From: Amy_Defreese@fws.gov
To: julie_reeves@fws.gov
Subject: Re: Monthly FO transmission team call Wednesday, November 7 at 2 (Mtn)
Date: Monday, November 05, 2012 12:11:57 PM
Attachments: FWSRegion6WetlandMitigationPolicyGuidance1997.pdf

---

Hi Julie,
I'm guessing we would probably get to this topic, but I'm wondering if it might be worth it to specifically reference the following as an agenda item:

- Potential or existing variation among field offices in treatment of wildlife resources in NEPA processes and Section 7 consultations (ie expectations for surveys, impact analyses and mitigation protocols)

Thanks!
Amy

Amy Defreese, Ecologist
U.S. Fish and Wildlife Service
Utah Field Office
2369 W. Orton Circle, Suite 50
West Valley City, Utah 84119

Office: (801) 975-3330 x 128
Fax: (801) 975-3331
Email: amy_defreese@fws.gov

"Reeves, Julie" <julie_reeves@fws.gov>

"Reeves, Julie" <julie_reeves@fws.gov>

11/05/2012 09:23 AM

To Amy Defreese <Amy_Defreese@fws.gov>, Ann E Gray <Ann_E_Gray@fws.gov>, Brian Novosak <Brian_Novosak@fws.gov>, Chris Warren <Chris_Warren@fws.gov>, Creed Clayton <Creed_Clayton@fws.gov>, Doug Young <Doug_Young@fws.gov>, "Jeff Berglund" <Jeff_Berglund@fws.gov>, Jeff Everett <Jeff_Everett@fws.gov>, "Jeri Wood" <Jeri_Wood@fws.gov>, Melanie Cota <Melanie_Cota@fws.gov>, Rick Donaldson <Rick_Donaldson@fws.gov>, Stefanie Stavrakas <Stefanie_Stavrakas@fws.gov>, Suzanne Anderson <Suzanne_Anderson@fws.gov>
cc Tyler Abbott <tyler_abbott@fws.gov>
Subject Monthly FO transmission team call Wednesday, November 7 at 2 (Mtn)

Hi, fellow transmission gurus,

Please remember to call in on Wednesday at 2 for our monthly discussion about transmission lines and the issues that we face in dealing with them. We have a lot on the agenda this week, so please plan to participate. We will try to touch base on everything.

Call in#: (866) 650-7570 Passcode: 889 6811, then pound

1) Transmission lines - each state can give a brief background and then an update on what is happening with the project. Any issues shared among transmission lines can be discussed under agenda item 3:

a) Boardman to Hemingway: Idaho Power (near Boardman, OR to near Melba, ID)

b) Cascade Crossing: Portland General Electric (near Boardman, OR to near Salem, OR)

c) Energy Gateway South: PacifiCorp (near Rawlins, WY to near Utah Lake, UT)

d) Gateway West: Rocky Mountain Power and Idaho Power (near Casper, WY to near Boise, ID)

e) TransWest Express: TransWest Express, LLC (affiliate of Anschutz Corporation; near Rawlins, WY to near Las Vegas, NV)

f) Bonneville Power Administration (covers projects in eastern Washington, parts of northern Idaho, and into western Montana)

g) Avista (covers projects in Eastern Washington, Northern Idaho, and Western Montana areas)

2) Policy/Directive updates and impacts.

a) USFWS Region 6 1997 wetland mitigation policy guidance (see attached document). Defines mitigation ratios for project-specific impacts (not necessarily limited to R6 or to wetlands).

3) Open mike/Specific issues. Some of these will bring up more questions than answers...

a) TransWest Express: USFWS proposed alternatives in Utah to avoid greater sage-grouse

b) Greater sage-grouse: avoidance, mitigation (and easements?), BLM's IM to "cumulatively maintain and enhance"

c) BLM's impact analysis: temporary versus permanent impacts

d) Migratory birds: Migratory bird conservation strategies

e) WECC guidance on separation of adjacent lines

f) Other pressing issues?

--
~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

Julie (Proell) Reeves
Fish and Wildlife Biologist (Energy)
U.S. Fish and Wildlife Service
Wyoming Ecological Services Office
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009
(307) 772-2374 x 232
(307) 772-2358 fax
Julie_Reeves@fws.gov

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. ~Aldo Leopold, A Sand County Almanac

(See attached file: FWSRegion6WetlandMitigationPolicyGuidance1997.pdf)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:

FWS/R6
ES

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225-0486

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228-1807

AUG 25 1997

Memorandum

To: Project Leaders, Ecological Services, Fish and Wildlife Management Assistance Offices, and National Wildlife Refuges, Region 6

From: Regional Director

Subject: Region 6 Wetland Mitigation Policy Guidance

The subject policy is attached and should be implemented immediately. If you have questions, please contact Dennis Buechler at (303) 236-7400, ext. 231. If you encounter problems using it, please also forward that information to Dennis. The document will be amended if deemed necessary as a result of your experience in using it or if new national policy, laws, or regulations affect the guidance.

Ralph O. Morgenweck

Attachment

cc: ES Suboffices, Region 6
Billings, MT
Kalispell, MT
Grand Junction, CO
Harvey Wittmier, RE, Region 6
Grady Towns, ND/SD, Region 6
David Bowman, CO/NE/KS/UT, Region 6
Chief, DHC/BFA, Washington, D.C.

U.S. FISH AND WILDLIFE SERVICE

REGION 6

WETLAND MITIGATION POLICY GUIDANCE

August 1997

ACKNOWLEDGMENTS

The bulk of the material in this guidance was obtained from excellent materials related to this subject previously prepared by Regions 1, 4, and 5 of the U.S. Fish and Wildlife Service. Substantial information also was derived from an October 18, 1996, memorandum prepared for the North Atlantic Division Engineer, U.S. Army Corps of Engineers. In addition, pertinent input was provided by several Region 6 Ecological Services Field Offices. Region 6 appreciates the professional analysis and authorship that went into those documents and recommendations. The sharing of that information greatly facilitated the development of a guidance that should be useful for field biologists and their supervisors.

-- Dennis Buechler, Author

REGION 6 WETLAND MITIGATION POLICY GUIDANCE

I. PURPOSE AND SCOPE

This document addresses several priority issues involved in assessing wetland mitigation proposals. Because of the national priority given to wetlands, that is the habitat type emphasized in this guidance. However, many of the principles described herein can logically be applied to the mitigation of any habitat of concern in Region 6 of the U.S. Fish and Wildlife Service.

The objective of this policy guidance is to promote consistency when evaluating mitigation recommendations throughout Region 6, while providing flexibility to do what is ecologically appropriate. Use of this guidance by Service employees in Region 6 is strongly encouraged but is not mandatory.

Part 501 FW2 of the Service's Manual (Fish and Wildlife Service 1993) provides direction to personnel to help achieve consistent and effective application of e Service's Mitigation Policy (F.R. Vol. 46, No. 15, January 23, 1981) in veloping mitigation recommendations to protect and conserve valuable fish and wildlife resources. Application of the Policy is intended to enable governmental and private developers to anticipate Service recommendations and to incorporate mitigation measures into the early stages of the planning process, thus helping to preclude unnecessary project delays, litigation, and other problems.

This guidance supplements the Service's Mitigation Policy and is to be used in conjunction with the Environmental Protection Agency's Section 404(b)(1) Guidelines of the Clean Water Act (40 CFR 230.10(a)). It is consistent with the provisions and intent of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) and the Endangered Species Act (16 U.S.C. 1531 et seq.). However, this guidance is for internal use only and has no legal authority over the activities of other agencies or the public.

II. BACKGROUND

As clarified by the Memorandum of Agreement between the Department of the Army and EPA, entitled "Mitigation Guidelines," dated February 6, 1990, compliance th 40 CFR 230.10(d) requires application of a sequence of mitigation in the following order:

A. Avoidance
B. Minimization
C. Compensation (i.e., compensatory mitigation)

Compensatory mitigation is required to offset unavoidable wetland impacts which remain after all appropriate and practicable avoidance and minimization have been applied. The Service's Mitigation Policy identifies four resource categories that indicate a recommended level of mitigation consistent with the value of the habitat in question to an evaluation species. It identifies when habitat may be irreplaceable and when mitigation of habitat "in-kind" is recommended. The general preference for onsite mitigation also is addressed.

III. FORMS OF COMPENSATORY MITIGATION

The focus of any mitigation must be the wetland functions that have been affected, regardless of the approach chosen. Compensatory mitigation may include restoration of filled, drained, or otherwise altered wetlands; enhancement of existing wetlands; and creation of wetlands in uplands. These terms are defined in Appendix A along with additional guidance on their use and suitability.

In this Region, the general order of preference for compensatory mitigation is restoration, creation, and enhancement. Use of habitat preservation for compensation normally should be reserved for special situations. Kruczynski (1990b) believes that wetland preservation usually should not be considered for compensatory mitigation because it results in a net loss of wetland function and acreage. Kruczynski maintains that preservation is acceptable only to protect unique and valuable wetlands in danger of destruction by development.

Although the Service policy allows it in exceptional cases, for similar reasons, preservation is generally discouraged as a form of mitigation. Preferably, it should only be used in conjunction with the other three forms of mitigation when needed to develop a habitat complex of various wetland types. Even in such cases, 1:1 credit is usually not appropriate for the preserved acreage because the values already exist, and merely preserving them makes no contribution to the Nation's goal of "no net loss" of wetlands. The objective is to offset wetland losses (see Section IV.B.). However, if opportunities exist to enhance the preserved wetlands, that option may be more desirable.

Preservation is also acceptable when a potential site constitutes important habitat for a listed threatened or endangered species. This latter use is appropriate when consistent with recovery objectives and when the project impacts do not affect listed species. If the species may be affected, appropriate consultation steps must be undertaken in accordance with the implementing regulations for section 7 of the Endangered Species Act which does not authorize "mitigation" per se.

All uses of preservation for mitigation should be reported via electronic mail or copies of correspondence to the Regional Section 404 Coordinator. Furthermore, two or more of the following criteria should be met before deciding that preservation is an appropriate mitigation approach:

A. The proposed preservation site performs significant physical and/or biological functions, the preservation of which is very important to the ecosystem or watershed in which the wetlands are located.

B. The preservation site is relatively rare, of high value to the evaluation species, and difficult to replace.

C. The site is under imminent threat of loss or degradation due to natural phenomena or human activities that cannot or likely will not be controlled through Federal, State, or local regulatory programs, including zoning. The existence of imminent threat should be supported by substantial clear evidence of destructive natural phenomena or land use changes which have been demonstrated by local or regional land use trends.

D. Preservation will be used in conjunction with a more comprehensive mitigation package involving other mitigation efforts (i.e., creation, restoration, and enhancement), such that preservation will increase the overall value of the mitigation area and facilitate effective and efficient management of a habitat complex.

E. The impacted wetlands are of poor quality and fall under Resource Category 3 or 4 of the Mitigation Policy.

F. The amount of impacted habitat is relatively small.

Where habitats are protected, restored, or targeted for protection or restoration under Federal programs designed to increase the Nation's wetlands base, the Service will not recommend, support, or advocate the use of such

lands as compensatory mitigation for habitat losses authorized under the section 10/404 wetlands regulatory permit program. This policy extends to Federal programs that protect or restore fish and wildlife habitats on private lands, and includes, but is not limited to, easement areas associated with inventory and debt restructure properties under the Food Security Act of 1985, as amended. It also includes lands protected or restored for conservation purposes under FSA fee title transfers, lands protected by a habitat management agreement, or wetlands protected by programs authorized by the Consolidated Farm and Rural Development Act, as amended. This position was established in the Deputy Director's memorandum of September 2, 1994, on this subject (Fish and Wildlife Service 1994).

IV. METHODS TO QUANTIFY COMPENSATORY MITIGATION NEEDS

A. Scientifically Based Models--In accordance with the Service Mitigation Policy, prior to formulation of mitigation recommendations, the impacts of the proposed project or action need to be analyzed and evaluated. When applicable, the "Habitat Evaluation Procedures" or other evaluation systems may be used as a tool for assessing the effects of wetland impacts (Solomon and Sexton 1993). In order to achieve general consistency among the field offices, the use of a scientifically based habitat assessment methodology is recommended when time and resources allow (Fish and Wildlife Service 1996). King et al. (1993) suggested that field offices use a standard methodology for requiring mitigation ratios. That methodology should take into consideration future with-project and future without-project scenarios over time; this will account for temporal loss of habitat value.

King and Adler (1991) propose a method of determining an appropriate replacement ratio that is based on the level and rate of functional replacement. It requires the use of wetland function assessment methods. The Corps of Engineers, Natural Resources Conservation Service, Fish and Wildlife Service, and Environmental Protection Agency are developing a method to assess wetland functions that is based on hydrogeomorphic characteristics of wetlands. This method will allow determination of mitigation ratios by comparing functional capacity units lost in impacted wetlands to FCU's generated in compensatory mitigation wetlands (Smith et al. 1995).

The hydrogeomorphic method assesses wetland functions on an areal basis and can be used to determine the amount of created or restored wetland required for compensatory mitigation. For example, if the impacted wetland has low functional capacity per unit area, a restored wetland could have a higher functional capacity per unit area and compensate for the lost wetlands with a smaller amount of area. The HGM may eventually replace the policy of simple ratios for compensatory mitigation, but at this point, it is uncertain whether HGM will live up to its intended objective as an effective rapid assessment methodology.

You may choose to develop new methodologies with your interagency counterparts that are tailored to specific area needs, as has been done in the Rainwater Basin and in the saline wetlands of eastern Nebraska. It is recommended that field offices coordinate with counterpart State and Federal agencies in attempts to reach agreement on use of similar methodologies for evaluating wetlands functions and values. An excellent example of such an interagency effort is the Standard Operating Procedure RB-SOP-96-01 that was developed by the Charleston District, Army Corps of Engineers, in cooperation with the Service and other agencies (Appendix B). The SOP provides a framework for using equations to determine site-specific mitigation needs when more rigorous, detailed studies are not considered practical or necessary.

The Midcontinent Ecological Science Center, Biological Research Division U.S. Geological Survey (formerly National Ecology Research Center) in Ft. Collins, Colorado, can be contacted to aid in the development of reliable assessment models, but they may require reimbursement. Contact the Landscape and Habitat Analysis Branch, i.e., Richard Stiehl at (970) 226-9421.

B. Use of Ratios--The use of site-specific ratios in assessing compensatory mitigation can be best applied in situations when the management potential of a particular mitigation site has been assessed through scientific means and when the types and quality of habitat affected by project impacts are relatively consistent. However, that combination is uncommon.

When the same mitigation site is used to mitigate separate impacted habitats that have equal habitat suitability value, the acreage tradeoff ratio will be the same each time, thereby reducing the need for site-by-site determinations. However, when the habitat quality of an impacted site is different from previously evaluated areas, a site-specific habitat assessment of the impacted area may be necessary to derive the appropriate amount of compensation needed. In other words, impacted habitats that perform different levels of functions and that have different values may warrant the use of different mitigation ratios.

In view of the fact that staff time and funding are rarely available to do adequate site-specific studies, to develop models, or even to interpret existing models, several Service Regions have decided that general guidance and replacement ratios need to be available for use by field biologists.

Neither the Corps, EPA, NRCS, nor the Service has an official national policy that specifies replacement ratios for compensatory mitigation. Recently published regulations for the establishment, use, and operation of compensatory mitigation banks recommend the use of functional assessment methods to determine the amount of compensatory mitigation credits available at a mitigation bank and the debits created by filling wetlands and loss of other aquatic resources. However, if an appropriate functional assessment technique is not available, then acreage may be used instead (Department of the Army et al. 1995).

The 1990 MOA between EPA and the Army regarding determination of mitigation under the Clean Water Act Section 404(b)(1) Guidelines states that replacement ratios may be greater than 1:1 where the functions and values of the area being impacted are demonstrably higher than the functions and values of the replacement wetlands, or where the likelihood of success of the mitigation project is low. On the other hand, it states that the replacement ratio may be less than 1:1 for areas where the functions and values associated with the impacted wetland are low and the likelihood of success of the mitigation project is high. Region 6 disagrees with the latter option because ratios of less than 1:1 do not contribute to the national goal of "no net loss" and probably could not be justified on the basis of impacts to all the wetland functions.

Kruczynski (1990b) proposes ratios based on the method of compensatory mitigation used and the timing of the compensation. Up front compensatory mitigation that provides fully functional created or restored wetlands prior to initiation of the permitted work would require a 1:1 replacement ratio. If performed concurrently, wetland restoration would require a 1.5:1 replacement ratio, while wetland creation would require a 2:1 replacement ratio, and wetland enhancement would require a 3:1 replacement ratio.

King and Adler (1991) cite the following reasons for compensatory mitigation ratios greater than 1:1:

1. Time is required for the created or restored wetland to replace the functions lost in natural wetlands.

2. The functions performed by wetlands created or restored in the future are not equal, in terms of present worth, to the impacted wetlands.

3. Created or restored wetlands cannot always provide full replacement of functions even if they are considered successful.

4. Created or restored wetlands do not always function as expected so there is a need for some margin of safety to replace lost functions.

Replacement ratios of greater than 1:1 have been required because of the uncertainty of wetland creation and the amount of time required to develop fully functioning wetlands from either an area that will be allowed to revegetate naturally or planted with seedlings of wetland species (Kruczynski 1990a and 1990b; Kusler and Kentula 1990). According to Kusler and Kentula (1990), the most difficult wetlands to create or restore are isolated freshwater wetlands, particularly forested wetlands fed by ground water, because establishing the proper hydrology is difficult.

King and Bohlen (1994) report that little data is available on the cost effectiveness of projects undertaken as mitigation under the section 404 program. However, the data that was available revealed "that these projects have been generally under funded and ineffective

and have had extraordinary high failure rates. Studies sampling mitigation projects in Florida, California, and the mid-Atlantic States, for example, have found that over 50 percent of mitigation projects failed."

The results of such studies, combined with the extensive experience of its Ecological Services biologists, led Region 6 to take the position that it is usually appropriate to strive for greater than 1:1 replacement ratio of habitat. To ensure achievement of full replacement of functions, a minimum ratio of 1.5 acres to 1 acre should be advocated when practicable. An appropriate exception would be where restoration has been done in advance, the habitat is established, and the desired functions have been scientifically assessed, or where there is a good history of success of such projects (e.g., restoration of hydrology in drained prairie potholes through plugging of drains).

Such an approach will ensure that other wetland functions, which are not easily quantified, are taken into consideration in the context of no net loss of overall wetland functions. It also will help account for the values lost through time until the replacement habitat is fully functioning. Last but not least, experience and followup studies have shown that for a variety of reasons mitigation rarely achieves the desired goal of "no net loss" and 1:1 replacement of lost or damaged functions. Key factors include inadequate preconstruction planning and investigation (e.g., acquisition of necessary hydrological data); inadequate funding of initial development and operation, maintenance, and replacement costs; lack of or inadequate monitoring; and lack of contingency measures that can be readily implemented when problems arise.

Acreage replacement ratios may be based upon wetland functions, value to select species (as may be assessed by best professional judgment and current assessment methodologies), acreage, and cover type of the wetland to be altered. Also factors such as timing, type, practicability, and location of mitigation to be performed may be addressed. See the flow chart in Appendix C for the preference of mitigation strategies.

Field offices may continue to use professional judgment on site-specific applicability, but variances that would result in less

acreage of mitigation from the recommended ratios should be documented with appropriate rationale. Major variances should be reported to the Regional Section 404 Coordinator.

The guidance put forth here does not supersede existing Federal or State laws or regulations. Where Federal and State requirements differ, the more stringent ratios should apply. These ratios also can be applied for compensation of important upland habitat losses. When possible, mitigation sites should be protected by title transfers or easements.

The following ratios are Region 6's recommended minimum requirement:*

Advance creation	1.5:1	(forested, scrub-shrub)
	1:1	(emergent)
Concurrent creation	2:1	(forested, scrub-shrub)
	1.5:1	(emergent)
Advance restoration	1.5:1	(forested, scrub-shrub)
	1:1	(emergent)
Concurrent restoration	2:1	(forested, scrub-shrub)
	1.5:1	(emergent)
Advance enhancement	3:1	(forested, scrub-shrub)
	2:1	(emergent)
Concurrent enhancement	4:1	(forested, scrub-shrub)
	3:1	(emergent)

*In August 1994, the Baltimore District published a set of compensatory mitigation issue papers that support the above ratios (Department of the Army 1996). As confirmed in telephone conversations between Dennis Buechler of the Region 6 staff and several of his peers in the Service, the Corps, and EPA in 1996 and 1997, these ratios are believed to be generally consistent with those in use in many parts of the country; thus, they were adopted for Region 6 use.

PRESERVATION ratios will be determined on a case-by-case basis but usually should be at least in the range of 4:1 to 5:1, depending on the value of the impacted habitat compared to the preserved habitat. Exceptions as low as 2:1 may be made when the preserved land comprises less than 50 percent of the total acreage of wetlands in a comprehensive effort to restore and enhance a habitat complex (e.g., prairie wetland types). Other exceptions may be made when the preserved habitat is rare, unique, and/or essentially irreplaceable (e.g., Resource Category 1), or when it provides important habitat for a listed or candidate threatened and endangered species.

UPLAND habitat normally should be created or restored to offset losses of in-kind habitat. However, sometimes upland habitat that is restored or created adjacent to a wetland may be substituted for part of the replacement of previously degraded or altered wetlands, if deemed critical for wetland functions at the mitigation site. Examples of key functions provided by uplands include buffering from disturbance, filtering of sediments to prevent premature wetland aging, and enhancing bird habitat. Because of such functions, the Wetlands Procedures Manual used by Regions 3 and 6 of the Service for their small wetlands acquisition program allows 80 percent of acquisitions to be dry.

Most biologists recommend a minimum of 4:1 upland grass cover to wetlands for improving waterfowl brood habitat around seasonal wetlands and for nongame bird habitat. However, large, contiguous, undisturbed blocks of dense cover (e.g., 300 acres within 4 square miles) are needed to secure waterfowl nesting from predators according to Ron Reynolds of the Habitat and Population Evaluation Team in Bismarck, North Dakota (pers. comm. March 7, 1997). The Conservation Reserve Program Rule allows a ratio of 6:1 acres of uplands, including natural wetlands and restored prior converted wetlands, to be accepted under CP23 when they surround a newly restored, cropped wetland.

However, substitutions of upland habitat for wetland habitat may not be acceptable to the Corps or EPA unless a thorough functional analysis (e.g., HGM) documents the upland's value.

The above ratios for scrub-shrub and forested wetlands are more stringent than those for emergent habitat because it takes many years for planted saplings to duplicate the functions and values of the mature vegetation that existed previously. Also, forested and scrub-shrub compensatory mitigation sites generally have lower success rates than emergent wetland systems. The ratios for enhancement account for the fact that the habitat already exists and is functioning. Therefore, significant additions to existing functions will be required to offset the net loss of productive wetland acreage. Further discussion of ratios is included in Appendix D.

V. COMPENSATORY MITIGATION TOOLS

A. Individual Mitigation Projects--Individual mitigation projects are those projects which will compensate for impacts resulting from an individual or standard Corps permit as defined in the "1990 MOA between the EPA and the Department of the Army Concerning Mitigation under the Clean Water Act Section 404(b)(1) Guidelines." These projects have value and should be given full consideration when selecting compensatory mitigation. However, be cognizant of the fact that individual "band aid" mitigation projects, especially when small, are difficult to monitor; and, as demonstrated via followup evaluations, they often fall short of success. Thus, mitigation banking or other options may be preferred.

B. Mitigation Banking--Mitigation banking refers to the restoration, creation, and/or enhancement of wetlands expressly for the purpose of providing compensation in advance of or concurrent with proposed or future wetland impacts. It requires the interagency approval of a mitigation banking instrument. As such, this section of the Regional guidance does not apply to mitigation measures established by Congress as part of the authorization for a federally constructed water project.

Region 6 strongly encourages use of a team approach to planning banks, establishing procedures for debiting and crediting, and monitoring success. The ratios on the previous page also are applicable to banking situations.

After an extensive effort, the interagency "Federal Guidance for the Establishment, Use and Operation of Mitigation Banks" was approved on November 20, 1995. It should be used as a general guide for all banking projects.

One aspect of the guidance that remains of concern to Region 6 is that it allows advance credits to be withdrawn from a bank if certain criteria are met. Such advance crediting may be necessary to enable desirable banks to be established. However, it is recommended that such actions be closely scrutinized, especially if creation is involved. Generally, Region 6 prefers that all construction on the bank site be completed, the needed hydrology be established, and habitat development at least begin to demonstrate success before any credits are given.

At a minimum, advance crediting should be commensurate with the level of habitat development in the bank as determined by the Mitigation Bank Review Team. For example, if the hydrology has been successfully established, you may provide some percent of credit (e.g., 15 percent) for that progress. Advance crediting also may be appropriate where restoration will be used and past experience indicates a high likelihood of success in that ecoregion and habitat type.

Most compensatory mitigation banks require replacement ratios between 1:1 and 2:1 (Environmental Law Institute 1994). According to the Environmental Law Institute (1994), there are five reasons why compensatory mitigation ratios are used:

1. To compare values of dissimilar wetlands.

2. To encourage restoration over enhancement or creation.

3. To compensate for the uncertainty that created or restored wetlands will duplicate the functions of natural wetlands.

4. In case the fully functioning created or restored wetlands will not function as well as the natural wetlands that are impacted.

5. As an incentive to delay the use of mitigation bank credits until full functional success has been attained at the bank site.

Mitigation banking can have some relevant advantages, particularly if (a) benefits are provided up front and (b) larger, better funded, and better managed wetland projects can be implemented. It is particularly useful for linear projects (e.g., highways and pipelines) that have many small fills that are difficult to mitigate but which can be cumulatively significant biologically. Depending on the terrain, it can be very difficult for such projects to avoid all wetland impacts. Therefore, sound mitigation banking projects should be encouraged, but they must be carefully planned and monitored. Also, responsible owners must be in charge of such banks, and necessary operating and maintenance funding must be legally ensured (e.g., via performance bonds).

Banks on public lands, other than National Wildlife Refuges, may be appropriate for projects that impact public lands, that are surrounded by public lands, or that benefit the public (e.g., highway projects), or where it is demonstrated to be a significantly ecologically preferable alternative. However, Region 6 will not recommend, support, or approve development of mitigation banks on National Wildlife Refuge System lands, including Waterfowl Production Areas. This position is consistent with current draft national policy.

There are several reasons for this position, including the following:

1. Those lands were set aside for wildlife conservation and rehabilitation using public funds or revenues from Duck Stamps or the Land and Water Conservation Fund. Except when specifically authorized by Congress as mitigation for major Federal water development projects, such lands were not set aside for mitigation purposes.

2. National Wildlife Refuges may not allow any use that is not compatible with the purposes for which they were established. Thus, use of such public lands for banking could represent a violation of the Service's Public Trust responsibilities.

3. These lands are already protected and being managed for fish and wildlife purposes. Use of such lands for mitigation in effect subsidizes mitigation banking, which in turn lessens the cost of mitigation to developers and may facilitate additional habitat losses.

4. A potential conflict with the management objectives for the refuge could arise because the Refuge Manager would have to manage lands in a manner dictated in the banking instrument or by the Mitigation Banking Review Team.

5. There may be legal problems related to unauthorized augmentation of Federal budgets when private parties pay for management projects on some types of public land established to provide wildlife habitat, such as NWR's and Waterfowl Production Areas (Fish and Wildlife Service 1988).

6. Mitigation on NWR lands may not replace the functions that were impacted onsite, and the mitigation may be out-of-basin. As a result, habitat on the refuge may benefit from the mitigation bank, but habitat functions at the project impact location may be lost forever. Spatial distribution of wetlands is important for several important functions including wildlife habitat, open space, and water quality.

7. Use of public lands for mitigation banks may lead to conflict of interest charges or the appearance that permits are being "sold" (Fish and Wildlife Service 1988).

8. If the bank sponsor files bankruptcy or just walks away from the mitigation bank, Refuges' budget may have to try to pick up the tab for completion of development and long-term operation and maintenance costs. Such funds are already inadequate to cover management needs.

The Service may accept lands, designated as mitigation banks or mitigation projects, into the NWRS under the following conditions:

1. The mitigation bank or project is compatible with the authorized purpose and the comprehensive management plan(s) of the Refuge and consistent with the mitigation banking instrument;

2. The project sponsor fully funds the transfer, management, and protection of the mitigation bank or project as outlined in the Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks (Department of the Army et al. 1995); and

3. If a mitigation bank is being acquired, the bank must be an established, functioning wetland, and all success criteria have been met in accordance with the approved mitigation plan.

All mitigation banking credits should be withdrawn prior to acquisition by the Service. However, if the Service elects to acquire the lands or the responsibility for managing the lands before

all credits are withdrawn, the project sponsor must remain responsible for meeting the criteria in the mitigation banking agreement.

Transfers of mitigation bank and mitigation project lands to the Service must be approved in advance by the Ecological Services and Refuges Programs in the Regional Office. Proposed transfers must undergo the same planning and environmental compliance process as lands purchased by the Service. For example, any proposed use of refuge lands must first meet the compatibility rules established by the NWRS and be compatible with the management objectives for the applicable refuge. Furthermore, in order for the Service to accept land as part of the NWRS, the Service must complete required public involvement and NEPA processes; and the Regional Director must certify compliance with various laws and Executive Orders. They also must meet the acquisition criteria in Appendix E.

C. Mitigation Funds--Mitigation funds or in-lieu fee programs wherein contributions from several mitigators are pooled to be used for one large future mitigation project are not mitigation banking per se but may in certain cases be an acceptable form of compensatory mitigation. It is mentioned as a type of mitigation to be considered along with mitigation banking in the Corps' latest notice on Nationwide Permits, published in the Federal Register on December 13, 1996 (Vol. 61, No. 241) (see page 65922). However, Region 6 States have not had enough experience with this approach to give it much support or guidance at this time. As the Service gains more experience, the information will be shared with Region 6 field offices.

According to staff from Region 4 of the Service, establishment of a fund may be effective in mitigating small wetland impacts for which the Corps routinely does not require compensatory mitigation, or where applicants are unlikely to develop adequate compensatory mitigation projects on their own. This type of mitigation has advantages similar to mitigation banks in that several mitigators can combine efforts to create a more substantial and effective mitigation project. However, there are inherent risks associated with its use. For example, pooled contributions are often used for after-the-fact mitigation.

The agencies involved must be convinced, after considering the risks involved, that the mitigation project will be completed in accordance with a written proposal and in a timely manner. The mitigation project must be identified and clearly defined. A habitat assessment should be performed up front to determine mitigation project benefits and the amount of contribution required from the applicants/mitigators.

An account must be established to hold monetary contributions until project implementation. The Fish and Wildlife Foundation has provided that function for mitigation projects on National Wildlife Refuges. Nonprofit organizations, such as the Nature Conservancy, State agencies, and county governments, also may be capable of providing that function.

Applicants must be willing to contribute money up front, so that the project will begin as soon as sufficient startup funds are collected, and mitigation near the area of impact is still preferred.

VI. ACCEPTABILITY OF OUT-OF-KIND/OUT-OF-BASIN COMPENSATION

The 1990 Army/EPA Mitigation MOA states that in-kind compensatory mitigation is preferable to out-of-kind compensatory mitigation. This MOA also requires the consideration of functions and values lost from the impacted area and their replacement through compensatory mitigation. In-kind compensation is defined in the "Mid-Atlantic Regional Guidelines on the Establishment and Operation of Wetland Mitigation Banks," dated November 1994, as the replacement of a specific wetland type, based upon the Cowardin classification system, with the same wetland type (Department of the Army 1996).

In-kind replacement refers to construction of a wetland that is hydrologically, structurally, and functionally equivalent to the impacted wetland (Eckles et al. 1994). The main goal of the replacement wetland is to perform the values and functions of the impacted wetland, thereby achieving a no-net-loss goal.

The Service promotes comparable in-kind replacement of all important wetland functions, taking into account temporal losses due to the time required for the compensated wetlands to become fully functional. For example, Eckles et al. (1994) agree that a long time is required to replace forested wetland communities. Shortly after the replacement wetland is constructed with the

planned vegetation composition, it will probably not resemble the impacted wetland in terms of age, community structure, vigor, and growth potential. Therefore, Eckles et al. (1994) consider forested wetland replacement to be out-of-kind compensatory mitigation, at least in the short term, because there are differences in wetland function and values between the constructed wetland and the impacted wetland. Out-of-kind compensatory mitigation for forested wetland impacts cannot be avoided, but it can eventually achieve in-kind replacement with careful planning, construction in compliance with the plans for the wetland, and long-term management and monitoring (Eckles et al. 1994).

The construction of ponds, with or without palustrine emergent wetlands along the fringe of the pond, is not in-kind compensatory mitigation for impacts to forested wetlands.

In-kind compensation is generally recommended because it promotes compensation for all wetland functions impacted. However, where a particular wetland type be prevalent in an ecosystem, it may be ecologically preferable to mpensate in habitat types or ecosystems that are more endangered or less common. Also, when in-kind habitat replacement is impracticable or technically infeasible, out-of-kind compensatory mitigation can be used. For example, out-of-kind mitigation may be acceptable if the mitigation site will result in significantly higher habitat value than the wetland impact site, or if the mitigation site is of equal habitat value, yet is more important to the overall ecosystem or priority species.

Normally, mitigation should take place in the same basin where the impacts occur to help ensure mitigation of affected functions. However, out-of-basin compensatory mitigation may be acceptable if it is beneficial to the impacted species, supportable ecologically, and compatible with Service mitigation objectives for the affected geographic areas.

VII. ACCEPTABILITY OF CONCURRENT COMPENSATORY MITIGATION ON PUBLIC LANDS (National Wildlife Refuges, National Parks, Bureau of Land Management lands, Forest Service lands, lands surrounding Federal water projects, State Wildlife Management Areas, etc.)

National Park Service usually prohibits use of park lands for mitigating impacts occurring outside their boundaries. The NPS also may be reluctant to create wetlands on their property to replace lost wetland values caused by their own projects; their reasoning being that they are not supposed to

convert habitat types. Thus, the only option remaining may be to search for degraded wetlands on their lands to restore.

Theoretically, public agencies like the Bureau of Land Management and the Forest Service should be actively managing important habitats like wetlands. Therefore, wetland restoration and enhancement opportunities would be limited. However, that is often not the case because of limited resource management budgets. Furthermore, the Service's Mitigation Policy encourages evaluating possible opportunities on public lands (e.g., fencing of riparian areas). Accordingly, FS and BLM lands should not be excluded from consideration. This alternative can be especially useful at high elevations where mitigation opportunities may be limited and in instances when the project is surrounded by public lands for several miles.

Based upon experience in Region 6, which has millions of acres of public lands, mitigating on public lands can have the following benefits: (a) It can promote partnerships between the participating agencies; (b) Mitigation may be more successful than on private land; and (c) Long-term maintenance and management are more likely to occur. Such benefits can be valuable because compliance reviews are rarely conducted on permitted projects. If inspections are conducted, they usually focus on projects permitted within the past year. The Corps and other regulatory agencies have little or no funding or incentive to evaluate older projects and to seek corrective actions if the mitigation site is not functioning as intended.

However, Region 6 does not recommend looking first to mitigate on public lands if the impacts occur on private lands. The reason is the general preference for in-kind and onsite mitigation that was discussed previously in Section VI of this document. Furthermore, Region 6 is concerned that public lands not become repositories for mitigation projects, especially when those public lands are a minor portion of the surrounding landscape.

Thus, before considering use of public lands to mitigate for concurrent impacts that have occurred elsewhere, each of the following criteria should be fully evaluated:

A. First, proposed wetland mitigation on public land should be projected to provide better habitat quality over the long run than would be provided by other alternatives.

B. The mitigation must be consistent and compatible with approved wildlife management objectives for the public land and be approved by the local lands managers as well as their supervisors.

C. If it is likely that the proposed habitat work would be implemented using public funds in the foreseeable future, the mitigation funds should be spent elsewhere to maximize overall habitat benefits and to further contribute to the no-net-loss goal.

D. Mitigation in the form of land acquisition should result in significant preservation value. The project proponent should be responsible for initial development, if needed. Furthermore, there should be negotiations on establishing an interest bearing account through the National Fish and Wildlife Foundation or an equivalent mechanism to defray any anticipated extraordinary operation and maintenance costs.

E. The mitigation should take place in the same ecosystem or watershed where the impacts occurred, benefit the impacted species of concern, and entail relatively small acreage unless acquisition is involved.

F. The project proponent and Service biologist should evaluate and investigate opportunities to improve habitat values for Trust Resources (e.g., migratory birds and threatened and endangered species). However, mitigation on Federal lands affecting threatened and endangered species (positively or negatively) will require consultation under section 7 of the Endangered Species Act.

G. Because the public's land is being used for a mitigation site, the project being mitigated should be government sponsored and benefit the overall public (e.g., public transportation). Exceptions may be considered if the net benefits for wildlife will be significant.

H. The project should be consistent with the Service's Mitigation Policy, and it must meet the requirements of the Clean Water Act Section 404(b)1) Guidelines and national policy on mitigation sequencing.

The Service may allow NWRS lands to be used as mitigation sites for development activities that occur on an NWR. Under these circumstances, mitigation activities should occur on the NWR being directly affected. Every effort must be made to avoid and minimize the effects before compensatory

mitigation is applied (Service's Mitigation Policy). Furthermore, mitigation activities must be compatible with the authorized use of the Refuge, should occur on Refuge lands under the terms of a Special Use Permit issued by the Refuge Manager, and must be concurred in by the appropriate Ecological Services Field Supervisor.

However, the Service normally opposes the use of NWRS lands for mitigating impacts occurring off of those lands. The current draft national policy states that compensatory mitigation for habitat losses that occur through the Section 404/10 program will not be implemented on lands and waters within the NWRS except under limited and exceptional circumstances.

Therefore, in addition to meeting the above criteria for mitigating on public lands, proposals for implementing concurrent compensatory mitigation on NWRS lands shall meet the following criteria:

1. The Service does not oppose issuance of the permit for which compensatory mitigation is required;

2. The proposed mitigation is compatible with the purposes for which the Refuge was established and is consistent with an approved Comprehensive Management Plan for the Refuge;

3. The mitigation would result in significantly increased resource benefits when compared to other appropriate, offsite mitigation options;

4. The mitigation agreement is written to ensure the Service is under no obligation to provide compensatory mitigation on any NWRS lands in the future; and

5. The mitigation plan is approved first by applicable Refuge Manager and the Ecological Services Field Supervisor, and then by the Director.

   In its comments on the draft national policy regarding mitigation on NWRS lands, Region 6 will request the requirement for the Director's approval be deleted. We are hopeful our position will be adopted. Regardless, when the national policy becomes final, the Regional Office will inform users of this Regional policy about any amendments necessary to ensure consistency with the national policy.

VIII. ENDANGERED SPECIES ISSUES IN THE CONTEXT OF MITIGATION

To ensure that mitigation sites will not adversely affect listed or candidate species and/or their critical habitat, the following must be considered:

A. Evaluate effects to threatened and endangered species when considering compensatory mitigation proposals that result in habitat changes (i.e., enhancement and creation of wetlands).

B. Address all indirect, secondary, and cumulative effects of mitigation proposals; keeping in mind a goal of beneficial, insignificant, discountable, or no adverse effects on protected species.

C. When species may be affected, coordinate closely with field office endangered species biologists regarding potential impacts and section 7 consultation responsibilities.

D. Look for opportunities to benefit candidate as well as listed species, to help preclude the need for eventual listing or to speed recovery.

IX. IMPROVING CREATION AND RESTORATION SUCCESS

Kusler and Kentula (1990) summarize factors affecting the success of wetland creation and restoration:

A. Restoration or creation of a wetland cannot completely duplicate a natural wetland, but some wetland systems can be approximated. Individual wetland functions can be restored or created.

B. Partial failures are common. Some of the reasons include:

1. Lack of basic scientific knowledge.

2. Lack of expertise in design.

3. Lack of supervision during implementation.

4. Improper site conditions, such as water depth, hydroperiod, substrate, nutrients, and grades.

5. Exotic species colonizing the site.

6. Herbivory by geese, muskrats, and deer.

7. Destruction of vegetation or soil by catastrophic events.

8. Lack of adherence to project plans.

9. Failure to protect sites from human impacts such as sediments, toxics, vehicles, and water pumping.

10. Failure to maintain planned wetland hydrology.

C. Success varies with wetland type and goals for wetland functions and target species.

D. Not all wetland functions can be created or restored to the same degree.

E. Short-term success may differ from long-term success because the constructed or restored wetland may not continue to function over time.

F. The ability to assess, recreate, and manipulate hydrology is important for long-term success.

G. Successful creation or restoration of wetlands depends upon the ability to manage, protect, and manipulate the projects and surrounding land over long periods of time.

H. Careful supervision and project design by knowledgeable personnel is necessary for successful wetland creation and restoration.

I. Site-specific analysis of factors is needed for improving the chances of success for each wetland creation or restoration project. There is no "cook book" for creation or restoring wetlands.

Kusler and Kentula (1990) make several recommendations to improve the success of wetland creation and restoration:

A. A wetland restoration and creation proposal must be reviewed with great care because there are many factors affecting the potential success of the project.

B. Multidisciplinary expertise and careful supervision are required for project planning, implementation, and monitoring, with any necessary corrective measures.

C. Well-defined, site-specific goals should be defined to determine proposed wetland characteristics and functions.

D. Detailed plans of the project should be prepared in advance so that they can be reviewed by the permitting agencies to evaluate the site-specific goals and probability of success.

E. Assessment of the functions and values of the impacted wetland should be done to help define the goals of the wetland creation or restoration project and evaluate its success.

F. Wetland hydrology (e.g., water depths, hydroperiod, and nutrient concentrations) must be carefully considered in the project design.

G. Created or restored wetlands should be designed to be self-sustaining for long-term existence.

H. The design of the wetland should be considered in relation to other wetlands and communities in the watershed.

I. Buffers, barriers, and other mechanisms should be considered to protect the project site.

J. Wetland restoration should be preferred to creation because restoration has a greater chance of success.

K. Monitoring and corrective measures, which are usually required for success, should be incorporated into the project.

L. Long-term management may be required to ensure continuous functioning of the project.

M. Compensation ratios greater than 1:1 should be used to account for the risks and uncertainties inherent in wetland creation and restoration. Standards for corrective measures also should be incorporated in the project plans and designs.

X. STANDARD PERMIT REQUIREMENTS REGARDING COMPENSATORY MITIGATION

A. Success Criteria and Monitoring Requirements--Field offices should encourage Corps Districts to develop standard monitoring requirements and success criteria, when applicable. For example, a permit condition could include the standard that an 80 percent revegetation success rate of target species at target size (e.g., specified dbh) will be achieved by the end of the second growing season. Furthermore, it could require provision of photographic documentation after planting at 3- and 5-year intervals. Some field offices and Corps Districts have already developed standard guidelines for mitigation projects which can be used as examples (see San Francisco District's Guidelines in Appendix F).

B. Performance Bonds--Performance bonding is typically used in mitigation banking to ensure project success. However, performance bonds also can be used to help ensure implementation of an individual mitigation project in those situations where factors such as the following are involved: (a) the need for expeditious permit issuance, (b) large projects, (c) very complex mitigation, or (d) a developer with uncertain fiscal capability. Some Service offices (e.g., Boqueron, Puerto Rico, and Vero Beach, Florida, Field Offices) have successfully used performance bonds to ensure compliance with individual mitigation project implementation, and they can be contacted for suggestions. Because bonding companies are not obligated to fulfill mitigative requirements in foreclosure situations, it is preferable to have the bond held by the regulatory agency or some other State or Federal agency.

XI. MITIGATION FOLLOWUP

Followup evaluation of permitted compensatory mitigation is strongly recommended in order to improve the effectiveness of Service recommendations. It also will be an inducement for developers to meet their requirements and will provide useful information for enforcement efforts. The Service's Sacramento, California, Field Office has developed standard followup procedures that can be used as an example (see Appendix G). The following guidance can be used to assist in followup evaluations:

A. Randomly select previously permitted sites to review, and schedule time at the beginning of the fiscal year to ensure these inspections will be completed. During the year, also select ongoing, potentially problematic permit and project actions that should be monitored. Time intervals for monitoring are at the staff biologist's or field supervisor's discretion.

B. The results of followup and monitoring can be used to improve mitigation success and recommendations made by the Service. Therefore, you may wish to focus on important projects, complex mitigation, certain contractors, and where experimental techniques and construction designs will be employed, especially for creation and enhancement. Report the results to the Corps and EPA for followup actions or remedial measures as needed. The Corps is supposed to take action if a permittee is not in compliance with mitigation requirements of the section 404 permit, in accordance with 33 CFR 326.

C. When available, use Corps data bases (e.g., RAMS and LANS Systems) to help track issued permits and to identify the type and timing of mitigation required in the permit conditions.

D. When possible, conduct followup and monitoring studies with interagency teams. Such an approach likely will result in more successful identification of problems and initiation of corrective actions. Independent review by the Service may be perceived as fault finding exercises that just result in finger pointing. Furthermore, the Corps may assert that, despite the intentions of 33 CFR 326, compliance and enforcement on their part are discretionary.

XII. CONCLUSION

Although the above guidance sets some parameters on the do's and don'ts of compensatory mitigation in order to obtain Region-wide consistency, it is not intended to constrain or stifle your creativity in developing new techniques and approaches for compensatory mitigation. Be imaginative, for "a mind once stretched by a new idea, never regains it's original dimensions." Please share all new approaches and insights with the Regional Office and other Ecological Services offices so that this guidance document can evolve with your successes.

REFERENCES

Department of the Army, Environmental Protection Agency, Department of Agriculture, Department of the Interior, and Department of Commerce. 1995. Federal guidance for the establishment, use and operation of mitigation banks. Federal Register, Vol. 60, No. 228, page 58605. November 20, 1995.

Department of the Army. 1996. Memorandum for Division Engineer (Attn: CENAD-ET-O) from John P. O'Hagan, Chief, Operations Division, Subject: Proposed revision to Chapter 105 of Pennsylvania safety and waterway management rules and regulations. 20 pp.

Eckles, S.D., T. Barnard, F. Dawson, T. Goodger, K. Kimidy, A. Lynn, J. Perry, K. Reisinger, C. Rhodes, R. Zepp, and the Chesapeake Bay Wetlands Workgroup. 1994. Mitigation technical guidance for Chesapeake Bay Wetlands. U.S. Environmental Protection Agency. 64 pp.

Environmental Law Institute. 1994. National wetland mitigation banking study: wetland mitigation banking. Institute for Water Resources Report 94-WMB-6. 178 pp.

Fish and Wildlife Service. 1988. Mitigation Banking. Biological Report 88(41). July 1988. 103 pp.

Fish and Wildlife Service. 1993. Interagency activities - general mitigation policy. Service Manual Part 501 FW 2. Release Number 069. February 24, 1993.

Fish and Wildlife Service. 1994. Memorandum from Deputy Director Richard Smith, Subject: Relationship of Federal Restoration Programs to Mitigation Recommendations for Federal Permits. 2 pp.

Fish and Wildlife Service. 1996. Habitat assessment - habitat evaluation procedures. Service Manual Part 870 FW 1. Release Number 241. March 20, 1996.

King, D.M., and K.J. Adler. 1991. Scientifically defensible compensation ratios for wetland mitigation. 20 pp.

King, D.M., and C. Bohlen. 1994. Estimating the cost of restoration: National Wetlands Newsletter. Environmental Law Institute, Vol. 16, No. 3. May/June 1994.

King, D.M., C.C. Bohlen, and K.J. Adler. 1993. Watershed management and wetland mitigation: A framework for determining compensation ratios. University of Maryland System Draft Report UMCEES-CBL-93-098. 17 pp.

Kruczynski, W.L. 1990a. Mitigation and the Section 404 program: A perspective. Pages 549-554 in J.A. Kusler and M.E. Kentula, eds. Wetland creation and restoration: the status of the science. Island Press, Washington, D.C.

Kruczynski, W.L. 1990b. Options to be considered in preparation and evaluation of mitigation plans. Pages 555-570 in J.A. Kusler and M.E. Kentula, eds. Wetland creation and restoration: the status of the science. Island Press, Washington, D.C.

Kusler, J.A., and M.E. Kentula. 1990. Executive summary. Pages xvii-xxv in J.A. Kusler and M.E. Kentula, eds. Wetland creation and restoration: the status of the science. Island Press, Washington, D.C.

Scodari, P., and L. Shabman. 1995. National wetland mitigation banking study. Commercial wetland mitigation credit markets: theory and practice. Institute for Water Resources Report 96-WMB-7, USACE, Alexandria, Virginia. November 1995.

Smith, R.D., A. Ammann, C. Bartoldus, and M.M. Brinson. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Wetlands Research Program Technical Report WRP-DE-9.

Solomon, R.C., and N.R. Sexton. 1993. A comparison of methods for evaluating wetland functions and values. U.S. Department of the Interior/Fish and Wildlife Service, Office of Information Transfer, Ft. Collins, CO. 2 pp.