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AQUATIC RESOURCES NEWS

A REGULATORY NEWSLETTER

Headquarters, U.S. Army Corps of Engineers, Regulatory Branch

A Note from Headquarters

This issue of the newsletter concentrates on mitigation and various procedures for evaluating whether compensatory mitigation plans replace lost aquatic resource functions as outlined in Regulatory Guidance Letter 02-2**.** The next issue will include several articles on the different Geographic Information Systems (GIS) currently in use by Corps districts. As you know, once the new data tracking system (ORM) is in place, a standardized GIS system will be used by all Corps districts.

I would personally like to thank Mike Rabbe, on a six-month development assignment from the Omaha district, for all of his hard work. Mike not only organized the first Corps/EPA joint conference, but worked very hard on the Mitigation Action Plan. He represented Corps HQ at the monthly meetings and the stakeholders forum and took the lead on drafting and commenting on action items. Mike's dedication and hard work not only reflected well on his district, but on HQ and our agency as a whole. Mike has written an article for this issue talking about his experiences here at HQ.

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Regulatory Developments: A Note from the Editor

This issue of the *Aquatic Resources News* addresses wetland impact and compensatory mitigation assessment procedures. We present two district approaches and continue examination of the functional assessment method known as the Hydrogeomorphic (HGM) Approach.

The first article presents a rapid and descriptive assessment method used by the New England District—the Highway Methodology Workbook Supplement. The method focuses on wetland suitability for various functions and values and then determining whether they are principal wetland functions and values. The method can be used to describe the wetlands at a proposed project site, compare project alternatives and develop goals for wetland compensation plans. The second article presents the Charleston District's Standard Operating Procedure for Wetland and Stream Mitigation, which includes a detailed method for calculating compensatory mitigation credits. The wetland mitigation credit example presented includes preservation, enhancement and a buffer in addition to restoration. The final example of a wetland impact and mitigation assessment approach is from the Corps Engineer Research and Develop Center. This article

Distribution of Aquatic Resources News

The *Aquatic Resources News* will be distributed to field staff by email. The Newsletter will also be available on the IWR website within the month at:
http://www.iwr.usace.army.mil/iwr/regulatory/regulintro.htm
Or you may contact the Editor, Bob Brumbaugh, CEIWR-PD (703) 428-7069 Robert.w.brumbaugh@usace.army.mil. HQ point-of-contact for the newsletter is Katherine Trott, CECW-OR (202) 761-4617 Katherine.l.trott@usace.army.mil

presents an overview of the HGM Approach including an example impact and mitigation assessment calculation based on wetland functions. The writer also discusses use of the Approach to monitor mitigation site trends towards success and points out that the HGM Approach is not overly time consuming given some training and, of course, existence of a regional HGM guidebook.

This issue also provides a brief description of the OMBIL Regulatory Module and an update on the Regionalization of the Wetland Delineation Manual. You are encouraged to suggest topics or submit articles for future newsletters.

Summary of "The Highway Methodology Workbook Supplement: Wetland Functions and Values, a Descriptive Approach" Used in New England States

Ruth M. Ladd

In the early 1990s, the New England District noted numerous problems with the numerical and ranked approaches in use at the time and responded by the development of the "descriptive approach." The approach provides a format for collecting and displaying descriptive data on wetlands. In addition, the document provides ways to represent the functions and values graphically so reviewers can visually compare wetland systems, which might be impacted by a project.

The methodology can be used for a variety of purposes:

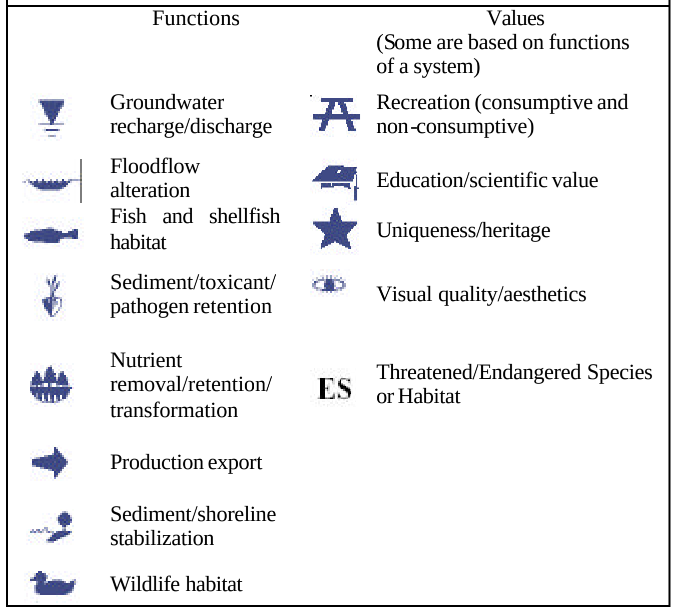
- describe project site;
- compare project alternatives;
- assist in avoidance and minimization of project impacts;
- determine significance of impacts;
- analyze environmental costs vs. project benefits; and/or
- develop goals for wetland compensation plans.

For the purposes of the document, functions are defined as the physical, chemical, or biological properties of a wetland ecosystem and values are human-perceived benefits derived from functions or other characteristics of wetland ecosystem. Needless to say, the functions all have value to society as well. Therefore, this approach includes both science and human value judgments.

There are two steps to the process. First, the evaluator determines if the wetland is <u>suitable</u> for (as opposed to necessarily performing) each of several functions and values. Evaluation of each function and value is done using a numbered list of "considerations" which can be expanded as appropriate, so long as the changes are explained. If the workbook listing of considerations is used, the appropriate numbers can be listed but some explanatory text aids the reviewer.

There are eight functions and five values included in the workbook (figure 1). They can be modified as appropriate.

Figure 1. Graphical Representation of Wetland Functions and Values



The second step is to determine, based upon professional judgment, which are the principal functions and values. The concept is to evaluate each wetland potentially impacted by a project alternative, as described above, and record the information on a data form (see figure 2).

In addition to the functions and values information, the following is included to assist the reviewer in understanding the context:

- General project/system information
- Position in the landscape and in relation to existing development
- Attachments of plant lists, wildlife species, a sketch of the wetland in its context, and a photo are recommended.

A weakness we have noted in this approach is that it does not require specifics of fish and/or wildlife habitat (types of species; usage) so some evaluators will simply indicate that a wetland functions as wildlife (or fish) habitat but not HOW it functions which is important in making an evaluation of project impacts and in formulating a mitigation plan. This assessment methodology is used throughout New England and beyond and has proven to be a tool, which through the use of function-specific icons provides information in a concise form suitable for a variety of purposes. The workbook supplement is available at <u>http://www.nae.usace.army.mil/reg/hwsplmnt.pdf</u>

(Editor's note: Ruth Ladd is a senior wetland scientist in the New England District Regulation Branch)

Figure 2: Example Wetland Function-Value Evaluation Form

Wetland Function-Value Evaluation Form

Total area of wetland 0.24 ac Human made? yes Is wetland part of a wildlife corridor? no or a "habitat island"? no

Adjacent land use parking lot, residential, wetland Distance to nearest roadway or other development 5 feet

Dominant wetland systems present PEM Contiguous undevelloped buffer zone present 20%

Is the wetland a separate hydraulic system? no If not, where does the wetland lie in the drainage basin? low

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Pizza Restaurant 198300449
Latitude N42.54156 Longitude W71.15802
Prepared by: Minkin Date 6/5/02
Wetland Impact: Type____ Area____
Evaluation based on: Office____ Field X
Corps manual wetland delineation completed? Y____ N X

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		X			
Floodflow Alteration	X		4,6,7,8,9,10,13	X	site was designed for flood storage
Fish and Shellfish Habitat		X			
Sediment/Toxicant Retention	X		1,2,10,12,16		site in urban area adjacent to natural wetlands
Nutrient Removal	X		3,4,8,9,12,13,14		sense cover of *Phragmites*
Production Export	X		2,7		probably some plant fragments
Sediment/Shoreline Stabilization		X			
Wildlife Habitat	X		6,11,13		probably minimal; red-winged blackbirds
Recreation		X			
Educational/Scientific Value		X			
Uniqueness/Heritage		X			
Visual Quality/Aesthetics		X			
ES Endangered Species Habitat		X			
Other					

Notes:

* Refer to backup list of numbered considerations.

Note that the form lists numbers under "Rationale." These numbers refer to lists of "Considerations" in the Workbook. For example, the wetland is suitable for wildlife habitat. The rationale provided is that the wetland is contiguous with other wetland systems connected by a watercourse or lake; dominant wetland class includes deep or shallow marsh or wooded swamp; and density of the wetland vegetation is high.

Charleston District Mitigation SOP for Wetland and Stream Mitigation

Mary Hope Glenn

In 1996, the Charleston District Regulatory Branch first implemented a Standard Operating Procedure (SOP) for compensatory mitigation, which provided a framework for evaluating not only impacts to wetlands and waters of the U. S., but also compensatory mitigation proposals for those impacts. The mitigation SOP has periodically been updated since 1996, first in 2000, then in 2002, to keep up with changes in mitigation policy, guidance and knowledge. The District has worked closely with the South Carolina Department of Health and Environmental Control, the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and the South Carolina Department of Natural Resources in the development of these documents to enhance its effectiveness and acceptability. The Charleston District mitigation SOP is applicable to regulatory actions requiring compensatory mitigation for adverse ecological effects where more rigorous, detailed studies (e.g. HGM, WET, HEP) are not considered practical or necessary. The intent of the SOP is to provide a basic written framework, which will provide predictability and consistency for the development, review, and approval of compensatory mitigation plans.

Charleston District's SOP may be used as a guide in determining compensatory mitigation required for project or for enforcement actions. The current SOP is divided into specific sections for evaluating wetlands (acreage basis) and streams (linear footage basis). Similar, but different worksheets were developed as appropriate for each section. Some projects require the use of both portions of the SOP to determine the appropriate level and type of compensatory mitigation. However, due to the topography of South Carolina, the wetland section of the SOP is typically used to evaluate wetland systems in the coastal plain and the linear section is typically used in the piedmont region of our State. The SOP does not address mitigation for categories of effects other than ecological (e.g., historic, cultural, aesthetic). Types of mitigation other than compensation (e.g., avoidance, minimization, reduction) are not addressed by the SOP and the SOP does not obviate or modify any requirements given in the 404(b)(1) Guidelines or other applicable documents regarding avoidance, sequencing, minimization, etc. Such requirements are evaluated during consideration of permit applications.

As with other Corps districts, the Charleston District requires that permit applicants/consultants submit written mitigation proposals that include specific information. In addition to the information typically required for mitigation proposals, the applicant/consultant should submit the mitigation worksheets from the SOP. Proposals are reviewed and the applicant/consultant is advised as to what additional information is required to make the proposal adequate for consideration.

A key element of the SOP is the establishment of a method for calculating mitigation credits. In the Charleston method, this is accomplished by the use of specific tables and worksheets to calculate mitigation debits and credits. Each table and worksheet is a matrix of various factors that indicate a measure of wetland function. The factors are defined in the SOP. They are assigned a numerical value on the worksheet by the applicant/consultant based on wetland functions and conditions at the site, the definitions of the factors, and the options given in the SOP tables. This method takes into account not only mitigation ratios, but several factors that the Charleston District and resource agencies determined could indicate a measure of wetland/stream function. The numerical values of the factors are then summed and multiplied by the acreage/linear footage of the impacted site to determine a number of credits.

One specific table and worksheet, for adverse impacts, is used to evaluate the impact site. Some of the factors used are Lost Type (Type A means tidal vegetated systems, bottomland hardwoods, etc.; Type B means seeps and bogs, savannahs and flatwoods, etc.); Dominant Impact (Fill, Impound, etc.); Duration, and so on. These factors are defined in the SOP. The Adverse Impact Table for Wetlands is provided in Table 1. The end result of the completed table is the number of required mitigation credits for the proposed impacts (see example, Table 2).

Several other worksheets are used to evaluate the mitigation site, based on the mitigation proposed (restoration or enhancement, preservation, or creation). The end result of these worksheets are the number of proposed mitigation credits (see example Tables 3 and 4). Finally, all of the credits are entered into a summary worksheet to ensure and demonstrate that the appropriate number and types of credits and thus appropriate mitigation are met by the proposal (see example Table 5). The following is a sample case for wetlands.

Example Case for Wetlands

Assume that the impacts take place in the coastal plain and involve permanent fill of 1 acre of Type A, slightly impaired waters for construction of a dike impounding 5 acres of Type A, slightly impaired bottomland hardwood wetlands, and permanent access roads over 0.4 acres of Type C, fully functional waters for a single-family residential development. The priority category ranking for all areas is tertiary.

The mitigation consists of restoring 8 acres of prior converted agricultural land to a natural forested wetlands and preservation of 22-acre of an on-site, pristine Carolina bay by transfer in fee title to a conservancy (Tables 3 and 4). A 25-ft wide upland buffer consisting of 1.9 acres surrounding the entire perimeter of the bay will also be transferred in fee title to the conservancy. The plan includes a 3-year monitoring plan, restoration of the natural hydrology by filling drainage ditches, and suitable planting of vegetation in the restoration area. No perpetual maintenance will be required. The restoration and preservation sites are adjacent to the proposed inundated area and the mitigation will be done concurrently with the proposed activity.

TABLE 1: ADVERSE IMPACT FACTORS FOR WETLANDS AND OTHER WATERS OF THE U.S. EXCLUDING STREAMS

FACTORS	OPTIONS					
Lost Type	Type C 0.2		Type B 2.0		Type A 3.0	
Priority Category	Tertiary 0.5		Secondary 1.5		Primary 2.0	
Existing Condition	Very Impaired 0.1	Impaired 1.0		Slightly Impaired 2.0		Fully Functional 2.5
Duration	Seasonal 0.1	0 to 1 0.2	1 to 3 0.5	3 to 5 1.0	5 to 10 1.5	Over 10 2.0
Dominant Impact	Shade 0.2	Clear 1.0	Dredge 1.5	Drain 2.0	Impound 2.5	Fill 3.0
Cumulative Impact	$0.05 \times \sum AA_i$					

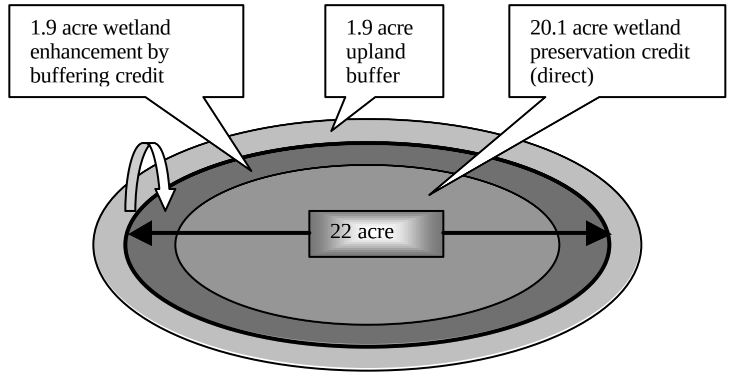
<u>Note</u>: For the Cumulative Impact factor, å?AA_i stands for the sum of the acres of adverse impacts to aquatic areas for the overall project. When computing this factor, round to the nearest tenth decimal place using even number rounding. Thus 0.01 and 0.050 are rounded down to give a value of zero while 0.051 and 0.09 are rounded up to give 0.1 as the value for the cumulative impact factor. The cumulative impact factor for the <u>ove rall</u> project must be used in each area column on the Required Mitigation Credits Worksheet (table 2)

TABLE 2: REQUIRED MITIGATION CREDITS WORKSHEET			
	Area 1 (Dike)	Area 2 (Impoundment)	Area 3 (Roads)
Lost Type	3.0	3.0	0.2
Priority Category	0.5	0.5	0.5
Existing Condition	2.0	2.0	2.5
Duration	2.0	2.0	2.0
Dominant Impact	3.0	2.5	3.0
Cumulative Impact	0.32	0.32	0.32
R = Sum of Factors	10.82	10.32	8.52
AA = Impact Area	1.0	5.0	0.4
Product = R x AA	10.82	51.6	3.4
Total Required Credits = å(R x AA) = 65.82			

TABLE 3: PROPOSED RESTORATION OR ENHANCEMENT MITIGATION WORKSHEET		
Factor	Area 1 (Restoration)	Area 2 (Enhancement by Buffering)*
Net Improvement	3.5	0.1**
Control	0.6	0.6
Temporal Lag	-0.3	NA
Credit Schedule	0.2	0
Kind	0.4	0
Location	0.4	0.4
M = Sum of Factors	4.8	1.1
A = Mitigation Area	8.0	1.9
Credits = M x A	38.4	2.1

*** See Diagram below**
**** Calculated using steps 1-6 (buffer width tables) in section 14.2.3 of the SOP**

TABLE 4: PROPOSED PRESERVATION MITIGATION CREDITS WORKSHEET	
Priority Category	0.2
Existing Condition	0.1
Degree of Threat	0.1
Control	0.6
Kind	0
Location	0.3
M = Sum of Factors	1.3
A = Mitigation Area (22 – 1.9 buffer)	20.1
Credits = M x A	26.13



$$PMC \geq RMC$$
$$66.6 \geq 65.82$$

$$PMC_{non\text{-}preservation} \geq \tfrac{1}{2} RMC$$
$$38.4 + 2.1 \geq \tfrac{1}{2}(65.82)$$
$$40.5 \geq 32.9$$

$$PMC_{Creation + Restoration/Enhancement\ (Non\text{-}Buffer\ Enhancement)} \geq \tfrac{1}{4} RMC$$
$$38.4 \geq 16.4$$

TABLE 5: SUMMARY OF MITIGATION CREDITS	
Category	**Credits**
Preservation	26.13
Restoration/Enhancement (Non - Buffering)	38.4
Enhancement by Buffering	2.1
Total Credits = å (M x A)	66.6

The Total Proposed Mitigation Credits (66.6) are greater than the Total Required Mitigation Credits (65.82), the credits for restoration/enhancement (non-preservation) (40.5) are greater than ½ of the required credits (32.9), and the creation plus restoration/enhancement (non-buffer enhancement) credits (38.4) are greater than ¼ of the required credits (16.4). (Refer to Tables 2, 3, 4 and 5 and the diagram above). Therefore, the quantity and mix of mitigation is acceptable. The Project Manager must also review the other aspects of the mitigation plan to assure that it is generally in compliance with the policies and guidelines for mitigation.

The definitions of factors and examples for the factors used in the tables and worksheets are found in the SOP, along with a host of supplemental information, including sample cases to show examples for use in evaluating wetlands, streams, and mitigation bank proposals.

Applicants are made aware that nothing in the SOP should be interpreted as a promise or guarantee that a project which satisfies the guidelines will be assured of approval, since the District Engineer (DE) has a responsibility to consider each project on a case-by-case basis and may determine in any specific situation that authorization should be denied, modified, suspended, or revoked. Following the guidelines does not confer any absolute guarantee of mitigation acceptability, since site specifics of a particular project may warrant alternative mitigation requirements.

The Charleston District has found that the mitigation SOP has proved to be a useful tool for performing a rapid functional assessment of project impacts and proposed mitigation. In addition, while this method is not intended for use as project design criteria, appropriate application of the method can minimize uncertainty in the development and approval of mitigation plans and allows expeditious review of applications by the Charleston District and the State and Federal resource agencies.

For additional information about the Charleston District Mitigation SOP, you may contact Mary Hope Glenn, Corps at 843-329-8044. The entire mitigation SOP may be found on the Charleston District website at http://www.sac.usace.army.mil/permits/sop02-01.pdf

(Editor's note: Mary Hope Glenn is a project manager in the Charleston District's Regulatory Branch)

The Hydrogeomorphic (HGM) Approach to Wetland Assessment: Application to Corps Regulatory Needs

Ellis J. "Buddy" Clairain, Jr.

Introduction

The HGM Approach is a procedure for measuring the capacity of a wetland to perform functions. It is designed to assess wetland ecosystems by analyzing both their structural components and the processes that link these components (Borman and Likens 1969). Structural components of the ecosystem and the surrounding landscape, such as plants, soils, hydrology, and animals interact with a variety of physical, chemical, and biological processes. Understanding the interactions of the structural components of the ecosystem with the surrounding landscape features is the basis for assessing ecosystem functions and the foundation of the HGM Approach (Smith et al. 1995).

Wetland functions are the normal or characteristic activities that take place in wetland ecosystems (Smith et al 1995). Wetlands perform a wide variety of wetland functions. However, not all wetlands perform the same functions nor do similar wetlands perform the same function to the same level of performance. The ability to perform a function is influenced by the characteristics of the wetland and the physical, chemical and biological processes within the wetland and surrounding watershed. Wetland characteristics and processes influencing one function also often influence the performance of other functions within the same wetland ecosystem.

Wetland functions represent the currency or units of the wetland ecosystem for assessment purposes but the integrity of the ecosystem is not disconnected from each function, rather it represents the collective interaction of all wetland functions. Consequently, wetland assessment using the HGM Approach requires the recognition by end users that this link between wetland functions and ecosystem integrity is critical. Understanding this relationship is particularly important when formulating plans to modify or create a wetland. One cannot develop criteria, or models, to maximize a single function without having potentially negative impacts on the overall ecological integrity and sustainability of the whole wetland ecosystem. For example, one should not attempt to create a wetland to maximize water storage capacity without the recognition that other functions, such as plant species diversity, will likely be altered from those similar wetland types with less managed conditions. This does not mean that a wetland cannot be developed to maximize a particular function but that it will typically not be a sustainable ecosystem without future human intervention.

How is the HGM Approach Different from Other Assessment Methods?

The HGM Approach is characterized and differentiated from other wetland assessment procedures in that it first classifies wetlands based on their ecological characteristics (i.e., landscape setting, water source, and hydrodynamics). Second it uses reference sites to establish the range of functioning of the wetlands and third it uses a relative index of function, calibrated to reference wetlands, to assess wetland functions.

The HGM Approach uses functional indices based on multiple criteria assessment models (Smith and Theberge 1987) to estimate the functional capacity of a wetland (Smith et al. 1995). The assessment models are simple representations of the relationship between the physical, chemical, and biological attributes of the wetland and surrounding landscape and the functional capacity of the wetland. Variables in the models are scaled to data obtained from the reference wetlands and assigned a subindex ranging from 0.0 to 1.0 with 1.0 assigned to variables with attributes similar to those measured at reference wetland standard sites. As the variable deviates from the reference standard, the subindex is reduced from 1 0. Variables are aggregated into assessment models based on the experience and expertise of model developers.

Characterization of a wetland type, its associated functional indices, and the data used to calibrate those indices are provided in regional guidebooks. Over the last few years, several regional guidebooks have been prepared, covering a wide range of wetland types (http://www.wes.army.mil/el/wetlands/hgmhp.html). Two recently published regional guidebooks are directly applicable to wetland assessment in the western United

States: one for depression wetlands (Hauer, et al. 2002a) and another for riverine wetlands (Hauer, et al. 2002b). Though developed for wetlands in the Northern Rocky Mountains, each should be applicable to other hydrogeomorphically similar wetland types but will require recalibration of the models to reflect changes in plant composition, soil types and other attributes specific to a particular region.

Objective

The objective of this article is to show how results from regional guidebooks can address many wetland assessment requirements of regulatory staff. More specifically this article provides examples where output from HGM regional guidebooks can be used to assist regulatory project managers in making decisions about a wetland's condition relative to other similar wetland types in the region, assess potential project impacts, project anticipated future wetland conditions, and compute mitigation requirements. I will use the regional guidebook for riverine wetlands in the Northern Rockies (Hauer, et al. 2002b) as an example although the application techniques can be used for any regional guidebook. This regional guidebook has been used to assess of impacts on the Yellowstone River (Hauer, et al. 2001) and the data for examples in this article were obtained from two wetland sites near Kalispell, Montana.

Potential Uses and Limitations

The HGM Approach does not replace the need for delineating a wetland boundary, preclude the sequencing process, nor supercede the Section 404 (b)(1) Guidelines analysis or public interest review. The HGM Approach is a tool that regulators can use to rapidly and accurately determine the level of environmental impacts of proposed projects, compare project alternatives, identify measures that would minimize environmental impacts, determine mitigation requirements, and establish criteria for measuring mitigation success. As such, the procedure will be helpful in providing greater certainty and reduced permit review times, thus allowing for expedited decision-making. Some examples where assessment results can be applied include the following (Smith et al. 1995).

- Assess baseline conditions
- Compare two wetlands
- Assess project impacts
- Identify ways to avoid and minimize impacts of a proposed project
- Determine after the fact project impacts
- Alternatives analysis
- Determine the least damaging alternative for a proposed project
- Determine compensatory mitigation for a proposed project
- Mitigation potential of a site (e.g., determine restoration potential of a wetland
- Develop design criteria for wetland mitigation or restoration projects
- Monitor success of compensatory mitigation efforts
- Compare wetland management alternatives or results
- Identify priorities for acquisition or set aside of wetlands

Time Required to Apply the HGM Approach

As with any wetland assessment technique, one is often concerned about the time and effort required to complete the procedure. The HGM Approach was initially developed to address regulatory needs and meet regulatory constraints. One person can generally collect the necessary data to assess a wetland and perform an analysis within half a day or less depending on the complexity and size of the site. The regional guidebook for riverine wetlands in the Northern Rockies has been used in several Regulatory V PROSPECT courses. Students at these courses were introduced to the basic concepts and terminology of the HGM Approach, instructed in the use of the regional guidebook, shown how to collect the necessary data, collected data from two sites, ran the analysis on those sites, computed project impacts, and developed a mitigation plan to offset project impacts. Working in 3-5 member teams, the students then presented a proposed mitigation plan at the end of the course. The students were from all over the country and many were unfamiliar with the plants or soils at the location of the course. Many were first-time users of the HGM Approach and yet they were able to successfully apply it after completion of this 4-½ day course. This demonstrates that application of the regional guidebooks can be achieved in a reasonable period of time. As users become more familiar with the HGM Approach and the regional guidebook within their district, their efficiency will increase dramatically. Considerable effort is also underway to develop software to expedite application of the HGM Approach.

Limitations

As important as it is to know what the HGM Approach was designed to do, it is also important to know what it is <u>not</u> intended to do. The HGM Approach does not assign a value to wetland functions. Value represents the significance of wetland functions to society or individuals, and often reflects local priorities or policy issues beyond the scope of the HGM Approach. The functional capacity indices resulting from the HGM Approach cannot be equated to the societal or economic value of that wetland function.

> ***HGM Approach Limitations***
>
> ✓ ***It does not assign value wetland function***
>
> ✓ ***It is not intended to compare different subclasses of wetlands***
>
> ✓ ***It cannot be used to assess cumulative impacts because it is limited to the ecosystem scale rather than the landscape scale***

The HGM Approach is also not intended to compare different subclasses of wetlands. Rather results should only be used to compare wetlands from similar subclasses in the same reference domain. Only by obtaining detailed quantitative data (e.g., cubic meters of water storage or grams of carbon m^{2} yr^{-1}) can a comparison of different wetlands be accomplished, but time and resources required to achieve such a comparison are beyond the scope of the public interest review process and the HGM Approach.

Results from the HGM Approach also cannot be used to assess cumulative impacts as required in the public interest review process (33 CFR 320.4 (a) (3). The HGM Approach is designed to assess wetlands at the ecosystem scale. Although this requires consideration of certain characteristics in the surrounding landscape, the assessment is restricted to the wetland ecosystem. Assessment of cumulative impacts requires consideration of the relationship of one ecosystem to another and the potential influence of one on another at a landscape scale, not solely at an ecosystem scale. Results from the HGM Approach might be used in conjunction with other procedures designed to examine impacts at a landscape scale such as those by Lee and Gosselink (1988), Leibowitz et al. (1992), and Gosselink et al. (1990).

Application of HGM Results

Application of a regional guidebook requires collection of office and field data. Each variable is then converted to a single subindex score ranging from 0.0 – 1.0 and then combined with different variables in a set of models to provide a Functional Capacity Index (FCI), also ranging from 0.0 – 1.0 for each wetland function. This index provides a relative measure of how the assessed wetland compares to least disturbed, ecologically mature similar wetlands in the region. The FCI can then be multiplied times the area of the wetland to compute Functional Capacity Units (FCU) to facilitate comparison of wetlands of different sizes. Therefore, the HGM Approach considers both the *quality* of a site using FCIs and the *quantity* (area) of the site to establish a common currency for comparison (FCUs). Chapter 5 in each regional guidebook provides detailed guidance for applying the guidebook. It includes the resources needed (topo maps, aerial photos, etc.) and protocols to follow for collecting and analyzing the data. Each regional guidebook provides an analysis of multiple wetland functions representing at least the following broad topics: hydrology, water quality, plant community, and wildlife habitat. The regional guidebook for riverine wetlands in the Northern Rockies (hereafter referred to as the riverine guidebook) provides an analyses of the following specific functions: (1) Surface-Groundwater Storage and Flow, (2) Nutrient Cycling, (3) Retention of Organic and Inorganic Particles, (4) Generation and Export of Organic Carbon, (5) Characteristic Plant Community, (6) Characteristic Aquatic Invertebrate Food Webs, (7) Characteristic Vertebrate Habitats, and (8) Floodplain Interspersion and Connectivity.

There are many potential ways to apply the HGM results. In the following sections, I will illustrate how results from the riverine regional guidebook can be used to: (1) assess a single site, (2) compare two or more wetlands, (3) calculate project impacts for a single site, (4) compute impacts for an "after the fact" permit action, (5) determine mitigation requirements, and (6) assess mitigation success.

Assess a Single Wetland

To address the objectives stated above, let us first establish a hypothetical set of results from application of the riverine guidebook. Data from a field site in Montana are presented in Table 1. Note that the HGM provides results for each of the particular functions analyzed in a regional guidebook. The practitioner can then consider which wetland functions are in the best public interest based on local knowledge, priority of the wetland to urban or community needs, or other reasons and take those factors into consideration when assessing the functioning of the particular wetland. In the example provided, the wetland seems, relative to other similar wetlands in the region, to be performing Functions 1, 3, 6, and 8 to levels similar to those for the reference standard wetlands. I have also calculated the Functional Capacity Units (FCUs) by multiplying the FCIs by the area (5 acres) of the site. Since scores are provided for each function, one has information that can be used to help decide whether to alter or protect a wetland based on a single function that is deemed to in the best interest of the public.

Although the HGM Approach generally discourages combining scores for all functions to get a single "bottom line" score, it is often necessary to develop such a score. Since the maximum score for a single function is 1.0 and represents the "best that it can be," that is, a fully functional wetland relative to reference standard wetlands, the bottom line score could be the average of all scores. In the example

Table 1. Functional Capacity Index (FCI) scores and Functional Capacity Units (FCU) for a single wetland near Kalispell, Montana.

Functions	Wetland A 5 acres	
	FCI	FCU
Function 1: Surface -Groundwater Storage and Flow	0.98	4.90
Function 2: Nutrient Cycling	0.72	3.60
Function 3: Retention of Organic and Inorganic Particles	0.93	4.65
Function 4: Generation and Export of Organic Carbon	0.68	3.40
Function 5: Characteristic Plant Community	0.60	3.00
Function 6: Characteristic Aquatic Invertebrate Food Webs	0.97	4.85
Function 7: Characteristic Vertebrate Habitat	0.71	3.55
Function 8: Floodplain Interspersion and Connectivity	0.98	4.90
Average	0.82	4.10

provided in Table 1, the overall score would then be 0.82 or close to a fully functioning wetland. One can then compute the FCUs for the site as 4.10 (0.82 FCI's x 5 acres).

Compare two or more wetlands

> ***The HGM Approach can be used to select an alternative that minimizes overall loss of wetland functions. It allows comparison of functions rather than acres.***

This example uses the data from the site in Table 1 and another wetland site near Kalispell, MT, to compare two wetland sites. This type of comparison is often required when making an assessment of two alternatives. When comparing Wetland A with Wetland B, it is still possible to evaluate the sites for the individual functions if certain functions are considered of high priority or in the best public interest. This comparison is similar to the analysis for a single function and can be accomplished by comparing just the FCI scores. In this example, it is evident that Wetland B is not as effective at performing any of the functions compared to Wetland A.

However, when comparing two wetlands, it is important to consider not only the functional capacity of the wetland, but also their size. Therefore, there is more reliance on the FCUs to integrate the characteristics of quality and quantity. In the example in Table 2, the larger wetland (Wetland B) does not provide the equivalent FCUs as Wetland A even though Wetland B is larger. Therefore, in an alternatives analysis it may be determined that impacts to the wetland resources could be minimized if some proposed action were allowed in Wetland B rather than in Wetland A, all other factors being equal. This is counter to the idea of minimizing impacts by using acreage alone. Wetland B, according to the data provided in Table 2 is more degraded than Wetland A for all functions. Although larger than Wetland A, functional losses to the wetland resources as a whole, might be minimized by altering the larger wetland. In this example, the same conclusion could be reached based on FCIs or FCUs.

Table 2. Comparison of two wetlands of different functional capacity and different sizes. Data collected from two wetlands near Kalispell, MT.

Functions	Baseline Conditions			
	Wetland A		Wetland B	
	5 acres		6 acres	
	FCI	FCU	FCI	FCU
Function 1: Surface - Groundwater Storage and Flow	0.98	4.90	0.52	3.12
Function 2: Nutrient Cycling	0.72	3.60	0.60	3.60
Function 3: Retention of Organic and Inorganic Particles	0.93	4.65	0.17	1.02
Function 4: Generation and Export of Organic Carbon	0.68	3.40	0.39	2.34
Function 5: Characteristic Plant Community	0.60	3.00	0.40	2.40
Function 6: Characteristic Aquatic Invertebrate Food Webs	0.97	4.85	0.43	2.58
Function 7: Characteristic Vertebrate Habitat	0.71	3.55	0.45	2.70
Function 8: Floodplain Interspersion and Connectivity	0.98	4.90	0.58	3.48
Average	0.82	4.10	0.44	2.65

Calculate project impacts for a single wetland

The HGM Approach can also be used to calculate the magnitude of impacts that may occur from a proposed project. Since the Approach utilizes data for individual variables, adjusts those data into index scores from 0.0 – 1.0 for each variable, and then combines the variable subindex scores to compute a FCI for each function, it is possible to project the future scores of each variable. Those individual variable scores can then be run in the models to compute an FCI score for anticipated post-project conditions. When projecting how each variable may change as a consequence of a proposed action, it is important to consider the normal ecological interrelationship between each variable. For example, if it is anticipated that the project may result in land clearing and removal of existing forest cover, then one might consider that the cleared area may be paved so no forest canopy, tree basal area, or vegetative cover may remain. If the area is not to be paved, then an increase in herbaceous cover would be expected since shading is reduced. Over time, if a forest is allowed to develop again, the herbaceous cover would decline as shading becomes more prevalent.

To compute project impacts, individual pre and post project functional scores need to be compared to examine how each function may be influenced by the proposed project. The overall score differences could also be considered. As indicated in Table 3, the proposed project has little influence on certain functions like Retention of Organic and Inorganic Particulates (0.93 vs. 0.93) or Characteristic Aquatic Invertebrate Food Webs (0.97 vs. 0.89) but Characteristic Plant Community is considerably impacted (0.60 vs. 0.29) by the proposed project. The size of the impact area is the same as the size of the original wetland so either the FCI or FCU scores can be compared. In the example in Table 3, there appears to be little overall impact (0.82 vs. 0.64) by the proposed project with some of the greatest impacts associated with the plant community and wildlife habitat.

The example presented above considers that the size of the wetland impacted is the same as the original wetland. However, the HGM Approach can also be used to compute project impacts when different areas of a wetland may be impacted at different levels of severity. For example, a building and landscaping project may be proposed for construction in a wetland area. The building could eliminate all wetland functions but landscaping may only reduce certain functions. Therefore, the wetland could be

Table 3. Assessment of potential project impacts on wetland functions of a single wetland.

Functions	Wetland A 5 acres			
	Baseline		Post-Project	
	FCI	FCU	FCI	FCU
Surface-Groundwater Storage and Flow	0.98	4.90	0.59	2.95
Nutrient Cycling	0.72	3.60	0.55	2.75
Retention of Organic and Inorganic Particles	0.93	4.65	0.93	4.65
Generation and Export of Organic Carbon	0.68	3.40	0.48	2.40
Characteristic Plant Community	0.60	3.00	0.29	1.45
Characteristic Aquatic Invertebrate Food Webs	0.97	4.85	0.89	4.45
Characteristic Vertebrate Habitat	0.71	3.55	0.46	2.30
Floodplain Interspersion and Connectivity	0.98	4.90	0.92	4.60
Average	0.82	4.10	0.64	3.20

divided into two assessment areas and the analysis performed on each and then the total impacts could be computed.

Compute impacts for an "after the fact" permit action

The process for assessing impacts for an "after the fact" permit application is to determine what the wetland was like prior to the impact, assess its present condition, and then compute the difference. Using the data from Table 3, but assuming that the baseline for Wetland A represents our anticipated wetland condition prior to alteration and the post-project condition for Wetland A represents our condition "after the fact," the process for computing impacts is exactly the same as projecting in the future. However, when projecting back in time prior data or knowledge may be available to characterize each variable in the HGM models. Using local knowledge, aerial photos, etc, it may be possible to reconstruct conditions prior to the alteration whereas when projecting into the future best professional judgment must be relied on about how each variable will be impacted by the project.

The two examples immediately above only consider the impacts at a single point in time. In the first example, impacts were projected for a single wetland at a single time in the future and in the second example, impacts were from a single point in the past and calculated for the present. However, the HGM Approach can also address changing impacts over time.

Determine mitigation requirements

Historically, mitigation requirements were typically computed based on the area impacted by a project with little consideration given to the *magnitude* of the impact. Mitigation ratios have been used in an attempt to address this omission but the ratios were generally static and assumed the magnitude of impacts were uniform regardless of wetland type or project type. However, using the HGM Approach, mitigation requirements can be computed based on both the magnitude of impacts as well as the areal extent of impacts. Since different projects often have different levels of impacts, the HGM Approach provides a more accurate estimate of impacts for each project.

To determine wetland mitigation requirements, it is necessary to determine the magnitude of project impacts by computing the FCIs for pre-project and post-project conditions as calculated in the example above for Table 3. It is then necessary to compute the FCIs for pre-mitigation conditions of the mitigation wetland and project future FCIs based on site conditions proposed in the mitigation plan. In the example below, I will use the data for Wetland A above for the project site conditions and Wetland C for the proposed mitigation site.

It is important to recognize that the amount of mitigation required should equal, at a minimum, the amount of impacts expected due to project implementation. The mitigation may, however, be greater to offset the temporal losses that may be experienced during the period prior to when the mitigation plan is fully achieved. For example, a proposed mitigation plan may include development of forested species to produce hard mast for wildlife use but time will be required for those planted species to reach a minimum size to become trees (typically 10 cm DBH) and additional time for the trees to provide mast production. Therefore, additional mitigation area may be required to offset the temporal delay in fully achieving the desired, and projected mitigation plan. For the example discussed below, I have assumed near immediate accomplishment of the mitigation plan.

To calculate the amount of mitigation required, first note the assumptions listed and the following formulas:

Assume:

In this example, it is assumed that all wetland functions are weighted equally and therefore, an average FCI is computed for each project wetland and mitigation site. However, functions can also be weighted differently and a geometric mean computed for the site FCI score.

- Wetland A is the wetland where a project is proposed;
- Wetland C is the location where mitigation is proposed; and
- Unavoidable Project Impacts = Compensatory Mitigation required.

Impacts = Functional capacity lost x area impacted

Where functional capacity lost = $(FCI_{Pre\text{-}project} - FCI_{Post\text{-}project})$
Therefore, Impacts = $(FCI_{Pre\text{-}project} - FCI_{Post\text{-}project}) \times A_{project}$

Where:

- FCI $_{\text{Pre-project}}$ is the Functional Capacity Index of the project wetland prior to project implementation
- FCI $_{\text{Post-project}}$ is the anticipated Functional Capacity Index of the project wetland after project implementation based on changes anticipated for each variable in the HGM models
- A $_{\text{project}}$ is the wetland area of the proposed project

Mitigation = change in functional capacity before and after implementation of the mitigation plan times the area of mitigation (which is unknown and must be computed) necessary to fully compensate for project impacts

Mitigation = Functional capacity increase due to the mitigation plan x area of mitigation required where functional capacity increase = (FCI $_{\text{Post-mitigation}}$ - FCI $_{\text{Pre-mitigation}}$) x $A_{\text{Mitigation}}$

Where:

- FCI $_{\text{Pre-mitigation}}$ is the Functional Capacity Index of the mitigation wetland prior to implementation of the mitigation plan
- FCI $_{\text{Post-mitigation}}$ is the anticipated Functional Capacity Index of the mitigation wetland after the mitigation plan is implemented
- $A_{\text{Mitigation}}$ is the area of the mitigation wetland necessary to achieve full functional replacement and must be computed based on the magnitude of impacts and the level of functional lift that can be achieved by the mitigation plan

Therefore, since project impacts must equal mitigation, then

$$(FCI_{\text{Pre-project}} - FCI_{\text{Post-project}}) \times A_{\text{project}} = (FCI_{\text{Post-mitigation}} - FCI_{\text{Pre-mitigation}}) \times A_{\text{Mitigation}}$$

and to calculate $A_{\text{Mitigation}}$ the equation becomes

Formula 1.

$$A_{\text{Mitigation}} = \frac{[(FCI_{\text{Pre-project}} - FCI_{\text{Post-project}}) \times A_{\text{project}}]}{(FCI_{\text{Post-mitigation}} - FCI_{\text{Pre-mitigation}})}$$

Using data from Wetland A in Table 3 as an example for the proposed project site and Wetland C as a proposed mitigation site, and the equations above, it is possible to calculate the areal extent of mitigation necessary to fully compensate for unavoidable impacts (Table 4).

Using the information provided in Table 4 and Formula 1, the amount of mitigation area required is:

$$A_{\text{Mitigation}} = \frac{[(FCI_{\text{Pre-project}} - FCI_{\text{Post-project}}) \times A_{\text{project}}]}{(FCI_{\text{Post-mitigation}} - FCI_{\text{Pre-mitigation}})}$$

$$= \frac{[(0.82 - 0.60) \times 5}{(0.52 - 0.44)}$$

$$= \frac{[0.22 \times 5]}{0.08}$$

$A_{\text{Mitigation}}$ = 13.75 acres of mitigation required

Since the proposed mitigation site is only nine acres, as indicated in Table 4, and 13.75 acres are required to fully mitigate for project impacts, the proposed site is not adequate. However, the mitigation plan could be modified to increase the functional lift (FCI $_{\text{Post-mitigation}}$ - FCI $_{\text{Pre-mitigation}}$) and the necessary mitigation area recomputed.

To compute the required mitigation ratio for the proposed mitigation plan as calculated in Table 4, is

Mitigation Ratio = 1:Calculated mitigation required/ A $_{\text{project}}$

= 1 : 13.75 / 5

= 1 : 2.75

Table 4. Data for comparison of two wetlands and computation of mitigation. Wetland A is the wetland to be impacted by a potential project and Wetland C is a proposed wetland mitigation site.

Functions	Wetland A 5 acres		Wetland C 9 acres	
	Pre-project FCI	Post-Project FCI	Pre-mitigation FCI	Post-Project FCI
Function 1	0.98	0.59	0.52	0.52
Function 2	0.72	0.55	0.60	0.67
Function 3	0.93	0.93	0.17	0.17
Function 4	0.68	0.48	0.39	0.46
Function 5	0.60	0.29	0.40	0.69
Function 6	0.97	0.89	0.43	0.43
Function 7	0.71	0.46	0.45	0.59
Function 8	0.98	0.65	0.58	0.60
Average	0.82	0.60	0.44	0.52

Assess Mitigation Success

In the example above, it was assumed that mitigation was achieved as proposed in the mitigation plan and that there was no delay in mitigation implementation. However, it is more common that some time is necessary to achieve all HGM model variables. The accuracy and adequacy of the mitigation plan can also be evaluated using the HGM Approach. The anticipated characteristics of each variable can be projected at particular time intervals, perhaps annually, and used to establish annual targets for the mitigation plan. Then the HGM models can be run on the projected dataset and compared to actual data collected annually to assess mitigation success (Figure 1).

Based on the data illustrated in Figure 1, the mitigation site was expected to provide an average FCI of 0.52 (Table 4) at the end of five years. However, it actually only provided an average FCI of 0.49 and therefore, was not as successful as planned. If the data are provided to regulatory staff at annual intervals, both graphically as in Figure 1 and in tabular form for each variable, regulatory personnel should very quickly be able to see the first year that the mitigation plan is not achieving its projected target and determine if mid-course corrections are needed. Using the tabular data, it should also become clear which variables are deviating substantially from the projected values and call into question the eventual success of the mitigation.

Summary

In summary, the HGM Approach to assessing wetland functions provides a rapid, and efficient method to address many regulatory requirements. It can be used to assess existing and projected conditions of a particular wetland, compare similar wetland types, assess potential project impacts, and assess the amount and adequacy of mitigation to compensate for unavoidable wetland impacts.

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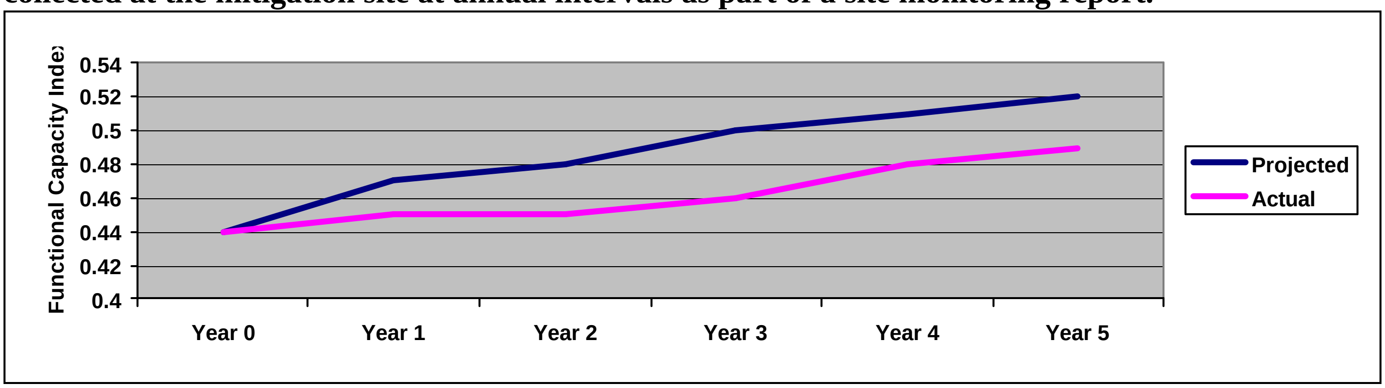
Figure 1. Comparison between projected mitigation FCI scores and actual scores derived from data collected at the mitigation site at annual intervals as part of a site monitoring report.



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On Assignment at Headquarters

Mike Rabbe

My recently completed developmental assignment, from June 8th through December 10th, 2003, was very informative and educational. My primary emphasis was to work on mitigation issues toward accomplishing the National Mitigation Action Plan (MAP) action items. My exposure was much greater however, as to how things (in particular Regulatory matters) work at the headquarters level. It was a very intriguing and challenging assignment. In the field we tend to be isolated from the intricacies that are woven into the complicated, complex, and politically sensitive Regulatory program (that is not always a bad thing). By HQ Regulatory fighting the big battles and shielding us in the field from the daily politics and taskers, this allows us to do our job of working with the regulated public in a fair and responsive manner. Working at Regulatory Headquarters in Washington D.C. was a great opportunity and experience. I would highly recommend to anyone who wants to understand how the Regulatory program operates at the Headquarters level, to consider taking a similar developmental assignment.

The following are some thoughts as I think back over the last 6 months...

- *Everyone can probably relate to the fact that most of us in the field have our plates overflowing with work. Consequently we tend to roll our eyes when HQ sends a tasker/request to the District/field asking us for information or data on a particular subject, with a short turn around time. However it seems HQ staff are subject to the same demands, or even worse, that we are subject to in the field. I will now have a much greater appreciation and tolerance of requests from HQ that are sent to the field and have short deadlines. I realize it is the domino effect and that HQ Regulatory has no control over some of the taskers we in the field are to respond to on short timeframes.*
- *I was involved in assisting in the logistics and support of upper management level meetings at HQ. Participating in these types of meetings was good exposure. I was especially impressed with the concern management showed for the field folks during various conversations throughout the two-day meeting. It was evident that they realize the stress and heavy workload the field folks face every day, being on the front line.*
- *I was most recently involved in helping host the EPA/COE National Regulatory Workshop in Key Largo, Florida. It was very challenging and demanding, dealing with the various problems that kept popping up, but it was a very valuable experience in how to host a national conference and working with other agencies. I am positive that the insight, exposure and recognition I received from both within and outside our agency will be priceless, in the near future.*
- *In the past 6 months, I made several presentations on various topics at different meetings across the country adding to my exposure to many different issues. Some issues I was exposed to included, enforcement issues at the enforcement conference here in D.C., regionalization of the 87 manual, compensatory mitigation issues, watershed perspective issues, and many other Mitigation Action Plan (MAP) action items at meetings in D.C., Florida, and Portland. It was a great learning experience, good practice in speaking, plus great exposure.*
- *Participating on the MAP interagency team was also a great experience. It was invigorating and challenging to work with various staff and policy makers of other agencies in formulating new guidance on compensatory mitigation. You felt like you were really making a difference and everyone was very positive in trying to accomplish something good for the aquatic resource.*
- *Working with HQ staff was a great experience also. Everyone was very professional, helpful and always dropped what they were doing to assist me in my work and questions I was always asking. The technical knowledge I gained through research and working with folks on various issues, will prove to be invaluable for my career.*
- *Finally, just having various staff bounce things off of me, inviting a field opinion, was also a great experience. It exposed me to the thinking of HQ Regulatory staff and often challenged me to new ways of thinking.*

(Editor's note: Mike Rabbe is the State Program Manager for Nebraska in Omaha District.)

Also of Interest

OMBIL Regulatory Module (ORM)

The OMBIL Regulatory Module (ORM) will be the new automated information system for the Corps Regulatory Program. ORM will replace the Regulatory Analysis Management System (RAMS and RAMSII) and other regulatory databases currently being used by Corps districts. ORM will help the Corps Regulatory Program improve its data collection efforts, and the information collected in ORM will be used to monitor program performance, conduct various analyses such as cumulative impact assessment, and provide real-time data for managers. Since ORM will be utilized at all Corps districts, and all data will be collected into a single central server, there will be fewer data calls. Headquarters and Divisions can assess workload and performance data directly, instead of requiring district offices to provide reports. An electronic permit application is being developed for use with ORM, so that the public can apply for Corps permits over the Internet. ORM will be used with Geographical Information Systems (GIS) to more efficiently review permit applications, and assess cumulative impacts. ORM can also be used to share information between other Federal agencies, such as compensatory mitigation data and Endangered Species Act consultation data. In summary, ORM will help the Regulatory Program modernize its information collection capabilities, promote consistency in program implementation, and provide better service to the public.

(Submitted by David Olson, HQ)

Regionalization of the Wetland Delineation Manual

The initial meetings for both the Alaska and arid west regional wetland delineation manuals have occurred. In these meetings, participants from the Corps, EPA, NRCS, FWS and state and local agencies identified 1) general regional boundaries for each manual, 2) geographic sub-regions, 3) plant, soil and hydrologic technical issues causing the most difficulty, 4) sources of information (e.g., studies, data) that might help resolve the technical issues and, 5) other technical people that may need to be involved in these efforts, either directly in the writing of the documents or as reviewers. We expect both efforts to continue through 2004 and the draft documents will be available for public comment as part of this process.

(Submitted by Katherine Trott)

Third Stakeholder Forum on Mitigation

As reported in the last newsletter, the Third Stakeholder Forum on Federal Mitigation was held in Portland, Oregon on July 29-31, 2003. The 2003 Forum Report has been posted on the Environmental Law Institute's website at http://www.elistore.org/reports_detail.asp?ID=10929&topic

Newsletter Communication

To comment on the newsletter, suggest topics, submit an article, or suggest events or articles of interest, please contact Bob Brumbaugh at:

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