropriate, consider using more than one wetland of the same type (e.g., depressional, riverine), class, size, vegetative cover, hydroperiod, and geographic region (preferably nearby and within the same watershed), while allowing for natural variability, as a reference to measure the success of your project. Depending on your project's goals and objectives, you may want to compare only certain functions or characteristics of your treatment wetlands with the reference wetlands.

B. Methods and Criteria

Depending on the primary goals and objectives of your project, site monitoring can be used to determine the chemical, physical, and biological health of your project and its success in treating effluent or other water sources. Monitoring criteria may include water quality (surface and ground water), sediment quality, temperature, hydrology (fluctuation, loading, variability and flow pattern monitoring by means of tracer studies), plant, benthic macroinvertebrate, fish tissue analyses, toxicity testing, seasonal vegetation mapping or physical sampling, habitat structure and diversity (including species richness), and wildlife use surveys (birds, amphibians, macro-invertebrates, and fish, if appropriate). Certain species, such as migratory birds, will require Federal and State permits to collect for monitoring purposes. Also, nuisance insects should be monitored to evaluate the need for vector control measures. Where appropriate, methods for monitoring should draw from the scientific literature for assessing biological conditions. The specific details of your monitoring plan should be determined through discussions with the permitting agencies. If your State has a wetlands biomonitoring program, it may be appropriate to incorporate your efforts into the program. Volunteer monitoring groups, such as the Izaak Walton League or local schools, may be able to assist you with your monitoring efforts.

C. Early Identification of Potential Problems

Try to anticipate potential problems and monitor for potential dangers to the wetland ecosystem, such as bioaccumulation, avian botulism and other avian diseases, vector problems, invasion of non-native plants and animals, debris accumulation, and nuisance conditions, and be prepared to respond quickly. Potential responses to such problems should be described in your contingency plan.

D. Timeframe

Be sure to monitor the constructed treatment wetland for the entire life of the project to help ensure that the wetland system performs as designed and meets its ecological integrity goals.

VII Federal Permits and Other Legal Issues

Federal, State, Tribal, and/or Local regulations, in addition to those listed below, may be applicable. Please be sure to coordinate with the appropriate agencies on all projects and, when appropriate, have cooperative and collaborative planning and information-sharing sessions with community and business representatives, environmental groups, regulatory agencies, and the general public.

A. Clean Water Act and "Waters of the U.S."

"Waters of the United States" or "waters of the U.S." are those waters regulated by the Clean Water Act (CWA) (see definition in Appendix I). By definition, waste treatment systems designed to meet the requirements of the Clean Water Act are not considered waters of the U.S. (40 CFR 122.2 9). If, however, your constructed treatment wetland is constructed in an existing water of the U.S., the area will remain a water of the U.S. unless an individual CWA Section 404 permit is issued that explicitly identifies it as an excluded waste treatment system designed to meet the requirements of the CWA.

If your constructed treatment wetland is constructed in uplands and is designed to meet the requirements of the CWA, then it generally will not be considered a water of the U.S. under the waste treatment system exclusion to the definition of waters of the U.S. If the constructed treatment wetland is abandoned or is no longer being used as a treatment system, it may revert to (or become) a water of the U.S. if it otherwise meets the definition of waters of the U.S. This definition is met if the system has wetland characteristics (hydrology, soils, vegetation) *and* it is (1) an interstate wetland, (2) is adjacent to another water of the U.S. (other than waters which are themselves wetlands), or (3) if it is an isolated intrastate water which has a connection to interstate commerce (for example, it is used by interstate or foreign travelers for recreation or other purposes).

The U.S. Army Corps of Engineers and the EPA decide on a case-by-case basis whether or not particular bodies of water are waters of the U.S. Contact your U.S. Army Corps of Engineers district or regional Environmental Protection Agency office for more information on this subject. If your constructed treatment wetland, or a portion of your constructed treatment wetland, is considered a water of the U.S., then it falls under the jurisdiction of the CWA and one or more of the following sections of the CWA may apply. If the constructed treatment wetland is not itself a water of the U.S. but it discharges pollutants into a water of the U.S., the discharge requires a permit under CWA Section 402.

B. Clean Water Act Section 303 Water Quality Standards

Under the CWA, States and Tribes (and in a few cases EPA) are to adopt water quality standards for all waters of the U.S. Water quality standards include designated uses for water bodies, criteria to protect these designated uses, and an antidegradation policy (Section 303). Permits for discharges to waters of the U.S., including jurisdictional wetlands, must ensure the discharges will not cause or contribute to a violation of water quality criteria or impair designated uses in the receiving water or downstream waters. If there are no water quality standards specific to a wetland, the water quality standards for the adjacent open waterbody may be applied to the wetland, depending on your state's policies. Please see Appendix II, "Section 303 of the Clean Water Act," for additional information.

C. Clean Water Act Section 401 Certification

Projects involving a federally-licensed activity that may result in discharges to waters of the U.S. (such as a CWA Section 402 permit from EPA and/or a CWA Section 404 permit from the U.S. Army Corps of Engineers) require certification under Section 401 of the CWA. Your permit application will need certification that the proposed activity will not violate water quality standards or other State or Tribal requirements. This certification must come from the State or authorized Tribe in whose geographic jurisdiction the discharge would occur, or in some circumstances from EPA. Note that the State or Tribe may place conditions on its certification that are intended to prevent such violations. States and Tribes may waive certification.

D. Clean Water Act Section 402

The CWA Section 402 program, also known as the National Pollutant Discharge Elimination System (NPDES) program, regulates the discharge of pollutants (other than dredged or fill material, which is covered, below, under Section 404 of the Clean Water Act) from point sources into waters of the U.S. Over forty states are authorized by EPA to administer the NPDES permitting program within their state boundaries. The construction and/or operation of a treatment wetland may involve these discharges to waters of the U.S. and, as a result, require an NPDES permit.

If construction of the treatment wetland will disturb 5 acres or more (1 acre expected to apply in 2002), an NPDES permit for the discharge of storm water is required. In most areas of the country, EPA or State NPDES permitting authori-

ties have issued storm water general permits for discharges from construction activities. These storm water general permits typically require operators of the construction project to submit a notice of intent (NOI) form, and prepare a site specific storm water pollution prevention plan, prior to disturbing any land at the site. For more information, please contact your NPDES permitting authority. A current list of State/Federal Storm Water Contacts is available at: http://www.epa.gov/owm/swlib.htm. For more information, see VIII., Question and Answer #1, and Appendix II, "Section 402 of the Clean Water Act."

E. Clean Water Act Section 404

If your construction activities involve the discharge of dredged or fill material (e.g., rock, sand, and soil) to waters of the U.S., you will need authorization under CWA Section 404. For example, if you wish to use a degraded jurisdictional wetland for wastewater treatment and plan to construct water control structures, such as berms or levees, this construction will typically involve discharges of dredged or fill material into that wetland. (Note: The use of existing wetlands for purposes of wastewater treatment is generally discouraged.) Subsequent maintenance may also require a permit, although Section 404(f) may exempt some routine maintenance from 404 permitting requirements. You should contact the U.S. Army Corps of Engineers (or the appropriate state agency) to determine the regulatory requirements associated with the proposed discharge of dredged or fill material. For more information, see Appendix II, "Section 404 of the Clean Water Act."

Compensatory Mitigation: In general, wetlands constructed or restored for the primary purpose of treating wastewater will not be recognized as compensatory mitigation to offset wetland losses authorized under federal regulatory programs. In some cases, however, components of constructed wetland treatment systems that provide wetland functions and values beyond what is needed for treatment purposes may be used for compensatory mitigation. For example, project sponsors may be eligible to receive mitigation "credit" for using treated effluent as part of a constructed treatment wetland system that restores or creates *additional* wetland acreage beyond the acreage needed for treatment purposes. The use of constructed treatment wetlands for mitigation for CWA Section 404 purposes is subject to approval by the U.S. Army Corps of Engineers, in consultation with other Federal and State resource agencies. Such decisions need to be made on a case-by-case basis, considering, among other factors, the appropriateness of the constructed treatment wetland to fully offset the anticipated impacts from the loss of natural wetlands.

F. Preapplication Treatment (see definition in Appendix I)

If your constructed treatment wetland is considered a water of the U.S. (e.g., is constructed in a water of the U.S.), you must treat the effluent, or other source water (storm water runoff, agricultural and livestock waste, etc.) prior to its entering the constructed treatment wetland sufficiently to meet all applicable water quality standards (and to prevent degradation of wildlife or biological integrity) and technology-based requirements. Municipal wastewater effluent generally must be treated to at least secondary levels before it enters waters of the U.S. (CWA Section 301). Other examples of treatment include best management practices for storm water and confined animal feeding operations.

G. Other Federal Legal and Programmatic Considerations (for descriptions, see Appendix II: Federal Statutes and Regulations)

- Clean Water Act Section 319 (Nonpoint Source Pollution Program)
- Estuary management plans under Clean Water Act Section 320
- Coastal Zone Management Act, including Reauthorization Amendments of 1990
- Endangered Species Act
- Fish and Wildlife Coordination Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act
- National Environmental Policy Act
- National Wild and Scenic Rivers Act
- National Historic Preservation Act

VIII Questions and Answers

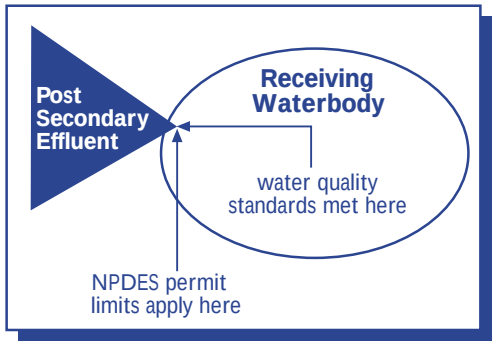
Question 1:

I am planning to build 50 acres of constructed treatment wetlands for post-secondary wastewater treatment of my small community's municipal wastewater effluent. I anticipate that the wetland will provide high value wetland habitat for wildlife and public use. Do I need any permits, do water quality standards apply to my project, and can I get mitigation credits?

If your new constructed treatment wetland is considered waters of the U.S. or will discharge pollutants to waters of the U.S., you will need a CWA Section 402 (NPDES) permit at the discharge point (please see the discussion on waters of the U.S. under VII.A and Appendix I). The permit's requirements will be based on the applicable water quality standards for the receiving waterbody. Three options for this are outlined below:

Option 1

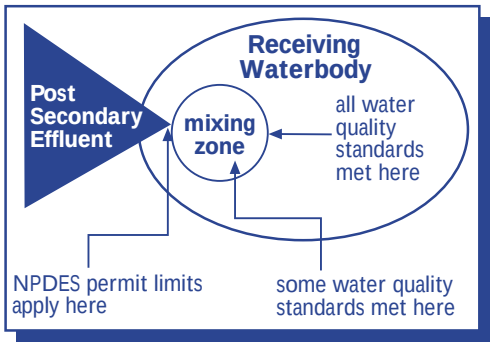
If the post-secondary effluent meets the applicable water quality standards requirements, you may receive a CWA Section 402 (NPDES) permit (with appropriate limits) to discharge directly into the waters of the U.S.



Option 1

Option 2

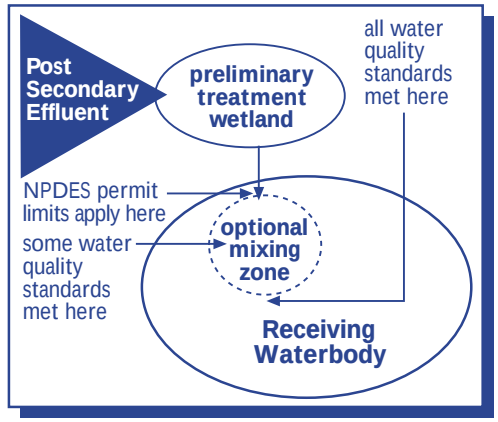
If the post-secondary effluent almost meets the applicable water quality standards for waters of the U.S., and can meet those standards within a short distance of the discharge, you may be able to use a mixing zone and receive a CWA Section 402 (NPDES) permit (with appropriate limits) to discharge directly into the waters of the U.S. Check with your state to see if mixing zones are allowed.



Option 2

Option 3

If the post secondary effluent will not meet the water quality standards for waters of the U.S. at or near the point of discharge, you may be able to discharge the post-secondary effluent to still another constructed treatment wetland that is not a water of the U.S. for further treatment. The discharge from this treatment wetland could then be treated in a manner similar to the effluent in Options 1 or 2.



Option 3

Be sure to coordinate with the appropriate NPDES permitting authorities prior to constructing the wetland. Also check with your state, because some states have developed specific water quality standards for wetlands, which may apply to your constructed treatment wetland project. Other water quality standards and technology-based effluent limitations may also apply, depending on the effluent source. For more information on standards, see VII: "Federal Permits and Other Legal Issues" and Appendix II, "Section 303 of the Clean Water Act."

If construction activities are proposed in existing wetlands or waters of the U.S., then the U.S. Army Corps of Engineers and appropriate State agencies must also be consulted for CWA Section 404 permitting (see VII.E, "Clean Water Act Section 404").

Portions of your project may be eligible for use as mitigation, depending on case-specific circumstances. Also, see the discussion of compensatory mitigation in VII.E, "Clean Water Act Section 404."

Question 2:

I live in an arid area and am hoping to use secondary wastewater effluent to restore a highly degraded natural wetland, while providing advanced treatment to the secondary effluent to meet requirements for downstream recreational use. Because of local water allocations and a drop in the water table, this site is now dry most of the year. The addition of effluent as a water source will help restore the wetland back to its historical hydrology and bring back the wetland dependent birds and wildlife. Do I still need permits and can I get mitigation credits for my restoration efforts?

Depending on the specific circumstances of your proposal, you may need federal authorization of your project. For example, if the particular degraded wetlands are considered waters of the U.S., discharges to create the waste treatment system will require a CWA Section 404 permit. A CWA Section 402 (NPDES) permit will also be required. As noted earlier, we encourage the use of appropriately treated effluent for restoration efforts only when it benefits the environment (See II.B "Opportunities for Restoration of Degraded or Former Wetlands.") Under some circumstances, portions of the restored wetland may be used as compensatory mitigation (see discussion of compensatory mitigation in VII.E "Clean Water Act Section 404").

Question 3:

Does my constructed treatment wetland become a water of the U.S. after it is no longer used as a treatment system?

If the treatment wetland is a water of the U.S., it will remain so after it stops being used as a treatment system. If the treatment wetland is not a water of the U.S., it may become (or revert back to, as the case may be) a water of the U.S. if it has wetland characteristics (hydrology, soils, and vegetation) and the following conditions apply: (1) it is an interstate wetland, (2) it is adjacent to another water of the U.S. (other than a water which is itself a wetland), or (3) it meets the interstate commerce requirements for an isolated intrastate water of the U.S. (for example, it is used by interstate or foreign travelers for recreation or other purposes). These decisions are made on a case-by-case basis. (See VII.A "Clean Water Act and 'Waters of the U.S.'")

Question 4:

If I need to perform general maintenance in the constructed treatment wetland, will I need a Section 404 permit to deposit removed vegetation or dredge sediments?

If the constructed treatment wetland is a water of the U.S., you may need a permit. Specifically, if the proposed activity involves discharges into waters of the U.S. or placement of fill material into waters of the U.S., a CWA Section 404 permit is needed unless the 404(f) exemption applies (see VII.E "Clean Water Act Section 404"). Activities such as building levees or sidecasting rock, sand, or soil into the wetland are likely to require such permits. We generally encourage constructing forebays in uplands to collect effluent and storm water prior to discharge to wetlands. You must obtain a permit to construct forebays in an existing wetland. Forebays should be designed to promote sedimentation and decrease the disruptive forces of the wastewater entering the system and thereby reducing impacts to water quality. Maintenance activities that are confined to

such areas will not require authorization if they do not involve discharges to waters of the U.S. Discharge from the maintenance of levees will likely be exempt from permit requirements under Section 404(f). (See VII.A and E for more information).

Question 5:

Will I need a groundwater permit for my constructed treatment wetland?

In general, groundwater protection permits are issued by State or Local agencies. You should coordinate with the appropriate State and Local agencies before you construct the treatment wetland. If the water in your constructed treatment wetland interacts with groundwater, then you may need a permit. If the wetland is lined with an impermeable liner, then interaction is unlikely and a permit may not be necessary. A Clean Water Act 402 (NPDES) permit may be required for discharges to groundwater where that groundwater has a direct hydrologic connection to surface waters of the U.S.

Question 6:

I am considering using constructed treatment wetlands to treat my municipality's stormwater flows. What general issues must I consider?

First of all, the treatment wetland should not be constructed in a waters of the U.S. unless you can sufficiently pretreat the stormwater flows to protect the values and functions of the waters of the U.S. Because storm water is an unpredictable effluent source and can contain high levels of toxic substances, nutrients, and pathogens, we strongly encourage that you construct the treatment wetland in uplands and use best management practices in these projects (see EPA's *Protecting Natural Wetlands: A Guide to Stormwater Best Management Practices*, EPA/843-B-96-001). Depending on the size of your municipality and other factors, you may need to get a CWA Section 402 (NPDES) permit. Be sure to contact all the appropriate wastewater authorities in your area during the early planning stages of this type of project.

Question 7:

Can I use constructed treatment wetlands to treat other effluents or source waters?

Yes, as long as you (1) generally avoid using natural wetlands which are waters of the U.S., (2) adequately pretreat the effluent or source water to protect the treatment wetlands and other nearby surface and groundwater sources, (3) contact the appropriate authorities, and (4) meet all applicable requirements. We also encourage you to follow the principles established in this document.

Appendix I

DEFINITIONS

COMPENSATORY MITIGATION
For the purposes of CWA Section 404, compensatory mitigation is the restoration, creation, enhancement, or in exceptional circumstances, preservation of wetlands and/or other aquatic resources for the purpose of compensating for unavoidable adverse impacts of a dredge or fill project which remain after all appropriate and practicable avoidance and minimization has been achieved.

CONSTRUCTED TREATMENT WETLAND
Engineered and constructed wetlands that utilize natural processes involving wetland vegetation, soils, and their associated microbial assemblages to assist, at least partially, in treating an effluent or other source water. In general, these systems should be engineered and constructed in uplands, outside waters of the U.S., unless the source water can be used to restore a degraded or former wetland (see II.B "Opportunities for Restoration of Degraded or Former Wetlands").

DEGRADED WETLANDS
Wetland systems that have lost some or all of their characteristic functions and values due to hydrologic alterations, discharges of fill material and/or other impacts such as pollutants, nuisance and invasive species, and discharge of point and nonpoint sources.

DESIGNATED USES
Classifications for waters of a State or Tribe by the State or Tribe that are to be achieved and protected. These uses must take into consideration the existing use and potential value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. Note that in no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the U.S. (*40 CFR 131.10(a)*)

DISCHARGE OF POLLUTANTS
The addition of pollutants, including dredge and fill material, from a point source to waters of the U.S.

DREDGED MATERIAL
Material that is excavated or dredged from waters of the U.S.

EFFLUENT
Wastewater, normally treated.

FILL MATERIAL
Any material that has the effect of replacing an aquatic area with dry land or of changing the bottom elevation of a waterbody.

FLOODPLAIN
The area that would be inundated by the flood which has a 1% chance of occurring in any given year, also referred to as the "100-year" flood (National Flood Insurance Program definition).

FLOODWAY
That area of the watercourse plus adjacent floodplain lands which must be reserved in order to allow the discharge of the base flood ("100-year" flood) without increasing flood heights more than a designated amount (National Flood Insurance Program definition).

FOREBAY
An area within a management pond, wetland, etc., that is sized to capture sediments and other debris as the material enters the unit. This area is designed to provide for equipment access to facilitate periodic removal of accumulated material.

INVASIVE SPECIES
Species that spread rapidly, are frequently non-native to the region, and tend to out-compete more desirable native forms and to become dominant.

JURISDICTIONAL WATERS, or JURISDICTIONAL WETLANDS
See "Waters of the U.S."

MITIGATION
See "Compensatory Mitigation."

MIXING ZONE
An area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient waterbody. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented. Compliance with effluent treatment standards typically is measured at the edge of the mixing zone. (*Water Quality Standards Handbook - Second Edition,* EPA-823-B-94-005, p. GLOSS-4.)

MONOTYPIC
Having a nearly total dominance of one species of plant, such as *Phragmites australis*, or *Typha spp.*, within an area.

NONINDIGENOUS or NON-NATIVE SPECIES
Species which are not native to the environment in which they currently exist and have been introduced by and often proliferate because of human activities.

NONPOINT SOURCE (NPS) POLLUTION
Sources of pollution not defined by statute as point sources. NPS pollution results from the transport of pollutants into receiving waters via overland flow runoff within a drainage basin. Because NPS pollution is diffuse, its specific sources can be difficult to identify.

OTHER SOURCE WATERS
Categories of wastewater other than municipal wastewater, such as acid mine drainage, industrial wastewater, agricultural and urban runoff, effluent from livestock operations, landfill leachates, etc.

POINT SOURCE
Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff. *(40 CFR § 122.2)*

PREAPPLICATION TREATMENT
The treatment of wastewaters prior to their introduction to constructed treatment wetlands, such that they do not negatively impact the wetlands' functions and values.

RESTORATION
"Return of an ecosystem to a close approximation of its condition prior to disturbance" and "the reestablishment of predisturbance aquatic functions and related physical, chemical and biological characteristics" (National Research Council, 1992).

SOURCE WATERS or WATER SOURCES
See "Other Source Waters."

STORMWATER
Flows and discharges resulting from precipitation events, such as rainfall or snowmelt, and include municipal and industrial stormwater runoff, combined sewer overflows (CSOs), and sanitary sewer overflows (SSOs). Urban stormwater runoff, which is often collected by storm drains and transported to receiving waters, can contain many pollutants that are accumulated as rainwater or snowmelt flow across the surface of the earth. Such pollutants include oil and grease, chemicals, nutrients, pesticides, heavy metals, bacteria, viruses, and oxygen-demanding compounds. (http://www.epa.gov/owm/wfaq.htm)

WATERS OF THE U.S.
All waters that are currently used or were used in the past, or may be susceptible to use in interstate commerce, including: all waters that are subject to ebb and flow of the tide; all interstate waters including interstate wetlands; all other waters such as intrastate lakes, rivers, streams including intermittent streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which would or could affect interstate or foreign commerce; all impoundments of waters otherwise defined as waters of the U.S. under this definition; tributaries of waters defined above; the territorial sea; and wetlands adjacent to waters (other than waters that are themselves wetlands) identified above. Courts have found that this includes such waters as isolated, intrastate waters which are used by migratory birds or which attract interstate travelers or from which fish or animals are or could be harvested and sold in interstate commerce. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA, are excluded from waters of the U.S. If such treatment systems are abandoned and otherwise meet the definition of waters of the U.S., they become or revert to regulated waters of the U.S. (See the regulations for specific details: *40 CFR § 230.3(s)(1-7),122.2 and COE Regulations at 33 CFR § 328.3(a)(1-7))*

WATERSHED
The total drainage area contributing runoff to a single point or "hydrologically defined geographic areas. . . typically the areas that drain to surface waters or that recharge or overlay ground waters or a combination of both." (June 1996 EPA *Watershed Approach Framework*)

WETLAND

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (Definitions taken from EPA regulations at *40 CFR § 230.3(t)* and COE Regulations at *33 CFR § 328.3(b)*.)

Appendix II

FEDERAL STATUTES AND REGULATIONS

MAJOR FEDERAL PROGRAMS AND REGULATIONS THAT MAY APPLY TO CONSTRUCTED TREATMENT WETLANDS

The U.S. Congress enacted the Clean Water Act to RESTORE AND MAINTAIN THE CHEMICAL, PHYSICAL AND BIOLOGICAL INTEGRITY OF THE NATION'S WATERS.

Section 303 of the Clean Water Act.

States and Tribes are to develop water quality standards for all waters of the U.S., including wetlands, subject to EPA approval. These standards, at a minimum, must consist of three major components:

1. Designated Uses - These are environmental goals for each waterbody within a State or Tribe. Each body of water is given one or more designated uses, such as "groundwater recharge" or "aquatic life support." The goal of the State or Tribe is to achieve, protect, and maintain these designated uses.

2. Water Quality Criteria - States and Tribes develop water quality criteria to support the designated uses of each waterbody in their respective jurisdictions. The criteria are either narrative statements or numeric limits on factors affecting the waterbody's health. A number of states are now establishing biological criteria, in addition to the more traditional physical and chemical criteria, to help determine the health of wetlands.

3. Antidegradation Policy - All States must have antidegradation policy language consistent with *40 CFR § 131.12* in their water quality standards, and must develop appropriate implementation procedures. Antidegradation policies, at a minimum, must maintain and protect existing instream water uses and the level of water quality necessary to protect the existing uses. These policies also ensure the protection of water quality for a particular waterbody where the water quality exceeds levels necessary to protect fish and wildlife propagation and recreation on and in the water.

Section 319(b) of the Clean Water Act (Nonpoint Source (NPS) Pollution Program).

EPA has oversight for a national program to control nonpoint sources of pollution. This program requires that States develop management programs for the control of nonpoint source pollution. EPA emphasizes a watershed-based approach, which can include protection and/or restoration of wetlands and riparian areas.

Section 401 of the Clean Water Act.
Certification verifying compliance with a State or Tribe's water quality standards and other requirements is necessary is required for federally-permitted or licensed activities that involve discharges to waters of the U.S.

Section 402 of the Clean Water Act (National Pollutant Discharge Elimination System (NPDES)).
Clean Water Act Section 402 establishes a program to regulate the discharge of a pollutant (other than dredged or fill materials, which are covered under Section 404 of the Clean Water Act) from a point source into waters of the U.S. The Section 402 Program is administered at the Federal level by the EPA. A State or Tribe, however, can be authorized to administer all or part of the program, upon approval by the EPA. As of 1998, 43 States have assumed the NPDES program.

The CWA defines a "discharge of a pollutant" to mean any addition of any pollutant to navigable waters from any point source. The term "pollutant" is defined as dredged spoil, solid waste, sewage, sewage sludge, chemical wastes, biological materials, industrial, municipal, and agricultural waste, etc. discharged into water. A "point source" is a discernible, confined and discrete conveyance, such as a pipe, ditch, channel or sewer, etc. from which pollutants are or may be discharged.

The CWA prohibits discharge of a pollutant from a point source except in accordance with a permit. Discharges to waters of the U.S. may be authorized by obtaining and complying with the terms of a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permits commonly contain numerical and narrative limits on the amounts of specified pollutants that may be discharged. These "effluent limitations" implement both technology-based and water quality-based requirements of the Act. Technology-based limitations represent the degree of control that can be achieved by point sources using various levels of pollution control technology. In addition, if necessary to achieve compliance with applicable water quality standards (see Section 303 above), NPDES permits must contain water quality-based limitations more stringent than the applicable technology-based standards.

Section 404 of the Clean Water Act.
CWA Section 404 establishes a program to regulate the discharge of dredged or fill materials into waters of the U.S. At the Federal level, the U.S. Army Corps of Engineers and the EPA administer the 404 program. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service have important advisory roles.

The U.S. Army Corps of Engineers has the primary responsibility for the permit program and is authorized, after notice and opportunity for public hearing, to issue permits for the discharge of dredged or fill material. EPA's responsibilities include development of the environmental guidelines by which permit applications are evaluated and review of proposed permits. States can assume a portion of the permit program from the Federal government. As of 1998, Michigan and New Jersey have assumed the 404 program.

The basic premise of the Section 404 program is that no discharge of dredged or fill material can be permitted if a practicable alternative exists that is less damaging to the aquatic environment, or if the nation's waters would be significantly degraded. Accordingly, applicants for a Section 404 permit must demonstrate that no practicable alternative exists that would meet the basic purpose of the project and have less impact on the aquatic environment. Once potential impacts to the aquatic environment have been avoided and minimized to the maximum extent practicable, applicants are required to provide practicable compensatory mitigation, such as wetlands restoration or enhancement, to offset any remaining adverse effects.

Coastal Zone Act Reauthorization Amendments of 1990, Section 6217(g).
This program is jointly administered by EPA and National Oceanic and Atmospheric Administration (NOAA), and calls upon states to develop and implement State Coastal Nonpoint Source Pollution Control Programs. EPA and NOAA have developed guidance specifying management measures for nonpoint source pollution affecting coastal waters (*Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, EPA/84-B-92-002). Included in this guidance is a chapter on protection and restoration of wetlands and riparian areas, and the use of vegetated systems for nonpoint source control.

The Endangered Species Act (ESA).
The 1973 Endangered Species Act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. Among other things, the ESA prohibits unauthorized taking, possession, sale, and transport of threatened and endangered species. It also requires Federal agencies to insure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat. The U.S. Fish and Wildlife Service and National Marine Fisheries Service can provide information on the location of threatened or endangered species and their habitats.

Fish and Wildlife Coordination Act.
This Act authorizes the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to cooperate with Federal, State, public, and private organizations in the protection of wildlife (including fish) and its habitat. It also requires that impacts to wildlife be given equal consideration in water-resource development programs. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service must be contacted regarding all new Federal water projects or federally-authorized water projects that modify streams or other bodies of water.

Magnuson-Stevens Fishery Conservation and Management Act.
The 1996 amendments to this Act require the Fishery Management Councils to describe "essential fish habitat" (EFH) for managed fish, including shellfish. The Act also requires Federal agencies to consult with National Marine Fisheries Service on any federal action (including those federally-funded or authorized) that may adversely affect EFH. National Marine Fisheries Service regulations emphasize the use of existing coordination processes (e.g., National Environmental Policy Act, Fish and Wildlife Coordination Act) for accomplishing EFH consultation. National Marine Fisheries Service is required to provide EFH conservation recommendations to both Federal and State agencies whose actions would adversely affect EFH. Federal agencies are required to respond to these recommendations.

Migratory Bird Treaty Act (as amended).
This Act implements four international treaties that individually affect migratory birds common to the United States, Canada, Mexico, Japan, and the former Soviet Union. The Act establishes Federal responsibility for protecting and managing migratory and nongame birds, including the issuance of permits to band, possess or otherwise make use of migratory birds, and the establishment of season length, bag limits, and other hunting regulations. Except as allowed by implementing regulations, the Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products.

National Environmental Policy Act (NEPA).
NEPA requires Federal agencies to make informed, environmentally-responsible decisions when considering Federal actions that may have a significant impact on the environment, such as when issuing a Section 404 permit. Generally, agencies must evaluate potential environmental consequences of proposed actions using Environmental Assessments (EAs) and/or Environmental Impact Statements (EISs).

National Wild and Scenic Rivers Act.
This Act selects certain rivers of the nation that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values; preserves them in a free-flowing condition; and protects them and their immediate environment for the benefit and enjoyment of present and future generations. It describes procedures and limitations for the control of lands in federally-administered components of the system and for dealing with the disposition of lands and minerals under Federal ownership. Rivers are classified as wild, scenic or recreational, and various prohibitions on the use of the waters and land apply, respectively. To preserve its current free-flowing condition, a designated river is protected from federally-supported dam building and other federally-authorized structural changes which would adversely effect the values upon which its designation was based.

National Historic Preservation Act.
This Act provides for the preservation of significant historical features (buildings, objects and sites). It established a National Register of Historic Places. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in this National Register.

Appendix III

FEDERAL FUNDING SOURCES

EPA's Clean Water Act State Revolving Fund (SRF)

Purpose: Provides grant funds to States to help them establish state revolving fund (SRF) programs. States, in turn, offer loans and other types of financial assistance from their SRFs to municipalities, individuals, and others for high-priority water quality activities.

Projects: While traditionally used to build or improve wastewater treatment plants, loans are also used increasingly for: agricultural, rural, and urban runoff control; wetland and estuary improvement projects; stormwater flow control and sewer overflows; alternative treatment technologies such as constructed wetlands.

Assistance: States offer loan rates that are two to four percent below market rates. Some states offer even lower interest rates to small, economically disadvantaged communities. 1999 budget: $1.35 billion.

Eligibility: Municipalities, individuals, communities, citizen groups, and non-profit organizations, though each State ultimately determines eligibility.

Address: U. S. EPA, Office of Wastewater Management, 1200 Pennsylvania Avenue, N.W. (4204), Washington, DC 20460
Phone: (202) 564-0748
Facsimile: (202) 501-2338
E-mail: srfinfo.group@epa.gov
Web Site: www.epa.gov/OWM

EPA's Nonpoint Source Implementation Grants (319 Program)

Purpose: To help States, Territories, and Tribes develop and implement programs to prevent and control nonpoint source pollution, such as creating constructed treatment wetlands to clean-up urban runoff and agricultural wastes.

Projects: States, Territories, and Tribes receive grant money (and may then provide funding and assistance to local groups) to support a wide variety of activities, such as technical assistance, financial assistance, technical programs, education, training, technology transfer, demonstration projects (e.g., best management practices), and monitoring specific to nonpoint source implementation.

Assistance: Grants are first awarded to State agencies. Local organizations can then apply for grants through the agencies, but they must provide 40 percent of the total project or program cost as non-federal dollars. 1999 budget: approx. $200 million.

Eligibility: State, Local, and Tribal governments, nonprofit and local organizations, etc. (Check with your state contact.)

Address: U.S. EPA, Office of Wetlands, Oceans, and Watersheds, 1200 Pennsylvania Avenue, N.W. (4502F), Washington, DC 20460
Phone: (202) 260-1799
Facsimile: (202) 260-2356
E-mail: ow-general@epa.gov
Web Site: www.epa.gov/owow/NPS

Appendix IV

REFERENCES

Executive Order 11988. *Floodplain Management.* May 24, 1977.

Executive Order 11990. *Protection of Wetlands.* May 24, 1977.

Godfrey, P.J., E.R. Kranor, S. Pelczarski, and J. Benforado (eds.). (1985). *Ecological Considerations in Wetlands Treatment of Municipal Wastewaters.* Amherst, MA, June 25, 1982. Van Nostrand Reinhold, New York, NY.

Hammer, D.A., ed. (1989). *Constructed Wetlands for Wastewater Treatment: Municipal, Industrial and Agricultural.* Lewis Publishers, Chelsea, MI.

Hammer, D.A. (1992). *Creating Freshwater Wetlands.* Lewis Publishers, CRC Press, Boca Raton, FL.

Kadlec, R.H. and R.I. Knight (1996). *Treatment Wetlands.* CRC Press, Inc., Boca Raton, FL.

Kadlec, R.H., R.I. Knight, J. Vymazal, H. Brix, R. Cooper and R. Haberl. (2000). *Constructed Wetlands for Pollution Control Process, Performance, Design and Operation.* IAW Publishing, London, UK.

Kusler, J.A. and M.E. Kentula, eds. (1989). *Wetland Creation and Restoration: The Status of the Science, Vol. I and II.* EPA/600/3/89/038a&b. U.S. EPA, Environmental Research Laboratory, Corvallis, OR.

Marble, A.D. (1990). *A Guide to Wetland Functional Design.* FHWA-IP-90-010. U.S. Department of Transportation, McLean, VA.

Merritt, A. (1994). *Wetlands, Industry & Wildlife: A Manual of Principles and Practices.* The Wildlife & Wetlands Trust, Gloucester GL27BT, UK.

Mitsch, W.J. and J.G. Gosselink (2000). *Wetlands, 3rd ed.* John Wiley and Sons, Inc., New York, NY.

Moshiri, G.A., ed. (1993). *Constructed Wetlands for Water Quality Improvement.* Lewis Publishers, CRC Press, Boca Raton, FL

National Research Council (1992). *Restoration of Aquatic Ecosystems.* National Academy of Sciences, Water Science and Technology Board. National Academy Press, Washington, DC.

Reed, S.C., R.W. Crites, and E.J. Middlebrooks (1995). *Natural Systems for Waste Management and Treatment.* McGraw-Hill, New York, NY.

Schneller-McDonald, K., L.S. Ischinger, and G.T. Auble (1990). *Wetland Creation and Restoration: Description and Summary of the Literature.* Biological Report 90(3). U.S. Department of the Interior, U.S. Fish and Wildlife Service, National Ecology Research Center, Fort Collins, CO.

Schueler, T. (1992). *Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland Systems in the Mid-Atlantic Region.* Department of Environmental Programs, Metropolitan Washington Council of Governments, Washington, DC.

Strecker, E.W., Kersnar, J.M., and E.D. Driscoll (1992). *The Use of Wetlands for Controlling Stormwater Pollution*. The Terrene Institute, Washington, DC.

U.S. Department of Agriculture, Soil Conservation Service (1992). "Wetland Restoration, Enhancement, or Creation." Part 650, Chapter 13 of the *Engineering Field Handbook*.

U.S. Environmental Protection Agency (1992). *Guidance for Modifying Water Quality Standards and Protecting Effluent-Dependent Ecosystems.* U.S. EPA Region 9 Interim Final Guidance. San Francisco, CA.

U.S. Environmental Protection Agency (1992). *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA84-B-92-002. Office of Water, Washington, DC.

U.S. Environmental Protection Agency (1993). *Constructed Wetlands for Wastewater Treatment and Wildlife Habitat -17 Case Studies.* EPA832-R-93-005. Office of Water, Washington, DC.

U.S. Environmental Protection Agency (1994). *North American Wetlands for Water Quality Treatment Database.* Risk Reduction Engineering Laboratory, Cincinnati, OH.

Guiding Principles for Constructed Treatment Wetlands

U.S. Environmental Protection Agency (1994). *Water Quality Standards Handbook - Second Edition*, EPA823-B-94-005. Office of Water, Washington, DC.

U.S. Environmental Protection Agency (1996). *Protecting Natural Wetlands: A Guide to Stormwater Best Management Practices.* EPA843-B-96-001. Office of Water, Washington, DC.

U.S. Environmental Protection Agency and U.S. Bureau of Reclamation (June 1999). *Free Water Surface Wetlands for Wastewater Treatment: A Technology Assessment.* EPA832-R-99-002. Office of Water, Washington, DC.

U.S. Environmental Protection Agency and U.S. Bureau of Reclamation (June 1999). *Treatment Wetland Habitat and Wildlife Use Assessment: Executive Summary.* EPA832-S-99-001. Office of Water, Washington, DC.

U.S. Environmental Protection Agency (September 1999). *Constructed Wetlands Treatment of Municipal Wastewater Process Design Manual.* EPA625/R-99/010. ORD/NRMRL Center for Environmental Research Information, Cincinnati, OH.

U.S. Environmental Protection Agency (December 1999). *Beneficial Use Manual - Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material.* EPA/842-B-98-001. Office of Water, Washington, DC.

U.S. Fish and Wildlife Service (1987). *Field Guide to Wildlife Diseases, Volume 1: General Field Procedures and Diseases of Migratory Birds.* Resource Publication 167. Washington, DC.

Water Pollution Control Federation (1990). *Natural Systems for Wastewater Treatment. S.C. Reed ed. Manual of Practice FD-16.* Water Pollution Control Federation, Alexandria, VA.

Watershed Management Institute and U.S. Environmental Protection Agency (August 1997). *Operation, Maintenance, and Management of Stormwater Management Systems.* Watershed Management Institute, Ingleside, MD.

Wetlands for Water Quality Management and Habitat Enhancement, Policy and Permitting Issues - Final ETI Report (January 1997) prepared for the City of Phoenix, U.S. EPA, and U.S. Bureau of Reclamation by the ETI Treatment Wetland Policy & Permitting Team and CH2M-Hill.

Appendix V

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Appendix VI

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EPA Wetlands Division
1200 Pennsylvania Avenue N.W. (4502F), Washington, DC 20460,
(202) 260-1799

EPA Wetlands Information Helpline
(800) 832-7828, email: wetlands-hotline@epa.gov

National Marine Fisheries Service
Office of Habitat Conservation, 1315 East-West Highway, Silver Spring, MD 20910
(301) 713-2325.

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CECW-OR, 20 Massachusetts Ave. N.W., Washington, D.C. 20314-1000
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U.S. Bureau of Reclamation: Land Suitability and Water Quality
P.O. Box 25007, Denver, CO 80225-0007
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U.S. Fish and Wildlife Service
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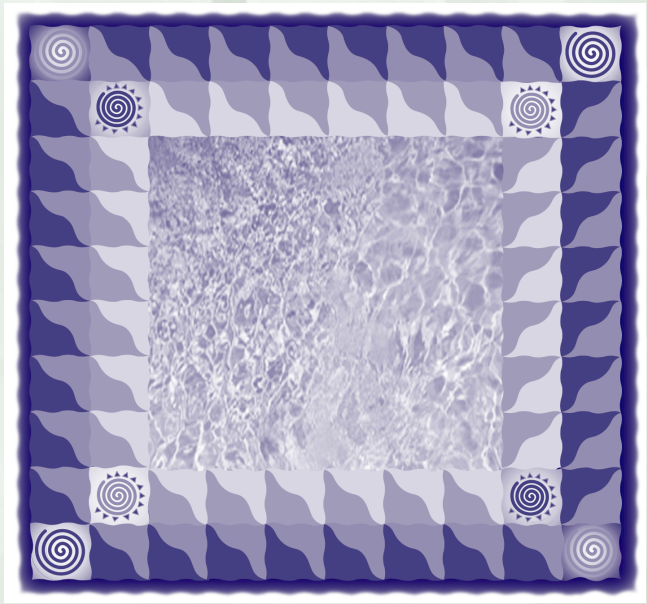

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