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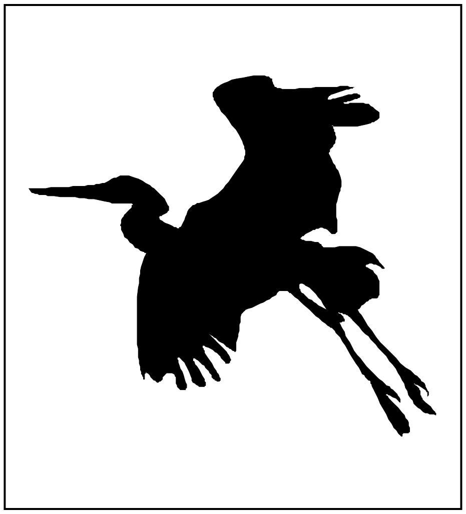

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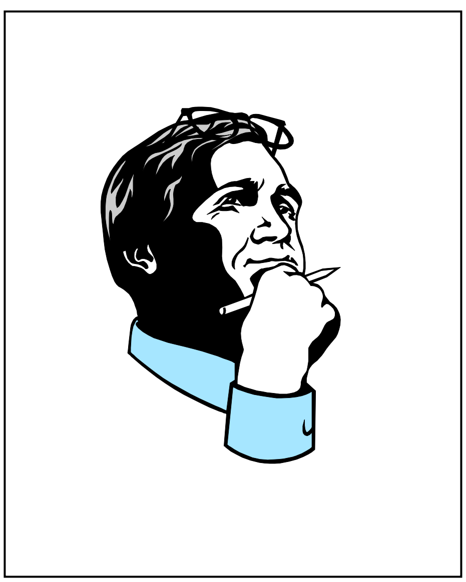
Wetland Assessment for Regulatory Purposes

INTEGRATING WETLAND ASSESSMENT INTO REGULATORY PERMITTING

Recommendations and a Proposed Assessment Process



By
Jon Kusler, Esq., Ph.D.

January 1, 2004

FINAL REPORT 3:
WETLAND ASSESSMENT FOR REGULATORY PURPOSES

INTEGRATING WETLAND ASSESSMENT INTO REGULATORY PERMITTING

RECOMMENDATIONS AND A PROPOSED ASSESSMENT PROCESS

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Final Report 2: Wetland Assessment in the Courts:
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DISCLAIMER

The views expressed in this report are those of the author and the Association of State Wetland Managers, and do not necessarily represent those of the sponsoring agencies and organizations.

ACKNOWLEDGMENTS

Principal financial support for this report was provided by the U.S. Environmental Protection Agency Wetlands Division and the USDA Natural Resources Conservation Service. Additional funding was provided by the U.S. Environmental Protection Agency, Region II, the Federal Emergency Management Agency, the Federal Highway Administration and The McKnight Foundation. This support is gratefully acknowledged.

FOREWORD

In 1996, the Association of State Wetland Managers began a four-year project to improve understanding of wetland assessment for regulatory purposes. This project involved a literature review, three workshops and a national symposium on wetland assessment, a legal study of assessment needs, and hundreds of interviews and discussions with wetland regulators and scientists who work with assessment.

Draft reports from this project were published in 2000 updated in 2003 and early 2004 through additional legal research, interviews, bibliographical and web searches.

This report is one of three final reports from the project. It draws on all aspects of the project and contains tables and boxes developed for the earlier reports. The first report, Assessment of Functions and Values, discusses in greater depth the assessment of wetland functions and values for regulatory purposes. The second, Wetland Assessment in the Courts, includes a review of federal and state court cases that address wetland and related resource assessment.

The recommendations and suggested process reflect the insights of many wetland regulators and scientists. We thank you for your recommendations and for making this report possible.

We hope these reports will stimulate thinking.

Sincerely,

Jon Kusler, Ph.D., Esq.

PREFACE

In 1999 Bartoldus published a report describing 40 “rapid” wetland assessment techniques that dealt with wetland functions and values (Bartoldus, 1999). This list was not inclusive. At the time, many assessment techniques not specifically designed for wetlands but useful for assessing some wetland features, such as hydrologic models, were also available. Since then, dozens of additional IBI and HGM models have been developed. A variety of GIS models have been used to evaluate wetlands or identify restoration sites and other models have been developed to address such issues as stream stability. The total number of assessment techniques in use or under development may now exceed 90.

How is the regulator, who must analyze a permit application, to decide what technique to use to gather and analyze information? What steps should be followed? How is the information gathering and analysis process related to the typical steps in regulatory permitting?

Many rapid assessment techniques, such as HGM, HEP and WETHINGS, may be applied in particular instances to assess wetland functions and values. But, no single technique meets all regulatory assessment needs, and there is little guidance available to suggest how a regulator should decide what technique, or techniques, should be applied in particular circumstances.

This report helps regulators answer these questions and better integrate wetland assessment into regulatory permitting. We suggest in the report a Collaborative Assessment Process, which can be used as part of regulatory permitting. This process can be used for developing the types of information that regulators typically need on permits.

The broad, five-step research and analysis process can help regulatory agencies choose an assessment approach and gather the information needed for decision-making on a particular permit. This process follows the typical steps in regulatory permitting applied at all levels of governance, including preparation of Environmental Assessment and Environmental Impact Statement Requirements. It can be implemented with limited money, staff and time. The process may used to assess wetlands, adjacent aquatic ecosystems, riparian buffers, floodplains and even uplands. It allows rapid, common sense sorting of information at early stages of project analysis. In many instances, the process involves collaborative research with the project applicant and other regulatory review agencies. The process suggested in this report must be tailored to the specific features of regulatory programs. It may need to be supplemented with staff guidance on the assessment of specific types of wetlands within an area.

The recommendations proposed here differ from typical wetland assessment methods in several respects. First, we address not only wetland functions and values (the focus of most assessment methods), but also other important needs for regulatory decision-making, such as wetland delineation, evaluation of natural hazards and determination of whether alternatives exist for a proposed activity. Second, we emphasize staged information gathering, with preliminary qualitative analyses followed by more quantitative analyses (only if needed) so that a regulatory agency need not gather more information than required. This is essential if regulatory agencies are to process permit applications with limited staff, finances and time. Third, we recommend collaborative information gathering and analysis, particularly for larger projects. Collaborative information gathering is needed not only to efficiently tap available expertise and information, but also to build consensus on wetland-related impacts and the adequacy of impact reduction and compensation measures. Fourth, as suggested above, this process can be used for not only wetlands but adjacent rivers, streams, riparian areas and floodplains.

The process we recommend incorporates much of what is already being done in regulatory permitting, but has not been written down**.** We would like to make information gathering more systematic and equitable, and we hope this report and the companion reports will help achieve these goals.

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CHAPTER 1: INTRODUCTION

Rethinking Regulatory Assessment

The initial goal of the wetland assessment project, which the Association of State Wetland Managers (ASWM) began in 1996, was to help regulators better use the Hydrogeomorphic Assessment Method (HGM). After conducting a small workshop on the HGM method in Washington D.C. in April 1996, ASWM held a national wetland assessment symposium in 1997 in Annapolis, Maryland, also focusing on HGM. This was followed in 1998 by a national workshop in Crystal City, Virginia on landscape-level wetland assessment and a workshop in Millbrook, New York on the use of reference in wetland assessment. A legal study of federal and state court cases pertaining to wetland assessment was carried out in 1998-1999 and updated in 2003 and early 2004. ASWM also interviewed hundreds of regulators and scientists about their experiences using various assessment techniques in the field. Four draft reports about wetland assessment for regulatory purposes were prepared and subjected to broad peer review in 1999 and 2000 (about 200 copies were distributed for review). Additional legal research, bibliographic and web research, and interviews were conducted in late 2002 and early 2003 including the conduct of workshop in Washington, D.C. in March 2003 concerning the reconciliation of various assessment approaches. A national symposium was held in October 2003 concerning landscape level approaches for wetland assessment.

In this extended, six-year effort, we found little use of formal wetland assessment techniques by regulators at any level of government. Regulators expressed great misgivings about existing techniques. Common complaints included: assessment techniques fail to address more than a small number of regulatory legal and administrative needs; techniques are based on invalid simplifying assumptions; they do not track with regulatory permitting procedures; they are too expensive, time consuming and require too much expertise; and they are too inaccurate. Regulators were interested in improved functional assessments, including new ways to determine the impact of proposed projects on wildlife, and the adequacy of impact reduction and compensation measures. However, most regulators thought the silver bullet assessment approach that could meet all their needs had not yet been found.

The search for a silver bullet has been going on for some time. There was great interest in the late 1980s in the WET methodology. This was followed by great interest in HGM in the mid-1990’s. Federal agencies proposed in 1996 that in two years HGM be used on 90 percent of federal Section 404 permits. However by 1998 (two years later), almost no use was made of HGM on regulatory permits and little use has been made since then although a variety of HGM guidebooks have been developed. Interest shifted in the past 4-5 years from HGM to IBI models, which have also proven difficult and time consuming to develop and implement, although many show long-term promise.

As a result of hearing what works and does not work for regulators, and the confusion about use of assessment methods, ASWM decided to propose an information gathering and assessment process that could be integrated with the five typical steps in case-by-case regulatory permitting. It is called the Collaborative Assessment Process because most regulatory assessments need to be carried out with information supplied by the landowner or consultant. Help from other regulatory and resource agencies is also often needed.

Regulatory Information Needs

The wetland assessment needs of regulators differ from the assessment needs of public land managers, land use planners, water planners, consultants and other wetland managers.

For example, consider the information needs in a typical regulatory permitting situation. Assume that a landowner wishes to partially fill a riverine wetland and is seeking necessary permits. If it is a small fill, the landowner may need only a local or state wetland permit. More often the landowner will need a federal Section 404 permit, a state wetland or waters permit, and both local wetland and floodplain regulatory permits. This is particularly true for larger projects that involve public waters, as well as wetlands. In many states, the landowner can file a joint permit application with the Corps of Engineers (Section 404) and the state. This permit application may be evaluated by the Corps, the state and any number of other federal and state reviewing and commenting agencies. Additional local zoning permits will often be needed.

Whether a permit is analyzed by a single regulatory agency or multiple agencies, a number of regulatory questions, which have information gathering and analysis requirements, must be answered. For example: Is the proposed activity a regulated activity? Is the proposed activity within a regulated wetland? Is the proposed activity on public or private land (affects what statutes apply, landowner rights)? Are there reasonable alternatives to the proposed activity? What other permits are required? Have these been obtained? Will the proposed activity increase flooding or erosion on other lands? Will it be subject to severe flood hazards? Will it have adequate onsite waste disposal (e.g., septic tank and soil absorption field)? Is proposed activity otherwise likely to damage adjacent private or public lands? What will be impacts on wetland functions? How may this affect the public? Will the public interest be served by issuing or denying this permit, considering a broad range of factors?

To answer these questions a regulatory agency must gather and analyze many of types of data with limited time, funds and in most instances, expertise. The agency must be able to evaluate wetland functions and values, as well as changes in these functions and values, and how these changes may impact society. (See Appendix A for use of the terms "functions" and "values" in this report.) In making these determinations an agency must determine: What functions and values are to be examined in a particular context? How? At what scale and to what degree of accuracy? In many instances, particularly for larger projects, the regulatory agency must evaluate the adequacy of compensation measures, including proposed wetland restoration, creation or enhancement.

In deciding whether the public interest will be served by issuing or denying the permit, the regulatory agency must also decide: Who will be hurt or benefited? How many will be hurt or benefited? In what way? How will they respond to these changes (e.g. acceptance, support, anger, etc.).

The regulatory agency often faces legal issues as well. Some include: Will the analysis meet minimum National Environmental Policy Act (NEPA) or state environmental impact act requirements? Will it comply with statutory and administrative regulation procedures and criteria set forth in the agency enabling statute and regulations? Will denial of the proposed activity raise possible taking issues or other legal complaints? If a permit is to be denied or conditioned, will the grounds for denial or the conditions be defensible in court? If denial or tight conditioning of a permit poses a "taking" challenge, what types of information should be gathered to help address such a challenge?

The regulatory agency must gather all the information needed to address these issues within a short statutory or regulatory period of time and with limited budget and expertise.

It is little wonder that regulatory agencies have not used time-consuming and expensive wetland assessment methods that address only a few of these questions and require the same level of detailed analysis on **each** permit application. Agencies must address a broad range of information gathering needs on each permit, although not all permit applications require detailed research and analysis for all issues.

Desired Features of an Assessment Process

Given the many types of information that a regulatory agency must gather and the budgetary and time restraints on decision-making, what are the desired features of an assessment process?

1. It must help a regulatory agency meet the **full range** of information needs for decision-making on a specific permit. Doubling up on field studies, such as information gathered from a single field visit to a site, is needed.

2. It should recognize that landowners/consultants, local governments, state and federal agencies, and the public must often play **collaborative roles** in research and analysis, particularly for larger projects. Collaborative information gathering can tap available information and expertise, distribute the cost of research and build consensus among regulatory and commenting agencies on relevant facts (e.g., Is a site subject to severe flooding? Is an endangered species present?).

3. It should include a variety of **sorting procedures** (e.g., red and yellow flags) with feedback loops to determine early the issues and problems at the site, whether more detailed studies are needed, and to apply these techniques, if needed. This coincides with the NEPA environmental evaluation requirements, which mandate that an agency must first take a hard look at potential impacts to evaluate their significance before the agency prepares an environmental impact statement.

4. It should **sequence** information gathering to get the easy information first. For example, a simple “no” may be rational and legally defensible if a proposed fill is in a floodway and would violate floodway regulations; if a septic tank system is proposed for a saturated area where such a system will not work; or if the site is rare and endangered species habitat.

5. It should help make a preliminary and qualitative determination as to whether **significant wetland functions and values** may be impacted at a site. (See Appendix A and Box 1.) If so, data gathering and analysis can be better focused. A workable process should also help the regulatory agency **select and apply the most appropriate assessment technique** to address impacted function, values or other features.

6. It should help the regulatory agency **evaluate the adequacy of proposed impact and reduction and compensation measures**—restoration, creation, and enhancement—including the adequacy of proposed monitoring procedures.

7. It should involve at least an early, superficial evaluation of the impact of permit denial or

conditioning **on the landowner** to determine whether possible "takings" challenges or other legal problems may result. If so, more detailed information gathering may be needed for the permit application.

8. It should be compatible with and encourage, over time, **mapping and other data gathering** at the local and state levels, including prior planning, such as wetland and flood maps, endangered species maps, identification of wetland reference sites, wetland management and watershed planning, and other ways to provide more up-front information and certainty to regulators and landowners.

9. It should be designed to **help build consensus** between landowners and regulatory agencies on critical facts (e.g., impact of a proposed activity of wetland processes, adequacy of proposed restoration) and the need for impact reduction and compensation measures. This is particularly important when several levels of government and several agencies at a single level are involved in evaluating a proposed activity, and agreement must be reached among the entities.

A lot of requirements! It is not easy to develop an information gathering process that satisfies all.

A few caveats before continuing to the proposed process that embodies these recommendations. It should be noted that our recommendations are designed for **case-by-case regulatory permitting** to generate the information needed to apply the broad, public interest review criteria of the Section 404 program or comparable state or local regulatory programs. Our recommendations can also be used to process "special exceptions" and variances in accordance with local and state conservancy zoning and wetland order procedures.

In the best of all possible worlds, detailed and accurate information about wetland functions and values, land ownership and hydrology, among other features, would be available up front for regulatory permits. In reality, the most that can be hoped for in most contexts in the near future is some combination of limited up-front information (e.g., maps of wetlands, floodplains, soils, endangered species, etc.) combined with more detailed, site-specific analysis of the sort provided in our process.

It should be emphasized, again, that the process we suggest is not intended as a substitute for more detailed wetland, floodplain, waters and riparian assessment methods, such as IBI, HGM, WETHINGS and HEC, in appropriate circumstances. Rather, the process establishes a framework for determining whether detailed assessments are needed and selecting and applying the most appropriate technique for the circumstances. (See Chapter 4.)

Box 1

Principal Collaborators In Assessment

In regulatory permitting, five principal collaborators may be involved in wetland information gathering and analyses, particularly for larger projects:

1. The regulatory agency. Agency staff plays the central research and analysis role in most regulatory programs. However, some wetland regulatory programs shift much of the information gathering burden (e.g., delineations, evaluation of functions and values) to permit applicants and their consultants.

2. The landowner and consultant. Much of the information gathering will often be carried out by landowners and their consultants for mid-size and large projects. The landowner and consultant also have an important role in research, even for routine permits, by providing a description of the proposed project, wetland boundaries, aerial photos, site photos and other information.

3. Other regulatory agencies. Floodplain management, pollution control, and planning and zoning may also have significant roles, depending on the project specifications, the facts and the regulations in effect in a particular jurisdiction.

4. Other commenting, resource management agencies and governments. Governments (e.g., towns, cities) without direct regulatory powers may also play a role in information gathering, depending on the project and site characteristics, agency expertise and other factors.

5. The public. The public may play a role in providing information in response to public notices and hearings. The public includes adjacent landowners, local land trusts and nonprofit organizations, academic institutions and other interested individuals.

Box 2
Why a Collaborative Information Gathering and Analysis Process Is Often Needed

An information gathering and analysis process that simultaneously involves the regulatory agency, the permit applicant, other agencies and the public in research and analysis is often desirable for several reasons:

- Proposed wetland activities often require federal, state, and local permits from more than one regulatory agency. Other agencies may be required to comment on permits even if they lack regulatory powers. Often many of these agencies require the same information.
- Many types of information and analyses are needed for regulatory decision-making and no single agency has the time and funds to gather all of this information.
- Existing information and hydrologic, botanical, biological and other expertise is often found in a number of agencies and places.
- Costs of information gathering are high and can often be shared among agencies and the landowners/consultants.
- Regulatory agencies often have limited time to generate and analyze information. Sharing information gathering can help meet these deadlines.
- There is often a need to build consensus among agencies concerning project impacts and the adequacy of impact reduction and compensation measures. Cooperative information gathering and analysis can help build consensus.

Box 3

The Role of the Project Applicant In Assessment

Typically, much of the information needed to evaluate a wetland permit must be provided by the project applicant because regulatory agencies lack the funds and time to gather this information. This includes much of the information needed for jurisdictional determinations, red and yellow flagging, and preliminary and more detailed analysis of functions and values. Applicants are also required to provide more detailed studies if initial analysis reveals the need for them or if an applicant wishes to carry out offsite compensation or use a mitigation bank.

It is important for the regulatory agency to reach some agreement with the permit applicant and the consultant (larger projects) early on regarding the information needed and the scales, accuracy and format of the presentation. Graphic, visual presentation of material has often proven particularly useful in helping a regulatory agencies form a clear picture of the proposed activity in its wetland context.

The U.S. Army Corps of Engineers, New England District Highway Supplemental Assessment Method, The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach recommends the following for applicant submissions: “The objective is to graphically display complex wetland information in a format that facilitates assimilation by reviewers and expedites regulatory decisions.” The guidebook provides illustrations of graphic presentations, including a wetland evaluation form with corresponding backup information and a study area graphic. The guide calls for display of other resources, in addition to wetlands, “in order to give the decision-maker a complete picture when evaluating alternatives.”

A permit applicant may be required to submit information at three stages of permitting.

1. **The permit application.** Regulatory agencies typically require that a project applicant supply the following information as part of a permit application (this list is not meant to be inclusive):
    - an overall description of the proposed project
    - a description of the area of wetland affected by the project, including wetland boundaries, size of fill, shape of fill, etc.
    - a map or description of the parcel as a whole (including, in some instances, adjacent parcels owned by the landowner)
    - existing use of the parcel
    - existing zoning
    - a description of why the proposed activity requires a wetland location and cannot be located on an upland site
    - a description of measures (if any) that will be taken to reduce project impacts
    - a description of measures (if any) to compensate for project impacts

Some agencies require additional information (particularly for larger projects), such as a preliminary assessment of wetland functions/values that may be impacted by the proposed activity. If a pre-application meeting has taken place, the permit applicant may also be asked to supply additional information concerning any issues or potential problems identified in this meeting

2. **More detailed studies.** Regulatory agencies may require applicants to submit information on a broad range of subjects--hazards, functions/values, design and implementation of restoration projects-- if preliminary analysis reveals the need. More detailed studies may pertain to red and yellow flag issues, such as:

- Uncertainties of wetland boundaries
- Uncertainties of public/private ownership
- Possible natural hazards, impact of proposed activities on hazards
- Possible endangered species
- Other functions/values
- Other problems or impacts (e.g., toxics, lack of consistency with plans)
- Proposed impact reduction measures
- Proposed restoration, compensation and enhancement

3. **Monitoring.** Project applicants on larger projects or projects involving wetland restoration, creation, and enhancement are required to submit reports on project implementation and operation. Reporting requirements are likely when wetland restoration/creation has been proposed to compensate for adverse impacts or where water pollution or other discharges require periodic re-evaluation and updating of permits.

Box 4
Field Visits: Doubling Up On Data Gathering

Regulatory agencies typically need to double up on information gathering during field visits because of limited budgets, staffs and time. For example, in a single site visit, a regulatory agency may:

- Check the type and size of wetland to determine if it is regulated (e.g., some states and local governments only regulate wetlands larger than a specified size)
- Check or identify the wetland water and/or riparian/floodplain zone boundary at the site of the proposed activity
- Determine whether a wetland is adjacent to other waters and connected to such waters (important to Section 404 jurisdiction)
- Determine (or approximate) the high water mark, if the wetland is adjacent to a navigable water, to determine the public/private ownership boundary in relationship to the proposed activity of the site
- Determine whether the regulated wetland water, and/or floodplain/riparian area is adjacent to other protected areas (parks) or is part of a larger corridor or drainage way
- Check out overall land ownership boundaries to make sure that the proposed activity will not encroach on other adjacent private or public lands (e.g., below high water mark)
- Determine whether the proposed activity might create a nuisance to adjacent lands (e.g., back up flood flows) based on location of the proposed activity and its characteristics and resource information
- Examine the overall topography, size and shape of the parcel and existing uses to determine whether practical alternatives exist to the proposed activity
- Look for signs of flooding and/or erosion to indicate possible natural hazards at the site, including flood marks on trees, debris, large rocks and trees moved by rapid flowing water
- Check the soils and elevation to determine whether onsite waste disposal may be possible (if the landowner is proposing an activity that requires a septic tanks/soil absorption field waste disposal)

- Look for signs of wildlife to indicate habitat value and the possible presence of rare or endangered species
- Examine the condition of the regulated area in terms of existing alterations, such as drainage, fills, litter, debris, exotics to help determine the condition of the wetland, its functions and relative permanence (relevant to assessment of functions/values, restoration potential)
- Determine whether there are possible restoration/creation sites on the parcel or nearby, if the landowner is proposing compensation measures

A Recommended Five-Step Process

To integrate wetland assessment into regulatory permitting, we recommend a five-step process. Later steps in this process may be partially omitted, depending on the conclusions drawn from earlier steps. The process is briefly described below and discussed in greater detail in the following chapters. The steps approximate the way information gathering often takes place in regulatory programs at all levels of governance.

Step 1. Determine whether the proposed activity is subject to the regulations (jurisdictional determinations). This step is unique to assessment for regulatory purposes. A regulatory agency cannot legally exercise authority over a proposed activity without determining that: (1) the wetland is a regulated type of area; (2) the proposed activity is a regulated activity; (3) the proposed activity is within the boundaries of the regulated wetland or adjacent regulated area; and (4) whether the site is publicly or privately owned (not needed in all instances but often affects state/local regulatory jurisdiction).

Such jurisdictional determinations are often based on information from a permit applicant, supplemented by office analysis and a field visit. Project applicants are often required to carry out a wetland delineation for larger projects. They also need to supply detailed information about the proposed activity – location, type, size, amount of wetland affected, proposed construction procedures, etc.

Step 2. Carry out a preliminary environmental assessment. The agency must decide whether the proposed activity may have significant impact on the environment and will comply with regulatory goals and standards. This step coincides with NEPA environmental evaluations as well as preliminary evaluation under state environmental review and wetland permitting acts. This preliminary environmental evaluation can be divided into two parts:

Part 1: Identify if any red or yellow flags exist.

Part 2: Determine, qualitatively, whether the proposed project may have significant impact on wetland functions and values. Impacts on other aspects of the environment should also be considered.

The regulatory agency needs to collaborate on this step with the project applicant, other regulatory and commenting agencies and often the public.

This preliminary examination must simultaneously consider whether there are alternatives to the proposed activity, whether the activity complies with other regulations, and the impact of the proposed project on wetland and related resources, including the magnitude of this impact and its significance to the public. The goals of the preliminary environmental evaluation which considers both site specific characteristics and landscape context are to determine:

(a) Whether there are any red flags that require an early “no” to a permit application, or yellow flags that require the agency conduct more detailed information gathering.
(b) Whether the proposed activity may have significant impacts on wetland and related ecosystem functions and values.
(c) What impact reduction and/or compensation measure may be appropriate, if a permit is to be issued (skip to Step 4)?

Step 3. If needed, carry out a detailed evaluation of project impact on functions/values, natural hazards, or other features, and determine the adequacy of impact reduction and compensation measures. This step is needed only if a preliminary evaluation reveals potential impact, issues or problems that require more information and analysis. Step 3 is required for almost all mid- and large-sized projects. It is also required if a project applicant wants to establish functions and values in greater detail for offsite mitigation, mitigation banking or other purposes.

In general, the project applicant is required to carry out more detailed studies, if they are needed. However, some studies may be carried out by the regulatory or commenting agencies.

The potential issues or problems investigated in Step 3 may pertain to delineation, alternatives, natural hazards, impact of activities on natural hazards, land ownership inconsistency with other regulations, possible impact on endangered species, possible impact on historical or archaeological sites, or other topics. Data gathering may involve the preparation of a full-scale environmental impact statement. Public hearings may accompany this stage of analysis.

Step 4. Apply fact-finding to regulatory criteria; prepare findings and decision on the permit, subject to various conditions, such as impact reduction and restoration, or creation. Negotiation with the landowner often takes place in this step, addressing specific project design and compensation, particularly if an effort is made to examine functions/values in depth and to negotiate compensation. Meetings between regulatory and commenting agencies may also take place. Various conditions may be attached to the permit.

Step 5. Monitor to determine compliance with permit conditions and success of compensation measures; enforce regulations. This may be undertaken by the permit applicant or it may be a cooperative effort of the applicant, regulatory and other agencies and organizations. Step 5 also involves data gathering for enforcement actions, and research and analysis to defend regulations against constitutional challenges. It may take place over a long time frame (e.g., 3-5 years or more, if restoration, creation or enhancement are involved). This step is extremely important in regulation, but one that typically receives limited funding and attention.

Individual Versus Collaborative Assessment

These five steps may be carried out by a single regulatory agency, but agencies have found that a collaborative approach is desirable, even for many modest and small projects. Assessment can best be collaboratively undertaken for large projects through the use of multidisciplinary teams and/or through a joint permit review process (e.g., multiple federal agency, state). Such a team approach is recommended by the New England Corps of Engineers Highway Supplemental Assessment Method, The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach.

An assessment team can consist of experts within an agency or experts from several agencies that have regulatory permitting or commenting powers. A team can operate on a continuous basis for all projects or for certain types of projects. It can also be assembled for a specific, large-scale project.

A team assessment approach has a variety of benefits. It can tap expertise and information not typically available in one agency or department. It can reduce duplication in assessment and improve coordination between agencies. It can help flag not only resource issues, but also social concerns by allowing feedback from various groups. Team assessment can help build consensus on important functions/values, issues and problems (if any) that need more analysis. This can provide greater certainty for landowners and reduce unwelcome surprises that may arise later.

Formation of a collaborative team may involve the following process:

(1) Any regulatory agency with wetland permitting power for a proposed project may initiate the formation of a collaborative assessment team. This lead agency should contact other bureaus or agencies with regulatory or commenting powers over wetland permits. The goal is to bring to the table regulators with the multidisciplinary expertise needed to evaluate the proposed activity.

(2) Goals for the team need to be established, as well as a framework for collaboration. An information network should also be set up (e-mail, fax, phone, periodic meetings).

(3) The lead agency provides copies of the application(s) to other team members. Copies may be accompanied by specific requests for review and analysis from individual agencies (e.g., flood analysis from a floodplain management agency). The team may often meet with the project applicant to discuss the plans and information needs. A team site visit may be held. One or more additional public hearings may be held for controversial projects.

To facilitate team analysis, it is important that the lead regulatory agency gather visual, graphic and other information easily understood by all of the team agencies, such as a sketch map of the project or wetland and photos of the wetland site. See New England Corps of Engineers Highway Supplemental Assessment Method, The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach.

(4) Once studies and evaluation are completed, the lead agency and the team can negotiate

impact reduction and compensation measures with the landowner, prepare formal findings and issue or deny the permit. Other agencies with regulatory authority may also make their decisions and findings (e.g., floodplain permits as well as wetland permits).

Monitoring and enforcement becomes the responsibility of the lead agency and/or one or more of the team members, often with periodic reporting by the landowner (e.g., restoration projects).

Box 5
Definitions and Acronyms Used In This Report

Definitions: In this report, terms are used in the following ways:

- *Assessment:* includes wetland-related data gathering and analysis, and the presentation of resulting information to regulatory decision-makers. It includes, but is not limited to, mapping, delineation, determination of ownership, natural hazards analysis, project impact analysis, analysis of functions and values, alternatives analysis, determination of mitigation needs, the design of mitigation measures, the determination of compensation needs, including compensation ratios, and monitoring and enforcement of regulations.
- *Capacity:* the ability of a wetland and related water and floodplain/riparian resources to produce goods and services of use to society. Capacity primarily depends on natural hydrologic, biological and chemical processes, as well as on other characteristics, such as soils, topography and size.
- *Data:* raw information, such as aerial photos, vegetation and soils information, topography, etc. not yet analyzed for a specific purpose.
- *Function:* natural processes that contribute to the capacity of a wetland and related ecosystems to provide goods and services.
- *Functions/values:* refers to the goods and services that wetlands provide and their value to society. Functions/values are sometimes referred to in other contexts as functional values.
- *Information:* data analyzed for a specific purpose; the results of such analysis.
- *Natural:* in an unaltered or relatively unaltered condition.
- *Opportunity:* the present or potential ability of a wetland with certain capacities to actually deliver goods or services to society. Opportunity depends on overall context. For example, a wetland may have the capacity to intercept pollution, but may not do so because there is no pollution. The presence of existing or anticipated pollution sources provides the opportunity for intercepting it.
- *Red flag*: an issue or problem sufficiently serious to warrant denial of a regulatory permit. (Also see yellow flag.)
- *Social significance:* the existing and reasonably foreseen benefits and costs to people and their attitudes toward those costs. Social significance in a wetland function/value context depends not only on capacity and opportunity, but also on who benefits and suffers adverse impacts, how many benefit and suffer adverse impacts, how they benefit or suffer costs, to what extent they benefit and suffer costs, and how strongly segments of society feel about the benefits and costs.
- *Value:* the attitudes of society toward wetland goods and services.
- *Yellow flag*: an issue or problem that requires more detailed investigation. A yellow flag issue may become a red flag after additional research (e.g., confirmation of an endangered species).

Acronyms

EPA: The U.S. Environmental Protection Agency.

GIS: Geoinformation System. A geo-referenced information storage and analytical system, usually computerized.

HGM: Hydrogeomorphic Assessment Method being developed by the U.S. Army Corps of Engineers in cooperation with other agencies.

IBI: Index of Biological Integrity; a biological reference standard of biological health and condition developed in accordance with biological indicator assessment approaches.

NRCS: The Natural Resources Conservation Service, United States Department of Agriculture.

HEP: Habitat Evaluation Procedure; a wildlife assessment procedure developed by the U.S. Fish and Wildlife Service.

HEC: Hydrologic Engineering Center; a series of hydrologic and hydraulic assessment techniques developed by the Hydrologic Engineering Center, U.S. Army Corps of Engineers.

WET: Wetland Evaluation Technique; a rapid assessment approach developed by the Federal Highway Administration, in cooperation with the U.S. Army Corps of Engineers and other agencies.

CHAPTER 2: JURISDICTIONAL DETERMINATIONS

Step 1 in the Collaborative Assessment Process is making jurisdictional determinations. An agency must first determine whether it has jurisdiction over a wetland and the, associated ecosystem (riparian area, floodplain, aquatic ecosystem) before it can exercise regulatory authority. It must also determine whether it has jurisdiction over the specific activity

Jurisdiction determinations are legally required for regulatory agencies at all levels of government. These determinations are unique to regulations because managers for other types of activities (e.g., planning and management of public lands by a land management agency) have authority over their lands and waters and do not need to establish this authority.

In many instances, jurisdictional determinations are quick and easy for the regulatory agency. In others (e.g., agricultural activities for headwater wetlands) there may be a variety of issues that need a field visit to resolve, for example, boundary delineation. It is not uncommon in such situations for regulatory agency staff to spend a considerable portion of their funds and time on jurisdictional determinations, such as disputed wetland boundaries.

Jurisdiction determinations often do not involve formal findings. Formal findings are required only if there is a problem, such as questions about the boundary or ownership, or the landowner challenges the jurisdiction of the regulatory agency.

An agency should take notes and keep records on the methods and procedures (if any) used and any fact-finding, such as determination of wetland boundary. Such records are needed to provide the basis for formal findings (if needed) and possible later defense of determinations in court. Photos of sites, including vegetation, are particularly useful for jurisdictional determination and to document base line conditions for later monitoring and enforcement, as well as to provide a basis for discussion, evaluation and negotiation.

To determine jurisdiction, a regulatory agency must typically answer the following questions:

1. **Is it a regulated wetland/related ecosystem in accordance with criteria set forth in a particular statute or regulation?** A wetland regulatory agency can only require a permit and impose restrictions if it has regulatory jurisdiction over the type, size and location of the wetland. Virtually all wetland programs, including the Section 404 program, regulate particular types or sizes of wetlands, or wetlands in particular areas. They do not regulate all wetlands. Most regulatory statutes clearly control wetlands that are adjacent to a lake, river or the ocean and such wetlands are easy to identify. It is often more difficult to determine jurisdiction of headwater, isolated or partially isolated wetlands because of statutory or administrative limitations on size or location. It is also more difficult to determine jurisdiction for partially drained or otherwise altered wetlands, such as prior converted wetlands.

Often regulatory agencies require that project applicants on mid-size and large projects delineate wetland/ecosystem boundaries. Wetland maps from other agencies, such as National Wetland Inventory maps and state wetland maps, may also be used. The regulatory agency still often needs to check the boundary in the field, particularly where substantial projects are proposed.

2. **Is the proposed activity a regulated or exempted activity?** Regulators must also determine whether or not a proposed activity is subject to regulatory jurisdiction. The Section 404 program, and state and local wetland programs exempt many activities from individual permits, such as repair of existing structures (constructed at the time regulations are adopted), normal farming and emergency repairs after a disaster.

Determining whether a proposed activity is regulated often does not require an assessment of the wetland itself. But, it can. For example, normal agricultural or forestry activities may be exempted, but not those involving substantial hydrologic modification. A field visit may be needed to determine whether an access road, maintenance of a drainage system, or other activity will involve a substantial hydrologic modification. Similarly, a field visit may be needed to determine whether a wetland is a prior converted wetland in accordance with Swampbuster, or whether a wetland has been abandoned.

3. **Is an individual permit required?** A determination of the need for an individual versus a general permit is required for the Section 404 and some state programs (e.g., New Jersey), not for all regulatory programs.

This is a federal (and to a lesser extent a state) issue for activities authorized by nationwide permits under the Section 404 program, for activities subject to Section 404 programmatic permits and state assumption, and for activities subject to certain state general permits. Notices for many types of activities subject to Corps nationwide or programmatic permits must be provided by project applicants to Corps' District offices for a preliminary determination to decide whether an individual permit will be required.

If the regulatory agency determines, based on a notice, that no individual permit is required, the landowner may go forward with the proposed activities subject to any BMP's (Best Management Practices) or other conditions. If the agency determines that an individual permit is required, both the agency and the permit applicant must often go through a more detailed assessment processes.

Whether or not an individual permit is required depends on the type and size of the project and its location. The determination may also reflect wetland characteristics, such as possible endangered species, recreational use or natural hazards. It may also be tied to a preliminary environmental evaluation.

Activities subject to the Corp's state or local programmatic permits or activities subject to a state assumed Section 404 program face similar issues. The state regulatory agency must submit notices of some types of proposed permits to the Corps and other federal agencies for certain activities. If the Corps or the EPA determines that the proposed permits raise no red or yellow flags, the state can continue to process the permit without further federal involvement. If the permit raises a red flag, an individual permit may then be required from the Corps. The type and size of a project are important in determining whether direct federal review is needed. Wetland characteristics may also be relevant to the decision.

4. **Where are the wetland/related area boundaries in relationship to the proposed activity?** If a proposed project or section of a project does not lie within the boundaries of a regulated wetland or a regulated buffer, the regulatory agency usually has no jurisdiction over that activity. Increasingly, however, states and local governments regulate wetland buffers, giving governments broader powers.

The regulatory agency may rely on the landowners or consultant to determine the boundary; may field check the determination; or may undertake the initial delineation itself. The Corps of Engineers in many districts requires landowners to undertake initial delineations. In some districts that is the only way a landowner can get timely consideration of a permit application. State and local wetland agencies more often undertake initial delineations themselves.

Usually, precise boundary delineation (within 10 feet) is not required for a wetland as a whole, only for the portion of the wetland that may be impacted by the proposed project. Delineation focuses on this area.

Delineation of boundaries is needed at different times for different regulations. For the Section 404 program, delineation is needed at the time of a permit since there is no advance regulatory mapping of wetlands. For state and local regulations, where wetland regulatory maps are required, preliminary boundaries must be shown on maps. Maps typically establish a presumption about the exact location of boundaries on the ground. However, maps are often at too small a scale to determine precise boundaries and contain inaccuracies. If there are disputes, regulators must identify more precise boundaries though field investigations.

Section 404 delineations typically involve field examination of vegetation, soils and hydrology in order to apply the wetland definition in the Section 404(b)(1) regulations. The 1987 Federal Manual for the Delineation of Jurisdictional Wetlands is usually used, although NRCS uses its own slightly different procedures.

Delineations must coincide with statutory wetland definition criteria. State and local wetland regulators must use state statutory wetland definition criteria in delineation, which are often, but not always, comparable to the federal criteria. Several states, such as New York, Michigan and Florida, have developed their own wetland delineation manuals.

5. **Who owns the site of the proposed wetland/related area activity?** Ownership affects the types of permits required. This information is more important for some regulatory programs than others.

At state and local levels, the regulatory jurisdiction of the agency often depends, to some extent, on land ownership. (See Box 6.) State statutes typically make a distinction between private and public lands in terms of regulatory permitting requirements. State public water statutes apply to publicly owned rivers, lakes and coastal waters, and a permit must be sought from one agency for alternation of public waters. State wetland statutes may apply to other wetlands, and another agency or bureau may issue this permit. Ownership is also significant to local wetland regulations. Local governments do not typically regulate public waters, but may regulate other waters and wetlands. Ownership determines who has regulatory authority and what statute applies.

Ownership is also important for deciding the appropriateness and legality of proposed activities.

Courts have held, under public trust doctrines and the doctrine of navigable servitude, that landowners have no right to fill, drain or otherwise modify publicly owned wetlands or to impair public rights in such waters. However, landowners may have riparian and water appropriate rights for certain uses and activities in such waters. Courts have held that landowners cannot generally claim any taking of their property when landowners propose to undertake activities that interfere with public trust or navigable servitude. Property ownership and rights become particularly important when a landowner challenges a permit denial in court as a "taking."

Finally, ownership helps determine whether a landowner may be encroaching on the rights of other landowners when carrying out a proposed wetland activity. Often landowners do not know where their precise underwater (or under wetland) property lines are located. Placing a fill in a wetland at such a site may trespass on adjacent property.

If there is any question about ownership, the regulatory agency may require the permit applicant to submit more detailed information showing boundaries, or the agency may undertake a field investigation (e.g., determine high water mark). Determination of property ownership is a particular problem for lake fringe, estuarine and coastal fringe, and riverine wetlands, where all or a portion of the beds of the water bodies are publicly owned, water levels fluctuate or accretion and reliction may further complicate boundary definition.

Box 6
Public vs. Private Ownership of Wetlands

Most lake, estuarine, and coastal wetlands and some riverine wetlands are wholly or partially in public ownership up to the high water mark, even where the upland is privately owned. Ownership of lands below the high water mark generally passed from the federal government to the states at the time of statehood. In general, states retained title to these lands as uplands, unless they were sold or otherwise transferred to private individuals. The beds of virtually all navigable lakes and coastal and estuarine waters are owned by the states to the high water mark. The beds of some navigable rivers are owned by the states. For an excellent discussion of ownership issues including public trust doctrine and thousands of case law citations see Slade, D. et al., 1990. Putting the Public Trust Doctrine to Work. Coastal States Organization; Washington, D.C.

Even if beds of navigable waters have been transferred to private ownership, beds and waters are typically subject to state public trust and, in some instances, federal navigable servitude. The beds of navigable rivers and streams are, in the majority of the states, owned by adjacent private landowners to the "thread" of the stream, but such ownership is also subject to state public trust and federal navigable servitude.

Many coastal, estuarine, lake and river fringe wetlands lay wholly or partially below the high water mark and are, therefore, subject to public ownership, state public trust or federal navigable servitude. In general, the beds of depressional, slope and flat wetlands are not owned by the public or subject to public trust or navigable servitude.

“Navigability” to determine whether the beds of lakes or tidal waters are owned by the state or if state public trust applies to these beds, as well as privately owned lake, tidal or riverine beds and waters, and is an issue of state law. “Navigability” to determine navigable servitude is an issue for federal law, and a federal test for navigability applies.

Unfortunately, determination of ownership is often complicated by the need to determine navigability and the high water mark. The common practice of describing private parcels in deeds not by metes and bounds or angles (degrees) and distances for upland boundaries, but to simply designate “to the waters edge” or to the “thread” of a stream for the remaining boundary also complicates determination of boundaries.

Boundaries may change over time as erosion and deposition occurs. In general, property boundaries do not change legally as a result of severe flood and erosion events, such as coastal storms. But, they do change where erosion or deposition are more gradual processes, as they are along the shores of many lakes and streams. In such circumstances, the owners gain title to the new upland and lose title to a new lake, estuary or stream bed.

Conclusion of Step 1

A regulatory agency can conclude Step 1 informally (without a written statement) or it can document findings (e.g., wetland boundary delineation shown on air photo) for the project file. More detailed documentation is usually only necessary when special issues or problems exist.

If a regulatory agency cannot conclusively determine jurisdiction based upon a rapid, preliminary examination, the agency may nonetheless continue the preliminary environmental analysis in Step 2. Jurisdictional issues, along with other issues, may then be resolved through field investigations.

CHAPTER 3: PRELIMINARY ENVIRONMENTAL ASSESSMENT: RED AND YELLOW FLAGGING

Step 2 in the Collaborative Assessment Process involves a preliminary environmental assessment for the proposed activity. There are substeps in preliminary environmental assessment:

(1) red and yellow flagging (the subject of Chapter 3)
(2) rapid assessment of wetland functions and values taking into account both landscape context and site characteristics, (the subject of Chapter 4), and
(3) assessment of broader environmental impacts if no obvious red flags or impacts on functions/values exist for the proposed project (also address in Chapter 4).

Red and yellow flagging and preliminary assessment of wetland functions and values are often undertaken simultaneously and have only been separated here for the purpose of discussion.

The Need for Preliminary Environmental Assessment

A Step 2 preliminary analysis involves a <u>quick, hard look</u> at environmental impact and the adequacy of impact reduction and compensation measures. It is intended to answer the questions: Will this project have significant environmental impact? If so, is immediate denial of the permit justified? Is a "yes" justified? If so, the permit may be issued subject to conditions. If the answer is "maybe," what additional studies are needed to mitigate these impacts?

A preliminary environmental assessment is consistent with National Environmental Policy Act (NEPA) requirements, as well as many state environmental policy acts and the need for preliminary assessment. NEPA requires that a federal agency prepare an Environmental Impact Statement if it finds, during the conduct of an environmental assessment, that an action may significantly impact the environment.

If the preliminary assessment indicates clear reasons for permit denial (red flags), then additional information gathering may be unnecessary. A project may be rejected on a variety of grounds such as: there is a practical alternative to the proposed activity; the activity fails to comply with other regulations; an area has been listed as endangered species habitat; the project applicant cannot demonstrate property ownership; or the area is subject to severe natural hazards.

If the preliminary environmental assessment indicates yellow flags, then more detailed research, including determination of impact reduction and/or compensation requirements, is needed. Permits are only unconditionally granted where minor impacts result from proposed activities. Determination of minor impacts may be based on the size of project, type of wetland and a wide range of other factors discussed in Chapters 3 and 4.

The preliminary environmental analysis suggested below is intended to be qualitative and does not require filling out complicated questionnaires or forms. However, an agency should keep notes about relevant factors in order to the form the basis for a formal decision on the permit application. The suggested procedure can't be tailored to regulatory agency needs and contexts.

Box 7

Strategies for Coping With Limited Budgets and Time Frames

Regulatory agencies can often combine red and yellow flagging strategies and preliminary review of functions and values and other environmental factors to cope with limited budgets and time. Strategies for accomplishing this include:

1. **Use a decision-making approach based on known information, which avoids the necessity of making difficult and problematic assessments and decisions based on these assessments.** For example, some permits for activities in wetlands and associated ecosystems may be rejected on alternatives analysis, natural hazards and other grounds before an expensive, time-consuming and error-prone effort is made to analyze specific functions and values.

2. **Use assessment approaches that narrow the issues through red and yellow flagging or filtering mechanisms to determine whether particular functions, values, hazards or other problems may exist at a site, and whether there may be significant impacts on society.** Such filtering mechanisms may involve:
   - Office analysis of permit applications and use of existing maps, photos, etc.
   - Consultations with other regulatory and resource agencies
   - Limited field visits
   - Public notices and analysis of comments
   - Public hearing and analysis of comments and testimony

3. **Tap the expertise available in regulatory and resource agencies, the academic community, interest groups and landowners through:**
   - Widespread distribution of project notices to solicit comments
   - Joint permit processing and the use of expert teams
   - Public hearings

4. **Apply wetland water or floodplain/riparian classifications (if appropriate), such as the NWI and the HGM classification, to suggest functions, values, restoration potential and other features.**

5. **Require mitigation and compensation measures, even if wetland/water/floodplain characteristics are not fully known.** Modify these measures only if a landowner can show that they should not be applied in a particular circumstance.

Consideration of Policy As Well As Scientific Issues

In beginning a preliminary environmental evaluation, an agency may best consider overall policy as well as scientific factors. Policy considerations can help identify red and yellow flags and determine the overall types, scale and accuracy of information that is needed at a site. An agency should consider three sets of policy factors in deciding whether a permit application deserves special attention. This will help determine the level of information gathering and analyses needed:

(A) Will this decision undermine a general regulatory policy or goal, or be precedent setting? More careful and extensive information gathering is needed for a permit application with general policy or precedent setting implications. For example, a permit application with cumulative impacts, such as the first fill proposed for a pristine wetland that may open the way for future permits, should be examined carefully. More extensive research will also be needed for a permit next to a national park or wildlife refuge, well field or estuarine sanctuary because the proposed activity may undermine a protection policy for the area.

(B) Is there some feature of the proposed activity that immediately suggests it will have significant environmental impact, given the type and size of the proposed activity, the type of wetland and the size of the impact, among other factors? Trying to quickly answer this question may appear to be jumping the gun on environmental analysis, but often it is not. The issue is whether some aspect of the permit application clearly deserves special attention. A regulatory agency can often determine this just by the type and size of a project and the amount of wetland that may be impacted. For example, it can easily be determined that a landfill that involves hundreds of acres of land and the loss of dozens of acres of wetland is a candidate for more comprehensive research. Similarly, detailed studies may be needed if an activity is proposed in a wetland adjacent to a water supply reservoir, where upland activities may pollute the water supply of thousands of people.

(C) Will this permit decision be subject to possible court challenge by other agencies, environmental organizations or the landowner? More careful and extensive information gathering, including record keeping, is needed for a permit that may be subject to court challenge. This may seem unfair from a scientific point of view, but courts demand more information to sustain regulations where there is severe impact on property owners. While it is impossible to foresee all controversies and court challenges, some may be anticipated. For example, even a superficial examination of impact of project denial on the project applicant can suggest a possible taking challenge if no economic uses remain for the entire parcel. If a landowner may have no economic use without the proposed permit, a regulatory agency should gather more detailed information to prepare for a possible court challenge and may wish to focus more on health, safety and nuisance considerations (e.g., flood hazards, water pollution).

A regulatory agency need not make a written determination if it concludes that a permit application requires special attention. However, all analyses from this point forward will need to be conducted with greater care, and perhaps with more accuracy and at larger scale.

Red and Yellow Flags

Red and yellow flagging is a quick, preliminary technique for deciding whether a permit application should be denied or subject to more detailed review. A red flag is an issue which justifies denial or a permit. Further investigation may or may not be needed. A yellow flag is an issue that deserves a cautious approach. Further investigation is needed. Red and yellow flag issues differ from one regulatory program to the next because goals and criteria differ. (Such flags usually include the factors listed in Box 10 and in Appendix D.)

Red and yellow flags may be identified from information in the permit application, maps or reports (e.g., flood maps, inventories of endangered species), aerial photos, comments from other resource or regulatory agencies, adjacent landowners, nonprofit organizations, or the public in response to notice procedures or public hearings. Red and yellow flags may be identified from field investigation.

A yellow flag issue (e.g., flooding) in preliminary analysis may emerge as a basis for permit denial after further data gathering and analysis. Conversely, an issue that initially appears to be a red flag may only require, after further consideration, more investigation and a cautionary approach. In attempting to identify yellow and red flags, the regulatory agency need not clearly ascertain that a particular impact exists. Further studies may be used to clarify this. It is enough to know that such impacts are possible or probable to decide that more investigation is needed.

Box 8
Goals for Step 2: Red and Yellow Flagging

Red and yellow flagging can:

- **Identify clear grounds for "early on" permit denial.**
- **Identify potential problems (e.g., increase in flood heights or erosion on other lands) that will need to be addressed by the regulatory agency, other agencies, or the permit applicant through more detailed studies or analysis.**
- **Help determine the wetland functions/values that will need to be examined in greater depth at the permit application site.**
- **Help avoid taking and other legal challenges by identifying early the permit contexts that may raise such problems (e.g., denial may result in no economic use for land) and help define assessment needs in these contexts.**
- **Determine changed or changing watershed conditions and other special factors that will need to be considered in analysis.**
- **Determine whether an individual permit application will require full-scale water dependency or alternatives analysis.**
- **Determine whether proposed federal activities or federally funded activities (whether or not subject to Section 404 permits) will have a significant impact on the environment, requiring preparation of an environmental impact statement.**
- **Identify groups and individuals who may have an interest in the permit application, who may be able to supply data, or who may wish to appear at a public hearing. They may then be notified about the pending application.**
- **Determine whether other agencies have jurisdiction over the permit application, and if so, clarify their needs and desires with regard to the application, and how they wish to proceed.**

Box 9
Examples of Red Flags

The following red flags may be identified. (See Appendix B for other lists of possible red and yellow flags related to functions/values used by various assessment techniques.)

- The activity does not comply with federal, state or local regulations or necessary approvals have not been obtained (e.g., 401 certification, CZM consistency review).

- The landowner has practical alternatives to the proposed activity.

- There is evidence of a severe natural hazard, such as a proposed activity in a FEMA or Corps of Engineers mapped floodway.

- There is evidence that the proposed activity will increase flood hazards, erosion or other hazards on other lands, violating adjacent landowner rights, threatening public safety, causing nuisances, etc.

- There is inadequate onsite waste disposal (septic tank/soil absorption systems do not work in high ground water contexts).

- The landowner has not demonstrated adequate ownership interest in the site of the proposed activity (e.g., the site is below the high water mark on a navigable lake, river or estuary).

- There is a documented endangered species or other protected species at a site.

- The wetland has been given special status by federal, state or local regulations, such as the Estuarine Sanctuaries Act, National Scenic and Wild Rivers Act, etc.

- The proposed activity may cause significant pollution because it is near a municipal well head (source water supply), involves an unacceptable discharge (e.g., toxic wastes) into a lake, river or stream, violates wetland water quality standards, etc.

Box 10
Yellow Flag Issues

General categories of yellow flag issues include the following:

1. Possible ownership problems. Knowing the type of wetland or related ecosystem may identify ownership problems. For example, the beds of lakes, estuaries and oceans are typically in public ownership. The beds of other wetlands are not. The beds of rivers may privately owned, but are often subject to navigable servitude. Ownership problems may also be suggested by the location of the activity on the lot (e.g., near a property line.)

Possible ownership problems may also be identified by: examination of a permit application, plot maps or other property ownership records; field inspection (boundary markers, nearby buildings, high water mark determinations); notification and comments from adjacent landowners; and public hearing.

2. Possible natural hazards. Potential natural hazards can be determined, in part, by knowing the HGM wetland type. Most wetlands immediately adjacent to the coasts, major rivers or major lakes are subject to significant flood problems during a 100-year flood and some, nearest open water, are in wave zones. Flood and erosion problems may also be identified by examining FEMA or other flood maps, USGS geologic maps (earthquake zones) or NRCS soils maps. Possible natural hazards may be established through notice and feedback from natural hazard agencies (flood plain, emergency management), examination of state or local hazard regulations, field visits, and feedback in public hearings.

3. Possible problems with onsite waste disposal problems and pollution. This is a potential problem wherever a residential or other building is proposed for a wetland area, there is no public sewer available, and there is no upland site for a septic tank/soil absorption field. This problem may be identified by examining the permit application, determining the availability of public sewers, and examining the plans for onsite domestic waste disposal.

4. Possible significant functions/values. For example, wetlands adjacent to major lakes, streams, estuaries and coastal areas are likely to have recreational, fishery and waterfowl values. Riverine wetlands along major rivers are likely to have flood conveyance functions. Specific functions/values may also be identified on endangered species maps, natural area maps and listings, maps and registries of historical sites, lake and stream inventories (available in many states), archeological site maps and listings, maps showing parks, and lists and maps of biological research areas. Soils and topographic maps may also suggest areas with potential significance. More specific functions/values may also be identified through notices to resource agencies, local governments, nonprofit organizations and through public hearings.

5. Possible conflicts between proposed activities and other regulations (zoning, tree cutting, floodplain). Possible conflicts are likely in coastal zones, lakeshore, scenic, wild river and other areas that are tightly regulated at state or local levels, or where industrial or commercial uses are proposed for wetlands in residential areas. Possible conflicts may also be identified by examining the permit application and copies of other regulations, providing notices to various agencies with regulatory jurisdiction, holding hearings and field inspection of properties.

6. Possible "taking" or other legal challenge if a permit is denied. Possible takings problems can be identified where an entire parcel is wetland; the parcel was purchased for development prior to adoption of the regulation; there are few existing or potential economic open space uses on the parcel; there is no upland development site on the parcel; there are no significant natural hazards; and where land values are high. A taking is particularly likely if a special value, such as an endangered species habitat, may prevent any alternation of the wetland. Possible taking problems can be identified by examining the permit application and making a field visit. The regulatory agency may need to undertake detailed data gathering and analysis, emphasizing documentation of natural hazards and other potential nuisance problems, if a taking is possible.

Box 11
Sources of Information for Red and Yellow Flagging

Sources of information for red and yellow flagging include:

- The landowner/consultant
- Wetland, flood, topographic, soils and endangered species maps; plans, regulations, books
- Direct observation
- Comments from regulatory agencies, nonprofit organizations, other governmental units, academic institutions and adjacent landowners
- Public hearings
- Joint permit processing procedures or multidisciplinary, interagency teams.

Five common red flags which may result in an early permit denial, include:

Alternatives Exist to the Proposed Activity

Although laws differ, wetland regulations generally require that applicants demonstrate there are no reasonable alternatives to a proposed wetland alteration. If a proposed project may have severe environmental impact, or if mitigation and compensation measures appear inadequate, regulatory agencies typically require a more thorough exploration of alternatives.

Principal questions for analysis of alternatives include:

(1) **Does a landowner have another location or design that will decrease or avoid wetland and related ecosystem impacts?** In general, a regulatory agency looks at the landowner's whole parcel (size, shape, topography, soils, etc.) to see if the proposed activity can be located on an upland portion. If this is possible, the permit application is often denied.

Some regulatory programs also look offsite the parcel to decide whether an alternative location exists. This is particularly true for mid-size and large projects, where the project proponent has the financial capability and flexibility to locate a proposed project (e.g., a shopping mall) at a variety of locations. However, there is less agreement among regulatory agencies concerning offsite analysis of alternatives and how practicality should be interpreted for a private landowner with a single parcel.

Regulatory agencies typically determine parcel characteristics for alternatives analysis based on (a) information from the project applicant in the permit application, (b) aerial photos, soil maps, topographic and wetland maps, and (c) site visits, where necessary.

(2) **Is the alternative practical?** The regulatory agency must typically decide whether alternatives are practical for the landowner. Relevant information often includes: parcel size and alternatives sites on the parcel, existing use of land, land value, taxes, regulations at time of purchase and the landowner's financial position. Many regulatory agencies also consider whether there are offsite alternatives.

If the landowner can make economic use of the entire parcel of land, many regulatory agencies consider this to be a practical alternative. This is consistent with the position of the U.S. Supreme Court and lower courts that regulations do not take private property if they are reasonable and provide landowners a reasonable economic return on entire parcels.

Economic use is a key factor at state and local levels in determining whether a variance should be granted for the proposed activity. (Variances are not available under the Section 404 program, but are in accordance with most local wetland regulations and some state programs). It is an important factor in terms of the Section 404 balancing test, which weighs public interests and private rights.

If a landowner has few or no economic uses for an entire parcel absent the proposed activity, a regulatory agency should undertake wetland assessment with particular care (e.g., boundaries, natural hazards). Regulations may be subject to a taking challenge. The gathering of health and nuisance information, including functions related to this information, is also particularly important under these circumstances.

The Project Fails to Comply With Other Regulations

A regulatory agency often will not issue a permit for a wetland/related resource activity if a proposed project does not comply with all applicable regulations, particularly if denial of such other permits is likely or approvals are required by law. For example, the U.S. Army Corps of Engineers will not issue a Section 404 permit when a state has denied water quality certification on such a permit under Section 401 of the Clean Water Act, or the state has notified the Corps that the permit will violate an approved Coastal Zone Management Program. The Corps will also not issue a permit if the permit will violate the Endangered Species Act or another federal statute.

Similarly, states and local governments often deny permits for activities in wetlands if they do not comply with wetland regulations and local zoning, floodplain and subdivision regulations, sanitary and building codes, grading codes, or other regulations. For example, an applicant that wants to place fill in a wetland for an industrial use will be denied if the wetland is part of a broader residential zone.

One of the most common grounds for denying a state or local application for a proposed fill and residential use of a wetland is failure to comply with sanitary codes that pertain to the use of septic tank and soil absorption systems for disposal of domestic, liquid wastes. If the landowner cannot first show adequate onsite water supply and waste disposal, local governments often refuse to issue permits for fills in wetlands when the fills will be used for residential purposes. Sanitary regulations typically require septic tank/soil absorption systems be provided for residences and other structures in areas without sewers. Sanitary regulations typically prohibit septic tank/soil absorption systems within a certain distance of lakes, streams and coastal waters, and high groundwater areas and areas with tight soils.

Denial of permits based on noncompliance with other permits, in some instances, raises “chicken or egg” problems because it may not be possible to determine whether a proposed permit will comply with other regulations until the application is submitted, in accordance with such regulations, and a decision is made.

In these circumstances, regulatory agencies may grant a wetland permit subject to obtaining other permits. Regulatory agencies may not require that other permits be obtained when evaluation of a wetland permit in other contexts may involve substantial and detailed fact-finding, with great costs to the agency or landowner and the issue of wetland impacts may be easily resolved. Regulatory agencies determine compliance with other regulations by examining the regulations themselves (e.g., local zoning) or, more commonly, by providing notices of permit applications to other regulatory agencies, with a request that these agencies determine compliance.

The Project Site Is Subject to Significant Natural Hazards

For a permit application in a wetland along a major river or stream, major lake or coasts, a regulatory agency often considers natural hazards early on. Natural hazards greatly influence the suitability of a site for development, and denial of a permit based on severe natural hazards is often politically and legally defensible. Reduction in natural hazard losses is a well-accepted regulatory objective by courts at all levels of government.

Flooding, including in some instances high velocity water and wave action, is the natural hazard of greatest concern in wetland regulatory contexts. This is particularly true for fills, structures, and other activities proposed for riverine, coastal and estuarine wetlands. Proposed wetland/related resource activities may increase flood and erosion problems on other lands. For example, fills may block flood flows, increasing flood heights and velocities on other lands. Residences or other structures placed in wetlands may also be damaged or destroyed. Sewage treatment plants and septic tank/soil absorption systems placed in wetland areas may not work, causing water pollution. Erosion, lack of structural bearing capacity of wetland soils and potential earthquake damage (which may be much more severe over filled wetlands than elsewhere) can also be problems.

How can a regulatory agency evaluate natural hazards? Examination of FEMA and other flood maps is a first step. Flood maps have been prepared for flood hazard areas adjacent to most major rivers, lakes, estuaries and the ocean for most of the nation. These maps typically show 100-year flood boundaries and elevations. Some riverine maps also show floodway areas and some coastal maps show high velocity wave zones. Flood maps do not exist for many smaller lakes and streams and for isolated wetlands.

In the absence of flood maps, knowing the type of wetland and the location of a proposed activity in relationship to a river, stream, large lake, ocean or estuary can help. In general, wetlands/related resources adjacent to major rivers and streams, large lakes and tidal waters may be presumed to be severely flood prone. In addition, physical evidence of flooding may be visible, such as flood marks on trees, debris, scour features, and large boulders (indicating high velocity flows), when a field visit is made to a wetland.

Wetland regulators can also consult with other agencies, such as floodplain management agencies, for evaluation of natural hazards, the impact of proposed activities on natural hazards, and the adequacy of protection or mitigation measures.

The Project Site Has Apparent and Important Functions/Values Which Will Be Significantly Impacted

Wetland regulators may deny a permit, early on, or require more detailed fact-finding if the proposed activity and its impact reduction and compensation measures have significant uncompensated impact on functions/values, such as presence of a rare and endangered species. More specific procedures for assessing impact on functions and values, when no early red flags appear, are considered in greater depth in Chapter 3.

The Project Site Has Other Important Environmental Characteristics that May be Significantly Impacted

Finally, a regulatory agency may deny a permit if it has other severe environmental impacts such as toxic wastes. See Box 12.

Box 12
Some Public Interest Factors Relevant to the Suitability of a Wetland Site for a Proposed Activity

Many additional factors are relevant to environmental impacts and the appropriateness of an activity at a wetland site. These factors may constitute red or yellow flags in a particular circumstance.

Man-made hazards:
- Toxics
- Oil or other wastes in wetland
- Other pollutants

Compatibility of proposed activity with adjacent uses:
- Residential
- Tourism
- Education and research
- Industrial
- Commercial

Impact of the proposed activity on public infrastructure:
- Roads
- Sewers
- Water Supply
- Electricity
- Storm water

Concluding Red and Yellow Flagging

If regulatory agency identifies one or more red flags, the agency may go directly to Step 4, whereby it makes findings and denies the permit application. If the regulatory agency finds no red flags but some yellow flags, the agency then conducts the second part of preliminary environmental analysis—more detailed assessment of functions and functions/values of the wetland and affected related ecosystems. It may also simultaneously begin a comprehensive examination of particular yellow flag issues, such as natural hazards.

CHAPTER 4: RAPID LANDSCAPE LEVEL AND SITE-SPECIFIC ASSESSMENT OF FUNCTIONS/VALUES

Assuming no obvious red flags, a regulatory agency now (as part of Step 2) more systematically determines whether a proposed project **may have significant impacts upon wetland and related ecosystem functions/values.** (Note some of these impacts will be revealed in red and yellow flagging). If significant impacts *may* occur, preparation of an environmental impact statement or comparable state or local environmental analysis will be required.

Qualitative Analysis of a Broad Range of Factors

We believe that a preliminary environmental analysis can best **qualitatively consider a broad range of factors** rather than focus with on only a few. We believe that experience over the last two decades suggests that a qualitative, collaborative, preliminary examination of both functions and values, which takes into account a range of relevant factors, often provides a more complete picture of potential impacts and their relevance to the public interest than many "rapid" assessment techniques for wetland functions or functions and values, which typically focus on only a few issues.

Simultaneously considering a large number of factors may appear difficult. However, common sense sorting of issues will often quickly suggest major relevant factors in a specific situation. We suggest that regulators focus on the **changes in specific functions/values** and other environmental features which will be caused by a specific proposed activity**.** Regulators do not need to know all functions/values of an impacted wetland.

Box 13
Examples of Wetland and Related Ecosystem Functions/Values

The following list has been drawn from regulatory statutes, ordinances, regulations and wetland literature. These functions/values depend, in part, on combinations of hydrological, biological, and chemical processes (termed "functions" by HGM). To some extent they also depend on overall wetland size and depth, hydrologic and ecological context, existing uses of the wetland, adjacent land uses, opportunity and social context.

Provide flood storage. Some riverine, depressional and other types of wetlands temporarily store flood waters, and reduce flood heights and velocities on downstream lands.

Provide flood conveyance. Some riverine wetlands convey flood waters, thereby reducing flood heights and velocities on upstream, adjacent and downstream lands.

Reduce wave damage. Some estuarine and coastal fringe, lake and river fringe wetlands reduce the force of waves, thereby reducing wave and erosion damage to back-lying properties and structures.

Provide erosion control. Many estuarine, coastal fringe, lake and river fringe wetlands help control streambank, streambed, lakeshore and estuarine shore erosion by reducing water velocities and binding the soil.

Reduce sediment loadings in lakes, reservoirs, streams, estuaries and coastal systems. Many fringing wetlands and others (depressional, flats) intercept and trap the sediment that flows into lakes, streams and estuaries.

Prevent and treat pollution:

• **Prevent pollution from entering water bodies.** Many types of wetlands intercept sediment, nutrients, debris, sediments, chemicals, etc. from upland sources before pollutants reach down-gradient rivers, streams, lakes, estuaries, oceans, ground waters.

• **Treat (remove) pollution in water bodies.** Wetlands located in lakes, streams, estuaries and depressions may remove sediment, nutrients and other pollutants from these waters.

• **Produce natural crops and timbers.** Many types of wetlands produce cranberry, blueberry, saltmarsh hay, aquaculture, wild rice, forestry and other natural crops.

• **Provide groundwater recharge.** Some riverine and depressional wetlands provide groundwater recharge, although most are discharge areas much of the year.

• **Provide groundwater discharge.** Some wetlands help maintain the base flow of streams and help reduce ground water levels, which would otherwise flood basements and cause other problems, by providing groundwater discharge.

• **Provide habitat for fish, produce fish.** Wetlands adjacent to lakes, streams, estuaries and oceans can provide food chain support, spawning and rearing areas, and shelter for fish.

• **Provide habitat for shellfish, produce shellfish.** Estuarine and coastal wetlands may provide shellfish habitat.

• **Provide wildlife habitat.** All types of wetlands may provide important habitat for mammals, reptiles, amphibians and birds.

• **Provide habitat for endangered and threatened species.** Virtually all types of wetlands may provide food chain support, feeding, nesting and substrate for endangered and threatened animals and plants.

• **Provide scenic beauty.** Many wetlands have aesthetic value. Scenic beauty may enhance real estate values, provide recreation and enhance ecotourism.

• **Provide recreational opportunities.** Many wetlands provide paddling, birding, hiking, wildlife viewing and other recreational opportunities.

• **Provide historical, archaeological and cultural opportunities.** Some wetlands, such as the Concord Marshes or the Everglades, have historical value; many others have archaeological values (shell mounds, burial sites).

• **Provide educational and research opportunities.** Many wetlands provide education and research opportunities for schools and government agencies.

• **Provide atmospheric gas exchange potentially important to the moderation of global warming.** Many wetlands produce oxygen due to plant photosynthesis; some wetlands are substantial carbon sinks.

• **Provide micro-climate modification.** Wetlands, particularly those near cities and other large de-vegetated areas, may reduce temperatures and reduce atmospheric pollution levels.

Box 14
Factors Considered in the Section 404 Public Interest Review

Section 320.4 (a)(l) of the U.S. Army Corps of Engineers Administrative Regulations requires consideration of the following factors in evaluating a Section 404 permit:

- Conservation
- Aesthetics
- Wetlands
- Fish and wildlife values
- Floodplain values
- Navigation
- Recreation
- Water quality
- Safety
- Mineral needs
- The needs and welfare of the people
- Economics
- General environmental concerns
- Historic properties
- Flood hazards
- Land use
- Shore erosion and accretion
- Water supply and conservation
- Energy needs
- Food and fiber production
- Consideration of property owners

Box 15
Sequencing Requirements for Section 404 Permits

Sequencing steps and requirements for reviewing Section 404 permits are set forth in the EPA's 404(b)(l) Guidelines (40 CFR Part 230):

Step 1: Determine whether the proposed project is water dependent.

Step 2: Determine whether practical alternatives exist for the proposed project.

Step 3: Identify the potential impacts of the proposed project on wetland functions in terms of project specific and cumulative effects.

Step 4: Identify how potential project impacts can be avoided or minimized in terms of project specific and cumulative effects.

Step 5: Determine appropriate compensatory mitigation for unavoidable project impacts.

Step 6: Grant or deny a permit to discharge dredged or fill material, based on a comparison of the values of the benefits gained from the proposed project versus the benefits lost from the proposed project.

Step 7: If a permit is granted, monitor compensatory mitigation to determine compliance.

Box 16
Wetland/Related Resource Characteristics Important to Capacity of a Wetland to Produce Goods and Services

- Size, shape, depth, geologic and landscape setting
- Climatological and hydrologic characteristics, including fluctuations in water levels, hydroperiod
- Overall ecological setting, including adjacent upland and aquatic habitat
- Water quality, water chemistry (e.g., pH) and nutrients
- Flora (vegetation): types, diversity of types and condition
- Fauna (animals): types, diversity of types and condition
- Soils
- Persistence, longevity of the wetland (i.e., will a wetland be here in 10 years?)
- Connectivity with other wetlands, floodplains, waters and upland habitat
- Possible changes in hydrology, due to urbanization, etc.
- Existing uses and alterations, restoration potential
- Presence or absence of buffers
- Presence or absence of active management measures (e.g., exotic weed control, water level control, fencing of cattle, etc.)

Suggested Procedures

How is a regulatory agency to quickly evaluate possible impact on functions/values?
We suggest that an agency answer the following four questions:

1. **What are the <u>types of wetland functions/values</u> that may be impacted, based on determination of the wetland class and subclass (using HGM, NWI)?**

2. **What are the <u>magnitudes of the wetland functions/values</u> that may be impacted, based on wetland size and location, type, information submitted by the project applicant, background information and field observations?**

3**. What are the <u>possible types of impacts and to what extent do they impact specific functions/values</u>, based on the specific project type and design, its location and proposed mitigation measures?**

4. **<u>What will be the societal importance of these impacts</u>, including the "opportunity" a wetland may have to serve the public, who may be affected, how many may be affected, how they will be affected and how seriously they will be affected?**

An agency can answer these four questions by simultaneously taking into account:

- the type of wetland (using HGM class) and functions/values associated with this type
- the context of the wetland in the landscape
- the location of the proposed activity within the wetland
- the type and magnitude of the proposed activity
- the condition of the wetland
- the opportunity a wetland may have to provide functions/values
- who may impacted by the changes in the wetland, how many may be impacted, how they may be impacted, and what their response might be.

We will now examine the four issues and steps in addressing these issues in greater detail.

(1) Qualitatively Identify Possible Types of Functions/Values That May be Impacted

In assessing potential impacts, a regulatory agency should first qualitatively determine whether there are wetland functions/values that may be significantly impacted at a proposed permit site. Possible types of functions/values that may be impacted may be identified by addressing the following more specific questions:

(A) What functions/values are suggested by the wetland class and subclass? As described in Appendix C, knowing the overall HGM hydrogeomorphic class and subclass of the wetland can suggest the important processes and functions and values which may exist at a site including the need for more detailed investigation of particular factors. The National Wetland Classification type as shown on National Wetland Inventory Maps can also help. If an HGM guidebook has been prepared for the class of subclass of wetland, this should be used.

Examples of types of functions/values which are suggested by simply knowing the class of wetland include:

- Coastal, estuarine, lake fringe, and river fringe often have recreational boating functions/values (canoeing). In contrast, many slope wetlands, flats, and depressional wetlands lack recreational boating functions/values.

- Many coastal estuarine, lake fringe, river fringe and depressional wetlands have significant fisheries functions/values. On the other hand, seasonal, depressional wetlands, slope wetlands and flats often have limited fishery functions.

- Many, if not all, riverine wetlands have flood conveyance functions. Many also have flood storage functions. Some depressional, lake fringe, and flats also have flood storage functions. However, slope wetlands do not usually have flood conveyance or significant flood storage functions.

Many more examples could be provided (see Appendix C).

(B) What functions/values are suggested by the overall landscape context? Is this a wetland on a stream with know flood problems. Flood conveyance and storage functions may then be particularly important. Is this wetland part of a wildlife migration corridor? If so, habitat values may be particularly significant. Does a wetland lie between agricultural fields and a water supply reservoir? If so, pollution control and sediment control functions may be significant.

(C) What functions/values are suggested by available flood, soils, topographic, endangered species, and other types of maps and written reports? Existing maps, written reports, GIS systems and other sources of information can suggest or document specific functions/values at specific sites (e.g. floodway maps indicating conveyance areas, endangered species maps indicating endangered species habitat.)

(D) What functions/values are suggested by the size of the wetland, scarcity of wetlands in the area, the condition of the wetland, and the landscape context? All of these factors can help suggest the types of wetland functions at a site. These factors are discussed in greater depth below in terms of estimating the magnitude of functions/values and the seriousness of project impacts.

(E) What functions/values are suggested by the collective knowledge of the regulatory agency and the regulatory team if the permit is being analyzed collaboratively? Individual team members or colleagues may have personnel knowledge acquired over a period of years pertaining to fisheries, waterfowl, bird watching, flooding and other factors.

(F) What functions/values are suggested by responses to public notice (and public hearing) if notice and/or hearing are provided?

(G) What functions/values are suggested by information provided by the landowner in the permit application? This should include a detailed description of the proposed project, including a map and photos of the site and a narrative.

An early meeting between the landowner and the regulatory agency or a collaborative assessment team (with collaborative permitting) can often help identify possible processes, functions/values and impacts on functions and values. The landowner (particularly for mid- to large-sized projects) may be required to provide a preliminary report addressing possible impacts on wetland functions and values

(2) Qualitatively Estimate the Magnitude of Functions/values at the Site

Having identified and narrowed the types wetland functions/values that may be encountered at a site, the agency then should then qualitatively estimate the magnitude of those functions (e.g., no functions/values, limited function/values, significant function/values, etc.). Information useful for suggesting types of wetland functions at a site is also useful for estimating the magnitude of functions/values. So, there is overlap. Magnitude of impact can be suggested by considering:

(A) What is the wetland class and subclass? Knowing the type of wetland can help the regulatory agency determine what types functions/values may be present, and their magnitude.

For example, a lacustrine fringe wetland will often have more fisheries value than a tiny stream, although both may have fish.

(B) What is size of the wetland? Often the magnitude of particular functions/values increases with the size of the wetland, although this is not always true. For example, a larger wetland will have more flood storage, fish spawning, and waterfowl production capacity. However, even small wetlands may be significant habitat for rare or endangered species.

(C) How scarce are wetlands and the wetland type in the area? There is a greater probability that wetlands play significant habitat roles (e.g. migratory birds, mammals, amphibians) and serve other functions (e.g. pollution control) if wetlands are scarce in an area. There is also a greater probability that rare wetland types are habitat for rare and endangered species. Proposed project impact upon a rare wetland type often requires more detailed investigation (Step 3) to determine whether rare and endangered species are present or the wetland has other special functions/values.

(D) What is the condition of the wetland? In general, wetlands in better condition also have more significant functions/values, such as habitat value. Projects affecting pristine wetlands need more careful analysis and permitting than those for altered wetlands because the condition of a wetland determines, in part, the magnitude of project impact on wetland functions/values. It also affects the adequacy of various impact reduction and compensation measures.

(E) What is the landscape context? In general, wetlands that are part of corridors or play significant buffering or other landscape ecosystem roles provide more substantial habitat, water quality protection, flood control, and other functions/values. See Box 19.

A regulatory agency can also use information provided by the regulatory team and information generated by public notice and hearing to estimate the magnitude of functions and values.

Box 17
Why Evaluate Condition?

To assess the magnitude of both present and future functions/values, regulators have found it useful to assess wetland condition relative to unaltered wetlands. Assessment of condition can help regulators:

- **Assess the magnitude of existing and projected functions/values.** A wetland in a natural or semi-natural condition often has a greater ability to produce particular goods and services, such as fish, waterfowl, birds, flood storage, and flood conveyance, than that an altered wetland. This is not always true, however, for specific functions because the ability of altered wetlands to produce a good or service may be greater for an altered wetland in some instances.

- **Assess the longevity or persistence of wetland functions/values.** The condition of a wetland often suggests the longevity or persistence of a wetland. Longevity is relevant to functions and values. A wetland that is rapidly filling due to sedimentation is worth less to society than one that will exit in perpetuity.
- **Assess the natural restoration potential of a wetland.** Condition can indicate whether a wetland is undergoing natural restoration, and the restoration potential of the wetland. For example, many wetlands drained for agricultural purposes are now reverting to natural wetlands due to sedimentation and vegetation in the drainage ditches, collapse of drainage tiles, and beaver activity. The magnitude of the projected functions/values of these wetlands is higher than for altered wetlands, where no restoration is possible. Knowing the condition of a wetland can also suggest the restoration potential of an impacted wetland.
- **Assess the adequacy of proposed mitigation and compensation measures, including mitigation ratios.**

A number of factors like those outlined in Box 21 are relevant to condition.

Box 18
Factors Relevant to Condition

- **What was the wetland like historically and what has changed?** Has it been partly drained? Filled? Is it subject to high rates of sedimentation or other threats that may destroy the wetland in a short period of time? Is it subject to pollution? Is the wetland being actively used for a specific purpose? Is it used for agriculture? forestry? stormwater discharge? other purposes Most functions/values are diminished by alterations. However, certain functions may be enhanced. For example, channelization and clearing of vegetation may increase flood conveyance.

- **Is the wetland now undergoing natural restoration (e.g., water levels increasing in a partly drained wetland)?** Will this restoration likely continue? A wetland undergoing natural restoration often has the potential for enhanced functions/values.

- **Is the hydrology of the wetland/related resource area changing due to urbanization in the watershed or other factors?** If so, what does this mean to wetland functions/values, such as habitat values, flood storage, and flood conveyance? Urbanization will usually increase both peak flood flows and total runoff. It will also increase pollution and sediment loadings.

- **What is happening to adjacent areas?** Wetlands/related resources protected by buffers or adjacent to public open space lands have greater habitat value. They are also less likely to be subject to pollution and sedimentation problems.

- **Will the wetland/related resource area be actively managed pursuant to the proposed activity?** A wetland with exotic weed control, water level control or fencing of cattle often has enhanced habitat functions/values.

Box 19
Importance of Overall Landscape Context

Some important functions/values revealed by examining the landscape context include the following, which may be stated as questions:

- **Is the wetland/related resource adjacent to a lake, river, stream, estuary, or ocean?** If so, the wetland will likely have water recreation, fisheries, waterfowl, water quality protection, wave retardation, erosion control, and, in some instances, flood conveyance functions/values. It will also be subject to flood and erosion hazards; it may be partly owned by the public or subject to public trust values. Such a wetland will typically be subject to state and local regulations. For these reasons, permit applications for altering wetlands adjacent to lakes, rivers, streams, estuaries, or the ocean typically require careful evaluation.

- **Are wetlands/related resources rare in the locality, state, or region? Or is this a rare wetland type in a locality, state, or region?** If either of these is true, a wetland is more likely to be habitat for rare or endangered species or a unique community. It is more likely to be important for water quality maintenance and pollution control, fisheries, waterfowl, among other purposes. It is a good candidate for detailed evaluation.

- **Does the wetland/related resource form part of a drainage way (either a permanent or ephemeral watercourse)?** If so, it is likely to have particular importance for conveying flood flows, reducing erosion and sedimentation, protecting water quality, and for fisheries and other habitat purposes. It is more likely to be part of a broader wildlife corridor, although other wetlands may also serve this role. A wetland that forms a portion of a drainageway is a good candidate for detailed evaluation.

- **Is the wetland connected with, contiguous to, and/or part of a larger wildlife corridor or area of protected lands?** Wetlands that form part of larger wildlife corridors are likely to have wildlife habitat value. Proposed alternations in such wetlands may impact not only the wetland, but also the larger protected area.

- **Are large populations located near or contiguous to the wetland?** If so, a wetland may have more opportunity to provide services to society. Destruction of the wetland may have immediate social significance.

Box 20

Importance of Landscape Context to Specific Functions/Values

Specific wetland functions/values often depend on overall landscape context and offsite, as well as onsite, features. Examples include:

Flood storage. The flood storage function/value of a riverine wetland depends on the flood characteristics of the river or stream and the size and shape of the entire wetland depression, including any berm, lip, or rim around the wetland. Protection of the wetland area alone will not protect much of the wetland's flood storage value, unless the topographic contours of the entire depression are also protected.

Flood conveyance. The flood conveyance function/value of a riverine wetland depends on the flood characteristics of the river or stream and the topographic contours of not only the riverine wetland, but also the area on both sides of the river or stream that are capable of conveying flood flows.

Fisheries. The fisheries function/value of a wetland depends on the characteristics of the wetland and whether the wetland is adjacent to and connected with a larger water body where fish may live, feed, and breed.

Waterfowl. The waterfowl breeding and feeding function/value of many wetlands depends on the characteristics of the wetland (if it has limited open water), whether the wetland is adjacent to a lake, river, or stream with open water, and the wetland's location in relationship to other wetlands.

Song Bird Habitat. The bird habitat function/value of a wetland often depends on the characteristics of the wetland and the adjacent buffer and upland areas, since many bird species nest in upland areas and use wetlands for feeding.

Mammal Habitat. The use of wetlands by raccoons, bears, deer, moose, mountain lions, and other mammals that do not live in wetlands often depends on adjacent upland habitat and the adequacy of the connections (corridors) between the wetland and upland habitats.

Reptile and Amphibian Habitat. The use of wetlands/related resources by reptiles and amphibians (e.g., snapping turtles, salamanders, frogs) depends on adjacent upland habitat and the adequacy of connections between the upland and wetland habitat, since many reptiles and amphibians spend only a portion of their life cycles in wetlands/related resources.

Recreational Uses. The use of wetlands/related resources by boaters and paddlers depends on the proximity of the wetland to open water and the ease of access to the wetland.

Pollution Prevention and Control. The pollution prevention and control functions of wetlands/related resources depends on the surface water runoff regime, including runoff from upland areas to lakes, streams, or estuaries, the position of a wetland in this regime, and its connections to other waters.

(3) Qualitatively Evaluate Possible Impacts on Specific Functions/Values, Including the Magnitude and Types of Impacts

A regulatory agency should next **qualitatively** evaluate the types and magnitudes of project impacts, including possible cumulative impacts of this project and other activities on specific functions/values, based on simultaneous consideration of project characteristics and the types and magnitudes of wetland functions and values already estimated. It is the interaction between the proposed activity and the wetland that is important in assessing and minimizing impacts, not the wetland or project characteristics alone. By considering project characteristics and wetland interactions, an agency can suggest the possible functions and values that may be impacted and narrow the wetland area and features that need to be examined, thereby reducing information gathering costs and time.

Often a regulatory agency can tell much about the magnitude of possible project impacts by knowing the type of project, its size and precise location, and the way it will be carried out. Box 24 lists some project characteristics relevant to the magnitude of impacts. Box 25 more specifically describes some impacts and how they may relate to specific functions or functions/values. Location of the activity within the wetland can also help suggest the types and magnitude of possible impacts on specific functions and values as suggested by Box 26.

Estimating cumulative impacts is particularly difficult. Consideration of cumulative impacts is facilitated if a development plan exists for an entire area, and a regulator can assume that all like properties will be similarly altered.

Some useful inquiries to help estimate the types, magnitude and irreversibility of impacts include:

(A) How much wetland will be affected and how will it be affected? In general, the larger the alteration, the larger the impact, although this is not always true. In general, larger projects should also be carefully examined, even if they do not involve large amounts of wetland alternation because of their potential impact on hydrology and water quality.

(B) Will the project affect fundamental wetland processes? A proposed activity that will affect fundamental wetland processes, such as a major alteration of hydrology (e.g., fill or drainage) may be assumed to have more significant impacts. Detailed examination of hydrologically-related and other fundamental processes is not possible in Step 2, but a regulatory agency can often gain important understanding of possible impact on hydrology or other fundamental processes by asking and answering (on a preliminary basis) the questions: “Where is the water in the wetland coming from? Where is it going? What are its characteristics? How will the proposed activity impact this water regime?”

(C) How sensitive is the wetland type (e.g., a bog) and how reversible will the changes be? For example, it is desirable to analyze with greater care a proposal for altering a wetland with irreversible impacts than a proposal to alter a depressional, cattail marsh, which may recover quickly.

(D) What is the condition of the wetland? In general, but not always, activities that affect pristine wetlands may have more significant impacts than those affecting altered and damaged wetlands.

Box 21
Project (Activity) Characteristics
Relevant to Impact

- Type of activity
- Size of activity
- Nature of activity/impacts (e.g., modification in hydrology versus simple vegetation removal)
- Manner in which activity will be constructed or implemented (e.g., construction practices)
- Manner in which the project will be implemented over time
- Possible wetland management (e.g., burning, exotic weed control)
- Proposed impact reduction measures
- Proposed impact compensation measures

Box 22
Possible Impacts as Related to Type and Design of Project

By considering the type of project, a regulatory agency can help narrow the impacts on functions/values that need analysis and determine the geographic scope of analysis. Examples include:

- **Filling of all or a portion of a wetland/water/related area (soil, dredge spoil, dams, dikes, levees, bulkheads, other structures).** Fill will permanently destroy all wetland processes, including functions/values for the filled area. In addition, fill (e.g. a road or levee) may cut off a wetland area from adjacent wetland, aquatic, and upland areas, substantially reducing pollution control, flood storage, flood conveyance, and habitat values for the remaining wetland area. Assessment for a fill should focus not only on functions impacted by the immediate fill area, but also the broader wetland and related adjacent ecosystem functions that may be affected.
- **Decreased water levels due to water diversions and ground water pumping.** Diversions and ground water pumping may destroy virtually all habitat functions/values that depend on the depth and quantity of water (e.g., waterfowl habitat, fisheries,). However, some functions/values may remain, such as flood conveyance and storage, depending on the circumstances.
- **Decreased water levels and substrate due to channelization and ditching or drainage.** Channelization and ditching often destroy all functions and values by converting the wetland to upland. Flood conveyance may remain. Assessment of channelization impacts, therefore, needs to consider impacts on the whole wetland and, in some instances, related aquatic systems.
- **Deepening of wetland due to dredging, placer mining, removal of topsoil, sand and gravel operations, channelization, etc.** Removal of wetland/floodplain/water substrate reduces or destroys certain types of habitat, such as fish spawning areas. It can also change a wetland system into an aquatic system and can contribute sediments and pollutants to the water column. However, certain functions/values may remain, such as flood conveyance, fish breeding and feeding, waterfowl production, and water-based recreation.
- **Water pollution.** Discharge of toxics, excessive nutrients, debris or other pollutants can destroy or damage specific types of plants and animals, depending on the type of pollutant, amount, duration, etc. However, flood conveyance, flood storage, and some pollution control functions/values may remain.

- **Sedimentation.** Sedimentation due to upland as well as wetland/related resource activities and changed hydrologic regimes (e.g., increased flow velocities and bank erosion in a stream due to channelization), or other activities can destroy all functions/values by permanently filling a wetland. More limited sedimentation can damage or destroy fishery and wildlife functions/values.
- **Tree-cutting, vegetation removal.** Tree cutting and other vegetation removal can temporarily reduce habitat functions/values and other functions/values, such as recreation, depending on the circumstances. However, other functions/values often remain.

Box 23
Project Impacts as Related to the Location of a Proposed Activity Within a Wetland

The location of a proposed activity within a wetland may suggest possible impacts to a wetland or related ecosystem. For example:

Deepening or reducing the outlet depth of a wetland. Deepening the outlet of a wetland/floodplain may greatly decrease the flood storage capability of the entire wetland and water levels throughout the wetland, and change the fishery, habitat, recreation, and other functions/values. On the other hand, placing fill or a structure at an outlet will often increase water depths, changing plant and animal communities.

Fill near the channel of a stream. Fills or other obstructions placed in a riverine wetland/floodplain near the channel of the river or stream often have much greater impact on flood conveyance than a comparable fill in a riverine wetland some distance back from the channel.

Fills in deep water portion of a wetland. Fills placed in the deeper areas of a depressional wetland may destroy or reduce the fishery by forcing fish into shallow water with resulting winter kill. Similar fill in outlying areas may have less impact on fishery. Fills at or near the open water portion of a river, lake, or the ocean will have greater impact on navigation and water recreation than fills in a landward portion of a wetland or floodplain.

Removal of wetland vegetation in high velocity zones of a coastal, estuarine, or riverine wetland. Channelization or other vegetation removal for sections of a wetland subject to high velocity waves or flows (e.g., portions of a coastal or lake fringe wetland adjacent to open water; streambed and stream bank riverine wetlands) will have more impact on wave retardation and erosion prevention than activities in other portions.

(4) Qualitatively Evaluate the Societal Importance of Projected Impacts

Some wetland assessment techniques, such as HGM, do not consider societal importance in the evaluation of wetland functions, although a regulatory agency may independently consider them. A regulatory agency cannot and should not ignore societal importance when determining the public interest or the compliance of a permit with regulatory goals. A regulatory agency can, on a preliminary basis, determine the opportunity and social significance a wetland may have and the other impacts of a proposed project on people. This evaluation must be **highly qualitative.**

(1) Opportunity. A proposed project may have significant impact if it substantially affects the opportunity a wetland has to provide functions/values to society. For example, a project that cuts off boat access to a wetland reduces the opportunity the wetland will have to serve recreation functions/values. Another example is a project that cuts off hiking to a wetland extensively used for bird watching, which reduces the ecotourism functions/values. Affects on opportunity should be examined with particular care for project proposals involving offsite and out-of-kind compensation, such as use of mitigation banks.

(2) Social Significance. Project impact will be more significant where large numbers of people may be affected and where health and safety or other serious threats to people or ecosystems may become issues (e.g., pollution of a municipal well field versus increased minor nutrients in a stream). A regulatory agency should consider who may be affected, how many will be affected, how they will be affected, and the possible societal reactions to changes in the wetland.

A regulatory agency cannot examine capacity, opportunity, and social significance in great depth in a preliminary environmental review. But, it can undertake an informal, hard look to determine whether there may be significant impact. Additional steps for determining opportunity and social significance are suggested in greater detail in the next chapter.

Concluding Step 2:
"No," Maybe," or Conditional "Yes"

Step 2 is concluded with the regulatory agency deciding whether the proposed activity **may** significantly impact wetland functions/values. If the regulatory agency decides that a wetland is subject to special problems or considerations that justify project denial, a significant red flag exists, Step 3 is omitted. The permit application goes directly to Step 4, where formal findings are made and the permit is denied. If the agency decides there are no red or yellow flags, and there are no significant impacts, Step 3 may also be skipped and the permit may be conditionally or unconditionally granted. Usually permits are issued subject to generic impact reduction and/or compensation conditions like those outlined in Box 25. If a there may be significant impact, but there are unresolved questions, the permit application will be subjected to more detailed investigations in Step 3.

The regulatory agency may indicate to the project applicant that information provided with the permit application is insufficient and that specific information is needed to evaluate the permit application. Or the regulatory agency may deny the permit "without prejudice" and provide suggestions about further studies that are needed and how the permit applicant might resubmit the permit with such studies.

Box 24
Typical Situation When Permit Application is Approved
(All of the following are present.)

- No red or yellow flags.
- No finding of significant individual or cumulative impact upon wetland functions/values.
- No or limited hydrologic modification.
- Use of best management practices for impact reduction.
- Routine compensatory restoration, creation, or enhancement (in some cases).

Box 25
Examples of Generic and Special Impact Reduction Measures

Generic Measures: Make sense in most contexts and can be applied on many types of projects.

- Require that project design disturb natural hydrology as little as possible.
- Require that as much fill as practical be kept out of a wetland/related resource area.
- Require contouring fills to change as little as possible in natural topography and water regime.
- Require revegetation of fill and riprap, and otherwise protect fill and other areas of exposed soil from erosion.
- Require revegetation, bioengineering to stabilize banks, other areas subject to velocity flows.
- Require that fills, grading, vegetation removal, etc. not be undertaken in the growing season.
- Require that dredge spoil be placed outside of wetlands and waters if drainage, dredging or channelization are undertaken. Contour spoil to form new wetlands.
- Require that upland filter strips be constructed to reduce sediment and other pollutants entering waters where wetlands are disturbed or destroyed.
- Require fencing of wetland.

- **Special Measures: Require more information and can be applied only in certain contexts and for certain projects.**

- Require design and operation of dams to mimic natural downstream flows, including flood flows.
- Require design and operation of dams to release sediments, mimicking natural sediment regimes.
- Require design of dams with fish ladders, other techniques to allow passage of fish.
- Require that levees, dikes be setback some distance from a river or stream to allow continuation of connected wetlands between river and levee.
- Require construction of detention areas and artificial wetlands to intercept stormwater, pollutants, and sediment before they reach natural wetlands.
- Require control of exotic plants, which may result from project disturbance.
- Require controlled burns to compensate for suppression of natural fires.

Compensation Ratios
Agencies may require relatively large, fixed compensation ratios for wetland restoration, creation, or enhancement (e.g., 3:1-20:1) when there is little detailed information available concerning specific wetland functions and values. Agencies may allow lower compensation ratios if permit applicants are willing to carry out more detailed analyses of wetland functions/values (Step 3).

CHAPTER 5: CARRY OUT MORE DETAILED ASSESSMENTS (IF NEEDED)

If the initial assessment reveals that there may be significant environmental impacts, the regulatory agency would now begin a more detailed assessment of these issues or problems (Step 3). This would usually be undertaken with the help of the landowner/consultant and, in some instances, and with the help of other agencies or a collaborative assessment team. Practical experience suggests that almost all mid-size and large projects involving substantial wetland alterations or offsite compensation measures will require a Step 3 analysis. However, the type and depth of the needed analyses will vary greatly.

The types of studies and the required levels of detail and accuracy will depend on the results of the preliminary analyses described in Chapters 1-4. They will also depend on factors, such as:

- The need for more detailed and accurate information if the permit application involves major policy issues or is precedent setting. For example, a proposal for a toxic waste dump or nuclear power plant in a wetland would need greater scrutiny than a proposal for a fill for a residential lot.

- Possible red flags and yellow flags identified at the site described in Chapter 3.

- The types and magnitudes of possible impacts to specific wetland functions/values (Chapter 4) or to the environment more generally.

- Significant changes in opportunity and social significance (Chapter 4) for wetland functions/values.

- Parcel characteristics and impact of permit denial on the landowner. More detail and accuracy is needed in wetland boundary delineation, assessment of natural hazards, and assessment of functions and values when there may be a potential "taking" due to economic impact on a landowner. Less detail and accuracy may suffice for a rural environment, where land values and taxes are low and existing forestry, agricultural, and other activities may offer economic uses.

More detailed studies may pertain to a wide range of issues or problems. Studies may involve:

- More detailed objective studies and analysis pertaining to wetland processes, functions/values, characteristics, project impacts, and the adequacy of compensation measures.

- More detailed assessment of social context, opportunity, and social significance.

Both will be discussed in greater depth below.

Box 26
Selecting a More Detailed Assessment Method

A regulatory agency should consider a variety of factors in selecting a more detailed assessment approach. This is intended to illustrate relevant considerations and is not intended to be inclusive.

What wetland management technique is being applied?

- For **highway other utility corridor planning** that compares alternative potential corridors, a WET-related approach or a regionalized HGM or IBI approach that allows comparisons between wetlands may be most appropriate.
- For **wetland regulation** involving a substantial mitigation proposal, one or more of the detailed assessment methods, such as HEC models for hydrologic analysis, HEP or IBI for biological analysis, and HGM for broader processes analysis, may be most appropriate, depending on the project.
- For **wetland restoration in a nonregulatory context**, WET-related comparative ranking models or Larson could be very useful to target sites. HEP and regionalized HGM and IBI models could be useful.

What is the stage of the project?

- For **general planning purposes** (infrastructure, land use, watershed), WET models may be quite useful. So may Synoptic, IBI and possibly HGM, if adequate models are available.
- For more **detailed site analysis and site planning**, more detailed field surveys, quantitative hydrologic models like HEC, stream stability models like Rosgen, and detailed biological surveys may be most applicable. HGM may also be useful.

What wetland functions/values or problems/issues need to be analyzed?

- If **biological features** and impacts are most in need of analysis, then a field survey, an HEP, an Instream Flow, HAT, IBI, or other biological model may be applied.
- If **hydrologic features** and impacts are most in need of analysis, then an HGM model, HEC, or other hydrologic model may be applied.
- If **stream stability** and impacts are most in need of analysis, then Rosgen, Proper Functioning Condition or another stream stability model may be applied.

What degree of accuracy is needed? If a low degree of accuracy is needed, then one of the WET-related approaches may suffice. If a high degree is needed, then a more accurate field examination or use of a more detailed assessment method like HGM (for processes) or IBI for comparative biological condition is suggested.

What scale of assessment is needed? If a site-specific assessment for a single wetland or several wetlands is needed, then a case-by-case assessment method may suffice, such as field biological assessment or WETHINGS. If a regional assessment of wetlands is needed, including comparative analysis of wetlands for highway corridor planning, land use planning, identification of restoration sites, or selective acquisition, than landscape or watershed approaches, such as the Synoptic approach, regional IBI models, WET-related models, regionalized HGM models, or Rosgen stream stability model need to be used.

More Detailed, Objective Studies

Regulators often find they need more detailed investigation of physical facts than is possible through a preliminary examination of a wetland and project impacts (Step 2) to resolve problems (e.g. boundary delineation), investigate functions and values, or evaluate the adequacy of impact reduction and compensation measures. More detailed studies may pertain to any one or all four of the principal questions suggested for a preliminary assessment in Chapter 3, including the types of functions/values which may be impacted, the magnitude of the functions/values, the types and magnitude of the project impacts, and the social importance of these impacts.

Regulatory agencies have often found it useful in carrying out more detailed studies to separate fact-finding from subjective value judgments. Fact-finding may include a broad range of subjects, such as ecological processes and conditions. For example, archaeological studies may be needed when a preliminary examination of a site reveals a shell mound. Detailed backwater computations may be undertaken (e.g., HEC models) to determine the impact of a proposed fill on flooding.

Detailed assessment of physical facts may concern a range of topics (see lists of red and yellow flags above), including but not limited to:

- Availability of alternative sites and designs
- More accurate wetland/related resource boundary delineation
- More accurate delineation of public/private ownership boundaries
- Wetland functions and values which may be impacted by the proposed activities
- Possible endangered, rare, or threatened species
- Possible flood and other hazards
- Possible archaeological or historical importance
- Possible nuisance impacts on adjacent properties
- Impact on significant functions
- Opportunities for onsite or offsite restoration, creation, or enhancement

A regulatory agency, a member of the collaborative team, and/or the landowner may use a variety of named (e.g. WETTHINGS) or less formal assessment approaches to provide more detailed, objective analyses (see discussion below). The approach used will depend on the specifics of the proposed activity, the wetland characteristics, the anticipated project impacts, and issues or problems identified in preliminary analysis. More detailed analysis of functions/values is particularly needed when a landowner wants to undertake offsite mitigation and must determine specific compensation needs to achieve a no net loss goal.

For example, a regulatory agency may apply one or more of the rapid assessment methods to provide a comparative evaluation of wetlands when, for example, alternative routes are under consideration for a new highway. However, as indicated in Chapter 3, no easy and simple, rapid assessment approach has emerged to gather all the hydrologic, animal species and other information needed due, in part, to the extremely complex and dynamic nature of wetlands. Air photos, satellite imagery, and other widely available information have proven useful but, due to fluctuations in wetland water levels, what is seen at one point in time is often not indicative of longer-term water levels, vegetation, or habitat.

Box 27
Observing Versus "Deducing"
Hydrology, Wildlife, Other Features

It is difficult to assess wetland/related resource functions/values, and possible impacts on those functions/values with a single field visit, air photo, or other one-shot observation. Water levels, vegetation, and wildlife vary seasonally throughout the year and from year to year. What is seen at one point at time differs from another point in time. Functions/values depend on long-term hydrology and vegetation, among other features.

Regulators have used four principal approaches to address the need for time-series information:

First, regulators in cooperation with the landowner/consultant and other agencies can conduct time-series studies, such as multi-year stream gauging for a river, installation and monitoring of piezometers for ground water elevation, the use of time-series aerial photos to track water levels and vegetation, and the use of multiple field visits to observe plants/wildlife. Long-term studies have the advantage of providing valuable documentation, but they are time-consuming and costly. They cannot be carried out in the typically short time frame of regulatory permitting. Use of such long-term studies is rare in the regulatory context and typically only occurs when such studies have been carried out in advance of regulatory permitting or there is a threat to an endangered species, a municipal well field, or some other function/value that justifies a long-term evaluation.

Second, regulators can use a variety of techniques to capture whatever time-series information is available. These include interviews and workshops with local birders, hunters, landowners, and others who may have made long-term observations at particular sites. This is sometimes undertaken in Step 2.

Third, regulators can extrapolate from known time-series information to unknown. For example, wetland regulators may use stream flow and ecological information from one study stream in a region to suggest stream flow characteristics and ecological characteristics for another stream.

Fourth, regulators can use various indicators, surrogates, and models to calculate, deduce, or infer long-term hydrology and plant/animal species from single field observations, aerial photos or other limited information. For example, soils information may be used to infer long-term hydrology because soils reflect long-term saturation. Hydrologic models (e.g. HEC) may be used to predict runoff and flood heights based on estimated rainfall amounts. Various combinations of vegetation, land form, soils, and other characteristics may deduce or characterize the capability of particular areas to produce certain plants and wildlife (e.g., WET, WETHINGS, HEP, HGM). Surrogates (e.g., one species of plant or animal) may be used to suggest the capability of an area to produce a broader suite of plants and animals.

The use of surrogates has been proposed in various wetland assessment methods. But, because of the range of simplifying assumptions, surrogates typically have considerable margins of error.

In carrying out more detailed assessments (or requiring that landowners/developers carry out assessments), regulatory agencies have often found that resource assessment approaches that have not been developed specifically for wetlands/related resources are useful. For example, wetland regulators have used hydrologic and hydraulic analysis techniques developed to evaluate the hydrologic functions of floodplains, rivers, and other features in the landscape. hydrologic and hydraulic analysis techniques have been used to determine wetland flood storage and flood conveyance (e.g., the "Rational Formula", HEC models). Regulators have applied wildlife evaluation models (e.g., HEP). Similarly, they have used instream flow models developed by fishery biologists. These approaches typically focus on a specific feature or issue. They are not, in general, comprehensive in their scope. Most do not consider opportunity or social significance.

Detailed examination of all available methods a regulator might apply is beyond the scope of this guidebook. We recommend Candy Bartoldus's useful description of 40 rapid assessment methods for Environmental Concern (Bartoldus, 1999). Some principal techniques examined in that report follow.

Examples of Assessment Methods

Methods available for more detailed assessment of functions, values or other wetland features include (1) rapid wetland assessment methods to provide overall (and in some instances comparative) evaluation of functions/values or functions, and (2) more specific assessment approaches that provide detailed analysis of specific functions or issues.

Available methods that provide more detailed assessment (see examples below) vary in terms of goals, issues considered, simplifying assumptions, accuracy, staffing needs, expertise needs, budgets and time required, adequacy in meeting legal needs, and other features. Many of these features are not readily apparent in the guidance documents, and there is typically little information in wetland literature on the uses and limitations of techniques. Consequently, it is not surprising that regulatory agencies have found it difficult to decide which technique or techniques to use.

Rapid Wetland Assessment Methods for Functions and Functions/Values

As discussed in Chapter 3, by 1999, more than 40 rapid assessment techniques had been developed to assess wetland functions or functions and values. However, they have generally proven to be quite expensive and time consuming, and have not developed the detailed information needed to assess the adequacy of impact reduction and compensation measures. It is difficult, therefore, to recommend any of them for general use. Nevertheless, regulators have found useful elements and have used these elements particularly for large-scale or linear projects (e.g. a road corridor) where it is desirable to compare wetlands.

Generalized functions/values assessment methods that incorporate lists of questions and matrices. A large number of rapid assessment methods have been developed to provide generalized, comparative assessment of wetland functions/values. The qualitative, collaborative assessment process suggested above provides a more adequate approach to assessment of wetland functions/values than most of methods. These methods have not, in general, proven very useful for evaluating individual permits, including the determination of compensation ratios if used alone.

However, these methods have been more useful when combined with other approaches and in evaluating alternative, proposed road corridors where alternative wetlands may be impacted. To use these methods, a regulatory agency must generally answer lists of questions for each wetland based on information provided in the permit application, available maps and surveys, and usually at least one field visit. These approaches often (but not always) provide more systematic analysis of functions and values for each wetland than suggested in Step 2. They typically do attempt to assign weights to various functions and/values. See, for example, Larson, J.S., ed. 1976. Models for Assessment of Freshwater Wetlands, Publication No. 32, Water Resources Research Center, University of Massachusetts, Amherst, MA.

WET and WET 2 were the first broad-scale wetland assessment approaches developed to evaluate a range of functions/values for specific wetlands in a regulatory context. See Adamus, P.R. et al. 1987. Wetland Evaluation Technique (WET), Technical Report Y-87, Volume II. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. WET was designed to evaluate 11 functions/values and the impact of proposed activities upon a number of targeted animal species. The assessor qualitatively evaluates the wetland by answering a series of questions. This creates a matrix. Capacity, opportunity, and social significance are considered. A similar approach, with numerical scores and weights, was developed by Hollands/Magee. See Hollands, G.G., and D.W. Magee. 1985. "A Method for Assessing the Functions of Wetlands," pp. 108-118 *in* J. Kusler and P. Riexinger (eds.), Proceedings of the National Wetland Assessment Symposium (1985), Association of State Wetland Managers, Berne, NY.

Many other matrices analysis models for comparison of wetlands were subsequently developed in Connecticut, New Hampshire, Maryland, Wisconsin, Oregon, Minnesota, and Ontario based on the Larson, WET, and Hollands/Magee approaches. See U.S. Army Corps of Engineers. 1988. The Minnesota Wetland Evaluation Methodology for the North Central United States. Minnesota Wetland Evaluation Methodology Task Force and U.S. Army Corps of Engineers, St. Paul District; NY.

Ammann, A.P. and A.L. Stone. 1991. Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire, NHDES-WRD-1991-3, New Hampshire Department of Environmental Services, Concord, NH.

Euler, D.L. et al. 1983. An Evaluation System for Wetlands of Ontario South of the Precambrian Shield. Ontario Ministry of Natural Resources and Canadian Wildlife Service, Ontario, Canada.

WET and similar matrices approaches were used extensively in the late 1980s and early 1990s for regulatory permitting and assessment of wetlands for planning purposes (Advanced I.D.'s, Special Area Management). Use has diminished over time, however, because these procedures are time consuming, complicated, and have proven inadequate for evaluating impact reduction and compensation measures and determining compensation ratios to implement a no net loss goal. In addition, the accuracy of these evaluations is often limited by simplifications, assumptions, and the failure to consider relevant factors.

Nevertheless, some elements of these approaches, such as lists of functions, lists of red flag issues, indicators, and annotated bibliographies, are useful and continue to be applied in regulatory programs. These approaches are most helpful in evaluating, in general, the relative value of various wetlands to determine the most appropriate location for a proposed highway or other large-scale project, where alternative locations are possible.

Qualitative analysis of functions/values. The U.S. Army Corps of Engineers. 1995. The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach, NEDEP-360-1-30a. New England Division's descriptive approach is different from other approaches and retreats from an attempt to assign numerical scores to functions and values. It is more qualitative and resembles the CAP process. It was developed in a region where there has been extensive experimentation with WET, Hollands/Magee, and other approaches, and is based on what has proven to be workable on individual permits.

This approach uses a multidisciplinary regulatory team (applicant's consultant, Corps of Engineers staff, and State and Federal agency staff) to evaluate the impact of project proposals on 13 wetland functions and values, including: ground water recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention, nutrient removal/ retention/transformation, production export, sediment/shoreline stabilization, wildlife habitat, recreation, education/scientific value, uniqueness/heritage, visual quality/aesthetics, and threatened or endangered species habitat. The document that describes the assessment method recommends that the project consultant first seek guidance from the Corps of Engineers, then evaluate the wetlands. The team will either be a party to this effort directly or review work results and offer comments.

The evaluation is a qualitative description of the physical characteristics of the wetlands, including a determination of the principal functions and values exhibited. The method rejects numerical methods unless the data is available to support the analysis. It prohibits arbitrary weighing of wetland functions and the ranking of dissimilar functions. The guide provides a simple evaluation form and calls for attachments, such as a sketch of a wetland in relation to the impact area and surrounding landscape, and an inventory of vegetation and potential wildlife species. It also calls for a graphical approach to wetland evaluation.

The document provides a draft evaluation form and an example of considerations that were taken into account for a New Hampshire highway project.

The approach is similar to Collaborate Assessment Process in many respects and ties into regulatory processes. It can be used in conjunction with comment, and notice and hearings; it is flexible and depends on discussion and negotiation; it uses a hierarchical, sorting approach to first determine relevant functions and then to focus on those factors in greater depth; it asks the project proponent for graphic, qualitative analysis, which can be understood by all members of a team; it relies on professional judgment and does not attempt to rigorously separate policy from fact; and, it considers a broad range of functions, such as recreation, heritage, education, and archaeological values.

More Detailed Analysis of Functions/Values or Other Issues/Problems

More detailed approaches for analyzing functions and values or other features include the following:

More detailed field observations/surveys. The most common approach for gathering more detailed information about a particular wetland feature, problem, or issue is to carry out (or require a landowner/consultant carry out) a more detailed field survey of the site to directly observe waterfowl, fish, mammals, reptiles, etc. or other features in the field. Field observations often do not involve use of a formal assessment technique, yet they are persuasive in court and provide factual information for denial or conditioning of permits.

Field observations and surveys may be used to not only determine wetland functions, but also to gather other types of information.

Some field surveys may involve the use of named techniques, such as the 1987 Corps of Engineers manual for the Delineation of Jurisdictional Wetlands. Formal use may also be made of transects and sampling procedures. More often, field surveys simply involve visual observations, note-taking, and photographs.

Use of hydrologic and hydraulic models (e.g., HEC, TR 20 others). Regulatory agencies (or landowners/consultants) have used a variety of hydrologic and hydraulic models to investigate flood conveyance, flood storage, erosion control, wave attenuation, and other hydrologic functions/values. These models can also be used to determine flood and erosion hazards at a site and the impact of a proposed activity on flood, wave, and erosion hazards.

For example, the Rational Formula an can be used to compute the quantity of runoff from a defined watershed area, based on rainfall, slope, area, and other factors. See, for example, NRCS (SCS) TR-20 computer program for Project Formulation Hydrology and TR-55 Urban Hydrology for Small Watersheds.

The Computer Program HEC-2, "Water Surface Profiles," is widely used by engineers in hydrologic studies to determine floodplains and floodways and the effects of fills, culverts, bridges, and other obstructions on water surface elevations. See, e.g., U.S. Army Corps of Engineers, Hydrologic Engineering Center, Floodway Determination Using Computer Program HEC-2 (1988); U.S. Army Corps of Engineers, Hydrologic Engineering Center, Training Document No. 26, Computing Water Surface Profiles With HEC-2 on a Personal Computer (1992).

Hydrologic and hydraulic models have been used in other contexts for floodplain management, stormwater management, watershed planning, stormwater, and other water-related programs to predict runoff, floodplain and floodway boundaries and elevations, flow velocities, and other hydrologic and hydraulic features. They have been used to evaluate not only the seriousness of flood hazards at a site (e.g., the 100-year flood elevation), but also the impacts of fills and other activities upon such hazards (e.g., backwater computations using HEC). They can also be used to project future hydrologic conditions by assuming various degrees of urbanization, impermeable surface, and density of development.

Hydrologic and hydraulic models typically make use of information gathered from stream gauging, rainfall estimates, and other sources of information combined with topographical, soils, vegetative cover, and land use information. These models provide quantified, numerical outputs for analysis of project impacts and evaluation of the adequacy of impact reduction and compensation. These models do not evaluate social significance. But, they can be used to determine the impact of various activities, including land use changes on specific downstream flood heights, etc. at specific locations (e.g., groups of residential structures). Hydrologic and hydraulic models are increasingly combined with GIS models to help predict future changes in hydrology.

Hydrologic information generated by these models, including mean depth of water, water velocities, and frequency and depth of flooding, can be useful in evaluating wetland functions/values since all functions/values depend on water regime. These models can also be used to determine flood conveyance and flood storage potential for a wetland, and wave retardation and erosion control potential; they can be used to determine flood and erosion threats at a site and the impact of proposed wetland activities upon those threats; and they can be used to evaluate the adequacy of project impact reduction and compensation measures.

However, data gathering to apply these models is often expensive since detailed topographic and hydrologic (e.g., stream gauging) information is needed. Global Positioning Systems and other techniques is reducing the cost of detailed topographic information. In addition, hydrologic information gathered for floodplain management, stormwater management, and other purposes can often be used for assessment of activities in wetlands, including wetland functions/values.

Use of stream hydrologic/geomorphic assessment approaches (e.g., Rosgen). Regulatory agencies have used a number of models to evaluate the morphology and condition of streams to determine functions/values, and restoration and management needs. The models evaluate the condition of streams versus natural streams in terms of stream slope and form. These approaches are increasingly used to determine possible erosion, flooding and other problems, the impact of activities upon these problems, and the adequacy of compensation measure. They are also used in planning and implementing restoration. See Dave Rosgen, <u>Applied River Morphology</u>, Wildland Hydrology, Pagosa Springs, Colorado (1997); L.B. Leopold, <u>A View of the River</u>, Harvard University Press, Cambridge, MA (1994).

Use of animal species and biological community evaluation models (e.g., HEP, WETHINGS, IBI (Indices of Biological Integrity, Instream Flow Models). Regulators can use a combination of field observations and various inferential (deductive) models to determine the capacity of particular wetland environments to serve as habitat for fish, amphibians, or mammals (e.g., IBI). These models can be used not only to determine functions, but also to establish water quality standards for wetlands, to enforce such standards, and to assist monitoring efforts.

For examples of these models, see HEP (Habitat Evaluation Procedures), U.S. Fish and Wildlife Service. 1980. <u>Habitat Evaluation Procedures</u> (HEP) Manual (102ESM), U.S. Fish and Wildlife Service, Washington, D.C.

Cable, T.T., V. Brack, Jr., and V.R. Holmes. 1989. “Simplified Method for Wetland Assessment”, Environmental Management 13, 207-213.
Whitlock, A.L, N. Jarman, J.A. Medina, and J. Larson. 1995. <u>WETHINGS</u>. The Environmental Institute, University of Massachusetts.
Adamus, P.R. and K. Brandt, <u>Impacts on Quality of Inland Wetlands of the United States: A Survey of Indicators, Techniques, and Applications of Community-level Biomonitoring Data</u>. EPA/600/3-90. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. (1990).
Davis, W.S., and T.P. Simon, eds. <u>Biological Assessment and Criteria. Tools for Water Resource</u>

Planning and Decision Making. Lewis Publishers, Boca Raton, FL (1995).

Use of approaches to evaluate restoration potential, identify restoration sites. A number of models have been developed to identify potential wetland restoration sites and to evaluate the restoration potential of wetlands, related floodplains, and aquatic ecosystems. See, for example, C. Bartoldus, E.W. Garbish, M. Kraus, Wetland Replacement Evaluation Procedure, Environmental Concern, St. Michaels, Maryland (1994), which recommends a procedure for calculating differences between the wetland to be impacted and replacement wetland in terms of six functions and 82 determinants. These functions include shoreline bank erosion control, sediment stabilization, water quality, wildlife, fish, and uniqueness/heritage.

For other guidance on the evaluation of restoration potential and condition, see Bureau of Land Management, Riparian Area Management, Process for Assessing Proper Functioning Condition, U.S. Department of Interior, Bureau of Land Management, Service Center, Denver, Colorado (1993, 1995).
Dave Rosgen, Applied River Morphology, Wildland Hydrology, Pogosa Springs, Colorado (1997).
C.R. Brown, F.O. Stayner, C.L. Page, C.A. Aulback-Smith, Toward No Net Loss, A Methodology for Identifying Potential Wetland Mitigation Sites Using a Geographic Information System, South Carolina Water Resources Commission Report No. 178, USEPA Report No. EPA904-R-94-001 (1993).

Assessment of overall ecological processes ("functions") using HGM. The HGM wetland assessment method was formally proposed by the Corps of Engineers and other federal agencies for use on Section 404 regulatory permits (see work plan published in the Federal Register, August 16, 1996). So far, the Corps of Engineers has published a variety of documents in addition to this action plan that describe this approach in greater detail. One is a procedural HGM document: Smith, D., A. Ammann, C. Bartoldus, and M. Brinson. 1995. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices, U.S. Army Corps of Engineers, Waterways Experiment Station, Wetlands Research Program Technical Report WRP-DE-9. More documents are on the way.

HGM was designed to help regulators assess overall wetland ecological condition and to establish compensation ratios. This approach has a number of new and interesting features in comparison with earlier rapid assessment approaches. HGM requires classification of wetlands by hydrogeomorphic setting (classes and subclasses), the establishment of profiles of classes through reference sites, and evaluation of wetland functions. It is the first technique to shift analysis from the end result--function/value--to the underlying biological, chemical, and other processes. This shift in emphasis encourages users to understand how wetlands work and facilitates analysis of the changes that projects will cause in wetlands.

The technique is quite complicated and time consuming. A variety of interim models have been developed, but there has been limited field testing to determine their validity in predicting processes (and ultimately functions/values), and it is unclear how quickly such interim models will become final. HGM develops only some of the information needed for analysis of functions/values and other factors for regulatory permitting. It does not consider opportunity or social significance, nor have the relationships between functions and functions/values been clarified. The practicality of this approach for routine permitting activities remains to be seen. It has received limited use in a regulatory context and questions remain concerning its application. However, the regulatory classification system, the information in guidebooks that characterize wetland processes, and the establishment of reference sites hold potential for improving assessment of wetland functions/values and those of related aquatic and floodplain/riparian ecosystems. Regional subclass guidebooks should also prove useful over time in helping regulatory agencies evaluate capacity and the impact of activities on capacity.

Box 28
HGM
Wetland Functions and Their Value

(From Smith et al., 1995. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices)

Functions Related to Hydrologic Processes	**Benefits, Products, and Services Resulting from the Wetland Function**
Short-Term Storage of Surface Water: the temporary storage of surface water for short periods.	Onsite: Replenish soil moisture, import/export materials, conduit for organisms. Offsite: Reduce downstream peak discharge and volume and help maintain and improve water quality.
Long-Term Storage of Surface Water: the temporary storage of surface water for long periods.	Onsite: Provide habitat and maintain physical and biogeochemical processes. Offsite: Reduce dissolved and particulate loading and help maintain and improve surface water quality.
Storage of Subsurface Water: the storage of subsurface water.	Onsite: Maintain biogeochemical processes. Offsite: Recharge superficial aquifers and maintain baseflow and seasonal flow in streams.
Moderation of Groundwater Flow or Discharge: the moderation of groundwater flow or groundwater discharge.	Onsite: Maintain habitat. Offsite: Maintain groundwater storage, baseflow, seasonal flows, and surface water temperatures.
Dissipation of Energy: the reduction of energy in moving water at the land/water interface.	Onsite: Contribute to nutrient capital of ecosystem Offsite: Reduced downstream particulate loading helps to maintain or improve surface water quality.
Functions Related to Biogeochemical Processes	**Benefits, Products, and Services Resulting from the Wetland Functions**
Cycling of Nutrients: the conversion of elements from one form to another through a biotic and biotic processes.	Onsite: Contributes to nutrient capital or ecosystem. Offsite: Reduced downstream particulate loading helps to maintain or improve surface water quality.

Functions Related to Hydrologic Processes	Benefits, Products, and Services Resulting from the Wetland Function
Removal of Elements and Compounds: the removal of nutrients, contaminants, or other elements and compounds on a short-term or long-term basis through burial, incorporation into biomass, or biochemical reactions.	Onsite: Contributes to nutrients capital of ecosystem. Contaminants are removed, or rendered innocuous. Offsite: Reduced downstream loading helps to maintain or improve surface water quality.
Retention of Particulates: the retention of organic and inorganic particulates on a short-term or long-term basis through physical processes.	Onsite: Contributes to nutrient capital or ecosystem. Offsite: Reduced downstream particulate loading helps to maintain or improve surface water quality.
Export of Organic Carbon: the export of dissolved or particulate organic carbon. Maintenance of Plant and Animal Communities: the maintenance of plant and animal community that is characteristic with respect to species composition, abundance, and age structure.	Onsite: Enhances decomposition and mobilization of metals. Offsite: Supports aquatic food webs and downstream biogeochemical processes. Onsite: Maintain habitat for plants and animals (e.g., endangered species and critical habitats), for agriculture products, and aesthetic, recreational, and educational opportunities. Offsite: Maintain corridors between habitat islands and landscape/regional biodiversity.

Indices of Biological Integrity. Many efforts are also underway to develop models for measuring the biological integrity and relative condition of wetlands. These efforts involve information gathering for particular plant and animal species for a range of similar sites with various levels of anthropogenic impacts. Information gathering typically pertains not only to plants and animals, but also to hydrogeomorphic setting, hydrology. Reference sites with no or little disturbance are identified, along with a suite of similar sites that represents various levels of disturbance. Plants, insects, amphibians, birds and other forms of life are compared at the various sites. Indicator species, which can be used to compare the relative condition of sites, are also identified. Quantitative indices, which allow the comparison of sites, are typically developed.

These biological surveys and indices have a number of important uses. First, the biological information gathered at site of a proposed activity can be used to determine the presence of endangered species, and the impact of a proposed activity on fish and wildlife. Biological information is also useful as a surrogate for the types and magnitudes of other wetland functions (e.g., food chain support, pollution control.) Indices can also be used to establish water quality standards for a wetland. For example, such standards can specify that water quality and other features (e.g. depth, vegetation) cannot be degraded to the point that there will be a loss of indicator species in a given water body. Alternatively, standards can specify that water quality and other features must be restored to the point that the water body will again support specific indicator species. Emergence of indicator species would indicate success.
Biological indices, and the background information and reference sites used to prepare such indices, hold promise for improving wetland assessment procedures for habitat functions and

values. However, development of biological indices is difficult, time consuming, and expensive. It is also difficult to develop accurate indices because of the many ecological zones within a single wetland. These zones shift by season and over a period of years as rainfall varies. Finally, the correspondence between biological integrity and many other wetland functions/values, such as flood storage, flood conveyance, erosion control, natural crop production has yet to be demonstrated.

Area-wide assessment of functions/values using the Synoptic Approach, GIS, and other approaches. The U.S. Environmental Protection Agency has proposed a synoptic approach to wetland assessment. This approach looks at wetland position in the landscape and overall landscape features to help evaluate wetland functions/values. (See Abbruzzese, B., S.G. Leibowitz, and R. Sumner. 1990. Application of the Synoptic Approach to Wetland Designation: A Case Study Approach, EPA/600/3-90/072, U.S. EPA Environmental Research Lab, Corvallis, OR.) It does not attempt to evaluate the functions/values of individual wetlands. The Synoptic Approach is broad brush, but has strengths evaluating wetlands in broader hydrologic, ecological, and policy contexts.

Other area-wide approaches that use GIS systems to provide landscape-level analyses have been developed in Michigan, Missouri, North Carolina, Maryland, and elsewhere. These, like the Synoptic Approach, consider soils, topography, location, and other factors. GIS models have been used in regulatory permitting in North Carolina and Maryland, but not as a complete substitute for case-by-case, on-the-ground analysis.

Evaluating Opportunity and Social Significance in Greater Depth

A number of qualitative approaches are also available to evaluate in greater depth the social/cultural context, including opportunity and social significance.

Box 29
Capacity, Opportunity and Social Significance

"Capacity" or **"efficiency"** refers to the natural-resource related ability of a wetland, and related water and land resources, to produce various goods and services of use to society. Capacity primarily depends on natural hydrologic, biological, and chemical processes, as well as other characteristics, such as soils, topography, and size. (See Box 18. See also Box 19 and Appendix E for more detail.)

"Opportunity" describes the ability of a wetland area to actually perform functions or to deliver certain goods or services to the public. For example, a wetland in a rural, wilderness setting may have certain capacity to remove pollutants, but there may be no pollutants to remove in such a setting. A wetland in an inaccessible rural area may have recreational potential, but there may be few users due to lack of access and long travel distances. This wetland lacks present opportunity to provide pollution control or recreation, but may have considerable future opportunity if development occurs in the area.

"Social significance" refers to the importance of wetlands/related resources to people and not simply the inherent capacity of wetlands to produce goods or services or the opportunity for such wetlands to perform specific functions. Social significance requires the simultaneous consideration of capacity, opportunity, and the people who may benefit or suffer costs from changes in a wetland. Assessing social significance requires a shift from examining the physical characteristics of wetlands to determining how a project affects goods and services and the attitudes and values of people. Consideration of social significance is needed in Step 2 for a number of reasons:

- Consideration of social importance is needed to assess the public interest when evaluating a Section 404 permit and applying similar criteria in state and local regulations. Consideration of social importance is also needed to make environmental equity determinations required by the Environmental Equity Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (1994).

If the projected activity project may have substantial impact on society, even limited impact on the resource may be unacceptable. For example, proposed damage to a wetland important to protecting the water supply of several million people may be unacceptable, even if limited damage to the resource were proposed.

Evaluating Opportunity

The opportunity a wetland now has or may have in the future to provide certain goods and services to society depends on a number of factors outlined in Box 30.. Opportunity and capacity somewhat overlap because both depend upon hydrologic and ecological context. For example, the capacity of a wetland to provide bird watching fisheries depends, in part, on present and future hydrologic regime and connectivity to other waters. A wetland with no water obviously has no fisheries capacity. Opportunity also depends on hydrologic regime and connectivity because a wetland cut off from adjacent waters has no opportunity to provide fish to adjacent waters.

Some approaches for evaluating opportunity in greater detail include:

- Examine land and water use inventories and plans for an area to suggest the opportunity that an existing wetland or proposed mitigation wetland has to influence existing or potential water or land use problems, such as water pollution or flooding.
- Determine existing and potential uses of a wetland by specific groups of people by examining air photos, visiting the wetland, or contacting fishing, bird watching, hunting, and other organizations.
- Examine demographic data to suggest the relationship of wetlands to the numbers and types of existing and potential users in areas for education, recreation, pollution control, flood and stormwater control, and other purposes.
- Carry out studies, such as HEC flood studies, to determine the importance of a wetland in storing or conveying flood waters and the possible impact on levees, houses, and other activities if this conveyance is not provided.
- Distribute notices about proposed projects to groups (e.g., bird watching clubs, fishing clubs) and publish notices in newspapers to solicit comments.
- Hold public hearings to solicit comments concerning existing and potential users and uses of areas.

Box 30
Assessing Opportunity: Some Relevant Factors

Some factors (listed as questions) relevant to assessment of opportunity include the following:

- How is the wetland presently used (e.g. bird watching, canoeing, etc.)?
- What is the location of the wetland in relation to existing and potential users (i.e. fishermen, bird watchers, recreational canoeists)?
- What is the location of the wetland in relationship to existing and potential watershed problems, such as pollution, flooding, or erosion, which are reduced or might be reduced by the wetland?
- What land and water use plans and overall regulations apply to the wetland and surrounding area?

Evaluating Social Significance

A regulatory agency can also qualitatively analyze social significance by utilizing the approaches outlined in Box 31 to qualitatively answer the following questions:

1. **Who will be affected by the project impacts?** This is significant from a number of perspectives. First, it can help determine whether a wetland impact is of statewide or national significance, rather than simply of local significance. Second, it can help characterize the interests involved. For example, private landowner riparian rights or public trust rights may be involved. Such legal rights may deserve special consideration in permitting. Third, it is relevant to social equity and social justice. For example, an urban wetland may be more important to urban minorities than a rural wetland.

2. **How many will be impacted?** A qualitative, generalized evaluation of the number of individuals who will suffer potential impacts is also relevant to the public interest. For example, a wetland that helps protect the water supply for New York City may provide benefits to more than eight million people, while another wetland may provide benefits to only a small number of individuals.

3. **How will they be impacted?** Wetland/related resources provide specific individuals with goods and services that affect society in different ways and have varying levels of importance. Characterizing the nature of the interest involved is an important step in determining importance to society. For example, impacts to a wetland that stores flood waters, thereby reducing downstream flash flooding, have health and safety implications. Similarly, a floodway that conveys flood waters without significant increase in flood heights will help prevent nuisances. Protection of health and safety and prevention of nuisances are afforded special weight by the courts.

4. **What weight does society attach to these impacts interests?** Evaluation of the significance that society attaches to particular interests is difficult because different segments of society give different weight to different interests. Nevertheless, importance can be qualitatively considered through common sense and a variety of approaches outlined in Box 33.

Typically, a regulatory agency will combine several of the following approaches for assessing social significance. For example, the agency may distribute the proposed permit application to a broad range of interest groups, publish a notice for comment, and hold a public hearing. The agency will also use common sense. It will not, typically, apply the other techniques listed in

Box 33 unless the permit application is particularly controversial or there are other special factors.

Box 31
Options for Assessing
Social Significance

Regulatory agencies have a number of approaches available to help assess public attitudes toward a project and the weight attached by society to particular functions/values of the wetlands that may be impacted. The first four are most commonly used. The remainder are too time consuming for most permits, but may be used in special circumstances. All produce qualitative results.

Commonly Used Approaches:

Regulatory agencies can elicit response from various segments of society concerning social attitudes toward protecting/allowing the destruction of wetlands and the adequacy of mitigation measures by circulating permit applications for review. The most broadly used technique to solicit feedback on public opinion and preferences from agencies and groups for a specific proposed permit is to provide notices of proposed permit applications to other agencies and to the public, and to examine the resulting comments to the proposed activity. Responses do give the regulatory agency some idea of the types and numbers of concerned individuals and the seriousness of their concerns.

Regulatory agencies can elicit response from various segments of society by holding hearings. Public hearings are also broadly used to gather information and to gauge public opinion, particularly on controversial projects. Hearings can also give regulatory agencies some idea of the types, numbers, and seriousness of public concerns.

Regulatory staff can use their ears, eyes, and professional judgment to recognize values held by society. Newspapers, television, interaction with interest groups and the public will help agencies recognize values broadly held by the public. This is, admittedly, very subjective. On the other hand, a regulatory agency does not need an independent poll to determine that the public does not want wetland landowners to pollute a public water supply.

Regulatory agencies can consult locally adopted plans and regulations to determine local priorities for protection and restoration. For example, the Lane County Regional Planning Agency undertook a detailed wetland assessment process and prepared a detailed wetland plan for West Eugene, Oregon. This assessment and planning process used a broad range of techniques to gain feedback from various groups and individuals concerning what wetlands should be protected, including one-on-one consultations, questionnaires, and public workshops. The plan was ultimately submitted to the electorate for approval and is now used as the basis for regulatory permitting.

Regulatory agencies can examine statutes, ordinances, and other legislative acts to determine what legislative bodies think is important and the possible weight afforded specific factors. For example, the Clean Water Act states the overall goal of “restoring and maintaining the chemical, physical, and ecological integrity of the Nation’s waters.” Similarly, state and local statutes, ordinances, and regulations state legislative priorities in goal statements and regulatory criteria. In some instances (e.g., the Endangered Species Act), legislation may also suggest the weight given to particular functions or functions/values.

Other Approaches that may be Used in Special Contexts:

Regulatory agencies can, with the help of legal documents and their attorneys, determine wetland functions and values that have been afforded legal status as public rights. Some wetland functions, such as recreation, may be protected under public trust concepts in a state. Some wetland functions, such as flood conveyance, may also have legal status in terms of landowner rights and duties. For example, in most states a wetland landowner who blocks flows through a fill may be successfully sued by other landowners on nuisance, trespass, negligence, or other grounds.

Regulatory agencies can undertake economic analyses for wetland functions and values at specific sites. Determination of economic value can help gauge overall economic value to society. However, economic valuation is typically time-consuming, expensive, and subject to many assumptions and uncertainties, particularly with regard to non-market values. Social values are also not easily translated into economic values.

Regulatory agencies can, in some instances, subject the question of value directly to local elected officials. For example, a wetland regulatory agency may submit a proposed special exception, variance, or wetland permit or proposed conservancy zone amendment to a local council for a vote to determine how the legislative body feels about protecting a specific wetland.

Regulatory agencies can subject the question of value to executive commissions or committees. Often local regulators submit proposed permit applications to appointed soil and water conservation boards, conservation commissions, or planning agencies for reaction and comment.

Regulatory agencies can, in some instances, subject the question of value to direct vote by the public. At the local level, proposed zoning amendments that may accompany permit applications may be placed on voting ballets for direct vote. Or, local land or water use plans that have wetland components may be subjected to direct vote.

Conclusion of Step 3

Step 3 concludes when the studies and further evaluation necessary to apply regulatory criteria and goals to the permit application are completed. The regulatory agency can then make findings and formally deny, issue, or conditionally issue a permit. See Step 4.

CHAPTER 6: DENYING, APPROVING, OR CONDITIONALLY APPROVING A PERMIT APPLICATION

This chapter addresses the fourth step in our proposed process. It involves the application of information gathering and analysis into final decision-making. The agency makes formal findings, determines compensation requirements, and makes a decision about the permit application.

In this step, the regulatory agency or team must not only determine whether the proposed activity is in the public interest, but also apply one or more specific standards, such as no net loss of function and/or acreage, no adverse impact on endangered species, no violation of floodway and floodplain regulatory standards, or compliance with water quality criteria.

For a “yes” or “conditional yes” of a small, routine permit, the regulatory agency or team may make few formal findings and simply issue a permit. Formal findings are more likely needed if detailed conditions will be attached to permit issuance, if the permit is controversial or may result in a court challenge. A regulatory agency typically prepares more formal findings for any denial or conditional denial.

For conditional approval of mid-size and large projects with compensation proposals, Step 4 often involves negotiation with the landowner/consultant. This negotiation may pertain to a variety of aspects of project design and implementation, including total amount of fill and excavation, revegetation, wetland restoration or creation, among other features. The results of the negotiation are reflected in the compensation ratios, formal findings and the permit conditions.

Establishing compensation ratios for larger projects is typically part of this negotiation process, although evaluation of the adequacy of compensation ratios may also take place in Steps 2, 3, and 4.

Compensation Needs and Requirements

With the establishment of the no net loss of function goal (or an equivalent goal) at all levels of government, the compensation needs, evaluation of the suitability of various areas on a parcel or offsite for providing compensation, and onsite or offsite compensation ratios have become more important in regulatory permitting for many mid-size and large projects. Consequently, information gathering and analysis to meet these needs has also become important.

Regulators must often evaluate the adequacy of compensation measures on a preliminary basis as part of Step 2 analysis. More detailed examination of proposed compensation often takes place in Step 3. However, final negotiations on compensation ratios often take place at the stage of final permitting in Step 4. A variety of factors outlined in Box 32 are relevant to suitability of various areas (onsite or offsite) for providing compensation (restoration, creation) for project impacts. Where project mitigation is proposed in the initial permit application, these factors need to be considered in earlier steps, as well as in final permitting.

Box 32
Evaluating Restoration/Creation/Enhancement Potential

Many factors are relevant to the restoration/creation/enhancement potential of a wetland/related resource site and the corresponding compensation ratios required to offset specific impacts at another site. These include:

Existing and potential hydrology of a site, including water depth, quantity, quality of water, maxima and minima, hydroperiod, velocities, and water quality. Hydrology is the most critical parameter for wetland restoration, creation, and enhancement because all wetland/related resource characteristics depend to some extent on the water regime. Required hydrology is, of course, quite different for fishery production versus song bird use. Various combinations of hydrologic parameters, such as water depth and hydroperiod, combined with soils and other onsite and offsite characteristics, will determine the functions and values of the restored, created, or enhanced wetland. With too much water, sites become aquatic ecosystems. With too little water, they remain uplands. Relevant information includes:

- Existing sources of water, water depths, velocities, hydroperiod, salinity, temperatures, etc.
- Alterations to original hydrology (e.g., fills, drainage, etc.)
- The permanency of alterations and whether a wetland might naturally restore itself (e.g., original water levels returning due to filling of drainage ditches by sediment, collapse of subsurface drainage tiles)
- Possible future changes in hydrology. It makes no sense to restore a wetland when there will be no water in ten years.
- Costs of correcting alterations

Other on-site conditions:
- Soils
- Vegetation
- Exotic species
- Existing land and water use.

Size. In general, the bigger the site, the better for restoration, but this is not always the case.

Proximity of the site to other wetlands/related resources and waters, and the presence or absence of connections to other water bodies. Many functions/values, such as water recreation, fish habitat, wave retardation, erosion control, and flood conveyance depend on the adjacency of a site to other waters and the adequacy of the connections or pathways between the site and other waters.

In addition, if a site is connected to other waters these waters may be a natural source of seeds for revegetation of the wetland and for entry of and fish and shellfish.

Relationship of wetlands/related resources to upland habitat, presence or absence of buffers, surrounding land uses. Functions and values are, to a considerable extent, determined by overall hydrologic and ecological context.

Possible threats to the restoration or creation project. Possible threats may include sediment, pollution, high velocity flows, water diversions, and encroaching uses (cattle, dogs, dirt bikes, etc.).

The type of project sponsor and whether active management will take place. Who will undertake the project and whether long-term management will occur are important in evaluating the probability of long-term success. In general, there is a greater probability of success when the project is undertaken by an expert organization with experience in restoring and creating wetlands, a commitment to making the project work over the long run, and a commitment to actively manage a wetland in terms of control of exotics, water level manipulation (if necessary), fencing, controlled burns, and other active management.

Who will benefit, who will incur costs. A major issue in offsite wetland restoration, creation, or enhancement and the use of mitigation banks in a variety of contexts is not whether particular wetland functions and values can be restored, created, or enhanced, but what segments of society will benefit from any restoration/creation and suffer costs from the destruction of the original wetland. For example, it is not enough to know that flood storage or conveyance potential will be restored or created at some location if wetland destruction results in increased flooding of specific downstream properties and the proposed restoration, creation, or enhancement does not alleviate this problem.

Establishing Compensation Ratios

Compensation ratios need to reflect the condition of the original site, the proposed compensation area, and other factors, such as the probability of project success, based on the type of wetland, the experience of the project proponent, whether long-term maintenance is proposed, and other factors listed in Boxes 33, 34.

The HGM methodology has been developed to help establish compensation ratios by determining the condition of a wetland relative to a wetland in a natural state. Condition can provide useful and important information for establishing compensation ratios, but assessing the condition of a wetland provides only some of the information relevant to appropriate ratios and determination of whether no net loss of function has occurred (see Boxes 33 and 34).

Conclusion of Step 4

The conclusion of Step 4 is action on the permit application: outright or conditional denial or outright or conditional approval.

Box 33
Factors Relevant to Establishment of

Mitigation (Compensation) Ratios

Some major factors relevant to establishment of mitigation ratios include:

- **The overall ecological condition (including persistence, biodiversity, ecosystem integrity) of the original wetland versus the probable ecological condition of the replacement (restoration/creation) wetland/related resource.** Larger ratios are justified when a replacement wetland will be less persistent, diverse, or have less ecosystem integrity than the original wetland.
- **The opportunity that society has to use the original wetland versus the opportunity that society may have to use the replacement (restoration/creation) wetland/related resource.** Larger ratios are justified when a replacement wetland will be less available for public use; small ratios are justified when a replacement wetland will be more accessible to a larger number of people.
- **The range and magnitude of functions/values of the original wetland/related resource versus the probable range of functions/values of the replacement (restoration/creation) wetland.** Larger ratios are justified when a replacement wetland will have a smaller number of functions/values with lesser magnitude than the original wetland.
- **The wetland/resource type and probable project outcome for this type.** Larger ratios are justified for the wetland types that have proved most difficult to restore or create, resulting in greater chances of project failure. Difficulty is determined by how hard it will be to restore or create original or comparable hydrology. In general, difficulty increases in the following order: (a) estuarine (shallow and deep marsh), (b) coastal (shallow and deep marsh), (c) lake fringe and stream fringe (shallow and deep marsh), (d) depressional (shallow and deep marsh), and (e) flat and slope (shallow and deep marsh, shrub).
- **Whether restoration or creation are involved.** Larger ratios are needed for the difficult efforts to <u>create</u> functions/values with the lowest probability of success, such as restoration or creation of endangered or threatened species habitat. Smaller ratios are justified for less difficult efforts to restore or create functions, such as flood conveyance or storage, which also have a greater probability of success.
- **The expertise and experience of the agency/consultant that proposes to carry out the project.** Larger ratios are justified for less expert and less experienced project proponents.
- **The length of time it will take for the restoration to become fully functioning.** Larger ratios are justified when it will take many years for a project to be fully functioning.
- **Threats to the restoration site.** Larger ratios are justified when there are threats to compensation sites (changes in hydrology, sedimentation, water pollution, etc.).
- **Whether the site will be susceptible to mid-course corrections.** Larger ratios are justified when the site has little mid-course correction capability; smaller ratios are justified when there is more correction capability.
- **Whether there will be monitoring to provide the basis for mid-course corrections.** Larger ratios are justified where there will be little or no monitoring.
- **Whether active management (with adequate guarantees) will take place over time.** Larger ratios are justified where there will be not active management; smaller ratios are justified where active management (e.g., fencing, exotic weed control, controlled burns) will be available.

Box 34
Why Assessment of Capacity Alone is Insufficient for

Establishing Compensation Ratios

Proposals have been made (e.g., the HGM method) to evaluate project impacts and to determine mitigation and compensation needs based primarily on assessment of impact on wetland functions, without formally considering how these processes (e.g., water conveyance) relate to services (e.g., flood storage or conveyance) and the opportunity these services may have to provide benefits to society or the significance of these benefits to society.

Sole consideration of processes does simplify project evaluation. It does not provide adequate information, in itself, for a public interest review or for establishing the adequacy of compensation needs and ratios.

The HGM method has been developed, in part, to establish wetland compensation ratios for residual impacts, including the computation of credits and debits for mitigation banks. HGM compares the condition of a wetland with a subclass in the defined reference domain. It does so by characterizing wetland subclass, by preparing profiles of wetland characteristics for that subclass through the use of reference sites, and then by comparing the condition of a specific wetland with other wetlands in that subclass. HGM assumes the highest functioning wetland is a wetland in a natural condition and compares other wetlands within a reference domain with wetlands in a natural or semi-natural condition. The rating a wetland receives (on a .0 to 1.0 scale) is then multiplied by acreage to suggest compensation ratios.

HGM stops there. It does not translate processes into services, nor does it assess opportunity or social significance.

HGM does hold considerable promise for improved evaluation of basic wetland processes and wetland condition relative to other wetlands. It can improve decision-making in terms of these two types of information. But, its failure to consider services, opportunity or social significance limits its usefulness to establish compensation ratios consistent with the no net loss goal and the public interest review process, unless supplementary procedures are applied.

Consider, for example, the assessment of functions (processes) using HGM in a typical urban setting for a small urban wetland. Assume that a landowner is proposing to fill or drain a two-acre urban wetland and wants to buy credits from a mitigation bank or to create or restore a wetland offsite in a rural setting.

Natural or nearly natural wetlands that operate at the highest level of functions within the reference domain for this subclass may be assigned a score of 1.0 (or close to a 1.0). Other wetlands with various degrees of alteration and levels of natural function will be assigned lower scores (e.g., 0.1-0.9). The two-acre urban wetland will then be assessed using this rating scheme.

How will the urban wetland fare?

The typical urban wetland has been partially drained or filled and is subject to hydrologic changes. It will, therefore, receive a lower score of .2 to .6 for most functions, if the reference domain contains relatively unaltered wetlands. If the reference domain were altered wetlands, the result would be different. Let us assume relatively unaltered wetlands in the reference domain, with an overall score for the urban wetland of .5.

What does this mean for compensation ratios if only ecological capacity is considered, rather than ecological capacity, opportunity, and social significance?

It means that the landowner/developer might propose to destroy two acres in the urban setting and replace it with one acre in a rural setting (2 acres x .5=1; 1 acre x 1.0=1) because, according to HGM, the condition scores are multiplied by acreage. While replacement of a two-acre urban wetland with a one-acre rural wetland might make ecological sense from the perspective of certain animal or plant species (some ecologists would strongly dispute this), would such a result be consistent with the public interest? Would it actually replace wetland goods or services or would it simply replicate **certain** wetland characteristics and processes at another site?

This is a critical question.

The opportunity for a wetland to provide goods and services to people is often much greater in an urban setting. For example, an urban wetland with the same capacity as a rural wetland to reduce pollution or provide flood storage often has much greater opportunity to perform these services than a comparable rural wetland. Urban runoff is typically very polluted and flooding is a particular problem in urban areas.

The social context and societal use is also often significantly greater in an urban wetland than in the rural wetland. But, this too is not considered. Tens of thousands of people who live near a wetland, lake or stream protected by such a wetland may directly benefit from the pollution prevention, flood storage or conveyance, educational, interpretation, or other functions/values of a wetland in an urban setting. Very few may enjoy those same benefits from a comparable wetland in a rural setting. There are social justice issues involved as well. Most minorities live in urban areas. Destruction of wetlands in urban areas and their restoration or creation in rural settings will significantly shift the incidence of benefits from rural to urban areas.

Failure to consider the impacts of such a shift would also, potentially, violate the Executive Order 12898 which requires that "(e)ach Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act of 1969…."

As noted above, HGM and similar approaches that focus on ecological capacity alone are useful in providing **some** of the information needed to compute compensation ratios. But, supplementary information gathering and analysis techniques are needed to help regulators determine the public interest.

Should such supplementary information gathering and analysis of opportunity and social significance be part of a formal assessment process or be left to the informal devices of individual regulators? Experience with numerical, rapid assessment approaches (e.g. state WET models) over the last decade suggests that numbers often develop a life of their own. If HGM provides the only numbers for ecological processes, without procedures for evaluating resulting services, opportunity and social significance, regulators will likely be pressured to give disproportionate weight to wetland capacity alone. Even a qualitative, written, descriptive evaluation of opportunity and social significance by regulators could provide some balance in evaluation.

CHAPTER 7: MONITOR AND ENFORCE

This chapter addresses the final step (Step 5) for integrating assessment into regulatory permitting –monitoring and enforcement.

Step 5 occurs after a permit is issued. Many regulatory agencies place limited emphasis upon monitoring and enforcement because they have little money and staff. They typically put their resources into Steps 1-4. But, Step 5 is particularly important when permits are conditionally issued subject to wetland restoration, creation, or other conditions. Quite often wetland restoration and creation projects are not carried out as stipulated in permits. Even when they are, monitoring is needed to determine success and to dictate possible mid-course corrections.

Some of the Step 5 information may be gathered from permit applicants through annual reports and other types of reporting requirements. But, there is no substitute for regulatory agency field surveys to monitor wetland activities, including compliance with conditions. Reconnaissance surveys may be used to detect violations through the use of satellite imagery, aerial photos, and other types of remote sensing.

Often a regulatory agency can carry out only a portion of the needed monitoring due to staffing and budgetary limitations and will need to utilize other organizations, such as other agencies, fishermen, and birders, to report violations.

The U.S. Army Corps of Engineers and a number of states like New Jersey have established computerized permit tracking systems, which provide a data base on all permits issued. These can provide the baseline conditions and assist monitoring efforts.

A number of states have established or are in the process of establishing bio-indicators for rivers. These efforts have been extended, in some instances, to wetlands (e.g., Wisconsin, Ohio). Bio-indicators have proven useful in indicating the condition of streams and the success of stream restoration efforts. Over time, bioindicators may also prove very useful in evaluating the success of wetland restoration efforts.

The establishment of wetland reference sites like those established by the University of Pennsylvania can also help monitoring efforts by documenting baseline conditions against which restoration/compensation projects and activities may be evaluated over time.

Step 5 involves not only monitoring, but also enforcement actions and defending regulations against court challenges, which requires supplemental information gathering at specific sites. This often includes developing information that courts consider particularly important in meeting constitutional challenges. Enforcement actions also require documentation of violations. See a companion report: <u>Wetland Assessment in the Courts</u>.

CHAPTER 8: SUPPLEMENTING CASE-BY-CASE INFORMATION GATHERING WITH UP FRONT ASSESSMENTS

A variety of up front assessment approaches hold promise for improving case-by-case wetland assessment procedures. These approaches can help regulators with Step 2 red flagging and preliminary environmental analysis. They can help establish watershed and landscape context in assessment; assist regulators perform more detailed Step 3 analysis of capacity, opportunity, and social significance; aid in the establishment of compensation ratios in Step 4; make wetland regulations more predictable and equitable; and reduce the administrative and financial burdens on private landowners. They can also help integrate wetland regulations with comprehensive land and water planning.

However, the dream of an inexpensive wetland assessment method that will allow accurate and inexpensive evaluation of all wetlands within a designated region and can replace all case-by-case information gathering will not be realized in the foreseeable future. Wetlands are too complex and conditions often change quickly. Regulatory information needs are too diverse. Detailed information gathering is too expensive. Approaches that combine up front and case-by-case permitting are needed to improve wetland permitting.

As will be discussed shortly, area-wide wetland assessments have been carried out for some communities as part of advanced identification, special area management, and wetland and watershed management programs. But, these efforts have been subject to a variety of limitations. Cost is a particular issue with area-wide approaches. The costs of accurately assessing a single wetland/related resource area on a case-by-case basis are multiplied by thousands of dollars when efforts are made to evaluate all wetlands throughout a region. There may be some economies of scale, but experience suggests there are few short cuts to detailed and accurate assessment. Because funds are limited, often only generalized data is gathered in area-wide efforts, and many simplifying assumptions and tradeoffs are typically made. As a result, area-wide surveys often lack much of the needed information for evaluating specific permits at specific sites.

This does not mean, however, that area-wide assessments are not useful in providing and analyzing specific types of information (e.g. endangered species, floodway, erosion maps) and for red flagging/yellow flagging or preliminary determinations of boundaries, functions/values, hazards, and other features. Some information is clearly better than none, providing it is not misrepresented or misused. And, it is possible to generate detailed information about specific issues, such as endangered species, on an area-wide basis. It is also possible to characterize wetlands on a landscape basis with regard to possible functions, threats, and other features. This has been done by the U.S. Fish and Wildlife Service on an experimental basis, using National Wetland Inventory data.

To be most helpful, such area-wide products must be in a form and format subject to refinement and confirmation through site-by-site field investigations, when necessary. Unfortunately, this has often not been possible with efforts to rate or otherwise characterize wetlands. The original data used in rating the wetlands is usually not available to the regulator, and it is extremely difficult to disaggregate the overall characterization or rating to allow confirmation and refinement through site visits.

Box 35
Up-front Information and Case-by-Case Permitting

Various types of up-front, area-wide information gathering (prior to individual permit applications) carried out by a regulatory agency or others can help a regulatory agency or agencies implement case-by-case permitting in a variety of ways related to the five steps in the suggested process:

Step 1. Up-front mapping can assist an agency carry out jurisdictional determinations. Maps can be used to designate regulated versus unregulated wetlands/related resources (e.g., New York State has mapped all freshwater wetlands over 12.4 acres in size--the regulatory cutoff size limit for state regulation). Maps can also help establish, on a preliminary basis, wetland/related resources boundaries and can suggest public/private ownership boundaries (e.g., Virginia, Florida).

Step 2. Step 2 preliminary environmental evaluation, including red and yellow flagging and assessment of impacts on functions and values, can be assisted by many types of up-front information gathering (e.g., flood maps, soils maps, topographic maps, lists and maps of endangered species, plat maps and land-ownership maps).

Step 3. Similarly, many types of maps and other resource information (e.g., detailed topographic maps, detailed soil surveys, rain gauging information, water surface elevation information) can help a regulatory agency or a landowner/consultant carry out more specific studies in Step 3, such as backwater computations using HEC-2, detailed investigation of potential endangered species, or detailed boundary identification, if such studies are needed.

Step 4. Several types of up-front information, such as regional inventories of potential restoration sites and the development of wetland reference systems, may help a regulatory agency negotiate with permit applicants in Steps 3 and 4 on compensation needs and compensation ratios and the use of mitigation banks. Reference site information can help guide restoration efforts.

Step 5. Air photos, satellite imagery, and other sources of up-front information can help regulatory agencies in Step 5 enforce regulations by documenting on the ground conditions as of particular dates. Photos, satellite imagery and other surveys may also be used to detect violations.

Combining Case-by-Case Information Gathering With Up Front Information Gathering and Analysis

As suggested above, case-by-case assessment processes can work best, over time, if used in combination with up-front, area-wide information gathering, including mapping and surveys.

Up front, area-wide wetland/related resource surveys are much sought after by landowners who want to know whether an area is a flood hazard area, endangered species habitat or subject to other special functions, values, or problems before they invest funds in project planning. Regulators also want more up-front information because it is difficult to carry out all of the needed information gathering within the short time frames and limited budgets typically available.

Unfortunately, much of the discussion of up front, area-wide wetland assessment has in the last few years been dominated by congressional and interest group proposals to place wetlands, once and for all, in three simple classes based on functions/values alone. This is unfortunate because there are many types of area-wide, up front assessments that can help improve regulations from both landowner and resource agency perspectives, and regulatory classification is only one of them (and very controversial).

Mapping and Surveys

Various maps and surveys can be combined with and improve case-by-case permitting processes. These include:

Wetland/related resource mapping (boundary delineation). Wetland mapping has been widely undertaken at all levels of governance. Wetland types, as well as boundaries, are typically displayed on maps, but there is usually no attempt to evaluate functions and values, hazards, or other features. These mapping efforts include:

- Wetland maps developed specifically for regulation by some states and local governments (e.g., Wisconsin).
- Wetland maps designed for broad use and sometimes used for regulation, such as National Wetland Inventory maps.

Wetland mapping has proven useful in regulatory programs for both landowners and regulatory agencies to suggest overall wetland boundaries. However, maps have not generally been sufficient, even at scales of up to 1 inch equals 200 feet, to determine precise wetland boundaries without further field surveys.

Wetland boundary maps have proven most useful for regulatory purposes if they are used on a presumptive basis, with more detailed delineation carried out as needed. However, boundary maps become costly with increasing scale and there must be a tradeoff between initial scale and case-by-case field checking. Maps for urban areas also may become quickly outdated due to the dynamic nature of wetlands and changing hydrologic conditions.

Wetland/related resource boundary mapping with evaluation of one or several functions/values or other characteristics. Wetland mapping with evaluation of one or several functions/values has been undertaken in a variety of contexts and can also be useful in implementing a collaborative assessment process. Examples of such maps include:

- Area-wide identification of wetland restoration sites (e.g., Everglades, Massachusetts, Minnesota)
- Inventories of wetlands of potential special recreational value (e.g., SCORPS)
- Inventories of wetlands of particular significance to waterfowl (e.g., North American Waterfowl Management Plan)
- Wetland property ownership maps (e.g., Florida, Virginia)

These mapping efforts, like more general wetland mapping, can help regulatory agencies identify general wetland boundaries and supply specific types of up-front information needed in case-by-case permitting. These maps have proven particularly useful for red flagging/yellow flagging and identification of functions and values. They have, however, typically been limited in terms of types of information and in accuracy and detail.

Broader area-wide natural resource inventories. A variety of broader natural resource inventories and map products can help a regulatory agency implement a collaborative assessment process by helping to define in advance wetland hazards, existing uses, archaeological and historical sites and provide other information needed to apply permit criteria. Examples include:

- Natural hazard maps (e.g., FEMA flood maps, erosion maps)
- Pollution inventories (state pollution programs, EPA., USGS)
- USFWS and State Heritage Program endangered species maps and lists of sites
- State Heritage Program natural area maps and lists
- Archaeological site maps and lists
- Land use maps

These maps are useful in providing certain types of upfront information and assisting the evaluation project impact and the adequacy of mitigation measures.

Advanced Resource Planning for Wetlands

A second type of upfront information gathering and analysis that can help implement a CAP process is more specific, advanced resource planning for wetlands. These planning efforts, undertaken by only a small number of local governments, generally involve mapping of wetland boundaries, evaluation of overall functions/values and, in some instances, natural hazards and other features. Social significance and opportunity have been considered in some of these efforts (e.g., Advanced I.D. efforts). Generally, these mapping and assessment efforts focus on functions and values.

Examples include:

- Local Wetlands and Watershed Plans (e.g., West Eugene, Oregon)
- EPA, NOAA, Other Special Area Management Plans (e.g., Hackensack Meadowlands)
- EPA/Local/Tribal/ or State Advanced Identification Projects. (e.g., Hackensack Meadowlands)

Most of these efforts have been undertaken by local governments with the help of EPA, NOAA and other agencies. Many efforts have compared wetlands, based on functions and values. Various function/values assessment methods have been used, such as a modified form of WET or WET 2. A number of these efforts have also used GIS systems to facilitate analysis.

These efforts have proven of some use in regulatory contexts, but have generally lacked the detail and accuracy needed for site-specific project review. In addition, consideration of functions/values alone, without consideration of broader factors, has limited the usefulness of these efforts in determining the suitability of wetlands for particular uses.

Efforts that attempt to provide aggregate evaluation of wetland functions/values on an area-wide basis, with a high, middle, low or ordinal rating score, have proven disappointing for regulatory purposes, although they have been useful for some red/yellow flagging and planning purposes.

Multi-objective resource management planning or land use planning with wetlands/related resource as one component. A large number of local governments (at least 4,000), regional planning agencies, and public resource management agencies have undertaken broader land use planning or combined land/water use planning with wetlands as one component. Plans are required in a number of states, such as Florida and California. The goals of these efforts are to allocate lands throughout the planning area to their most suitable uses. Wetland boundary maps are often used in these efforts. Other types of natural resource and cultural/economic data, such as flood maps, soils maps, topographic maps, geologic maps, vegetation maps, existing use maps, maps of public facilities, are typically overlaid on wetland maps. These broader planning and management efforts include, but are not limited, to:

- Coastal Zone Plans
- Shoreline and Shoreland Plans
- Scenic and Wild River Plans
- Floodplain Management and Greenway Plans
- Environmental Corridor Plans
- Water Quality Protection Plans
- Critical Area Plans
- Local Land Use Plans
- Watershed Plans

Local governments have generally made no effort to assess, in detail, the functions and values of particular wetlands in these efforts. The overall suitability of wetlands for development in comparison to other lands in a community is, however, considered. Larger wetlands, particularly those adjacent to water bodies, are typically placed in conservancy zones based on natural hazards, public/private property ownership, costs of public services, compatibility with other uses, and overall functions/values, among other factors.

Multi-objective resource management planning, with wetlands as one component, more adequately determines the suitability of wetland sites for various purposes than other approaches because the evaluation is from a geographically broader perspective and more factors are taken into account. Such multi-objective resource management efforts have proven useful for overall conservancy zoning and subdivision control. However, the wetland maps used in these efforts have often been at quite a small scale for regulatory purposes.

Wetland Regulatory Classification or Categorization

Several states (e.g., New York) and a number of communities have attempted to broadly categorize wetlands for regulatory purposes based on at least superficial assessment of functions/values of individual wetlands. These efforts have only been of limited value for case-by-case permitting because they are based on too little information and attempt to oversimplify the evaluation process. They have also been costly and time-consuming to implement.

Attempts to classify wetlands for regulatory purposes have also proven to be misleading if they consider too few factors. For example, efforts to classify wetlands that consider only functions/values may overstate development potential because they do not consider natural hazards. The determination that wetlands as a whole or most categories of wetlands are suitable for development needs to be based upon a combination of hazards, public ownership, public rights in waters, functions/values, and other features.

Computer-Assisted Assessment and GIS Systems

Looking to the future, computer-assisted assessment techniques and GIS systems also have broad potential for assisting case-by-case permitting. Over the last decade, interest has grown at all levels of government in the use of computer-assisted wetland assessment, including the use of computer models to evaluate certain wetland characteristics on an area-wide basis and for some types of case-by-case site review, such as determination of the impacts of fills on flood conveyance through the use of HEC-2 backwater computations. In the summer of 1996, the Association of State Wetland Managers held a national workshop concerning the use of GIS systems and on-line services in wetland and floodplain management. More than 80 papers were presented; there were 250 total participants.

Geographic information systems (GIS) include a variety of analysis approaches that code and analyze information spatially (geographical reference). Wetlands are only one type of information contained in a system. With a geo-referenced approach, analysis is now almost always done by computer, but information can also be manually geo-referenced through overlays (e.g., “McHarg” resource overlays). The computer facilitates storage and simultaneous analysis of various types of information pertaining to particular geographical areas, such as topographic, vegetative and soils data, and the analysis of the relationships among this information. Computerized water resource models (e.g., flood storage, flood conveyance, water quality) can also analyze geo-referenced information through the application of mathematically-based water resources flow models.

At one time, interest in GIS was confined to a small number of users with mainframe computers and large sums of money. But, interest in GIS systems has grown exponentially as inexpensive personnel computers with rapid computing capacity and large data storage capacity have become available. Relatively inexpensive software (e.g., ArcInfo, MapInfo) with powerful GIS capability and the availability of a great deal of natural resource information in a digital form, such as National Wetland Inventory maps and FEMA flood maps, has also helped increase interest. New technologies, such as Global Positioning Systems and low level digital imagery, hold promise for addressing some of the difficult geo-referencing problems with GIS systems and providing some of the detailed data that have been lacking.

Some of the strengths of GIS systems and computerized water resources flow models for wetland assessment include the following:

- GIS systems can store and quickly process large amounts of data
- GIS systems can combine, for analytical purposes, natural resource data with census, tax, economic, and other data
- GIS systems can quickly analyze multiple scenarios (e.g., evaluate the impacts of various project designs)
- GIS systems can print out analyses in a variety of formats (maps, charts, tables, 3-dimensional models, etc.)

More specific wetland applications are described in Box 36.

Box 36
Application of GIS

Systems in Area-wide Assessments

GIS systems can assist area-wide wetland assessments in several ways:

Parcel analyses. Wetland up-front planning and permit processing efforts can benefit from the parcel analysis capabilities of land information systems (LIS), which have already been implemented by many local governments and are being developed by others. LIS systems are a type of GIS that uses the ownership parcel to encode and analyze data. Types of information useful to wetland regulation and often available from these systems include:

- Parcel ownership
- Existing use of parcel
- Property values
- Taxes
- Zoning classification and other regulations
- Public facilities (sewer, water, roads)
- Demographic data (how many people nearby)
- Flood maps, wetland maps, other special resource features
- Broader topographic, soils, and other natural resources data

Parcel-level LIS approaches are often not specific enough to precisely delineate wetland boundaries because information is encoded by parcel rather than natural resource boundary, but they provide broader parcel information useful in red flagging and determining opportunity and social significance.

Red and yellow flagging. GIS or LIS systems with wetland components can also be used for broad inventory and red and yellow flagging purposes even if the system lacks data at the scale and degree of accuracy needed for site-specific regulatory analysis. Use will depend, of course, upon the information available in the system. For example, a GIS or LIS with wetland types (e.g., digital NWI data) and overall acreage can be used to determine whether particular types of wetlands are rare in a locality. It may be used to determine the proximity of wetlands to other wetlands and waters. The system might also be used to red flag flood hazards if flood maps have been encoded into the system.

Determining opportunity and social significance. GIS and LIS systems can be used to determine the relationship of wetlands to pollution sources, flood flows, public lands, and to population centers and various wetland users.

Determining possible cumulative impacts, the implications of various development scenarios. One of the strengths of GIS and LIS systems is their ability to analyze alternative development scenarios for a geographical area. For example, in processing a permit application for a 1-acre fill for a 10-acre wetland, it might be useful to assume a 1-acre fill in all similar wetlands in the region and to determine the hydrologic implications. Or it might be useful to determine changes in existing hydrologic regime due to projected urbanization of a watershed for a wetland restoration project. A computer hydrologic model could help with both.

Hydrologic analyses. Computer models have become an essential tool in flood routing, determination of flood conveyance areas, determination of erosion and deposition, water pollution analysis and types of water resources investigation that lend themselves to numerical modeling. Computerized hydrologic models (commonly now combined with broader GIS systems) are being increasingly used for floodplain management planning, stormwater management, water supply planning, water quality planning, and other water resources planning, and management efforts to not only determine existing conditions (water depths, quantity, flood regimes, sediment regimes, pollution), but also to predict long-term changes, such as anthropogenic changes in hydrology due to urbanization of watersheds. It is possible to project various build out scenarios (e.g., various densities and types of development) as well as the implications of various management schemes, such as flow diversions and operation of dams.

With the strengths outlined in Box 36, one might expect widespread use of GIS and computerized information systems in wetland regulation. GIS systems have, to a limited extent, been used for wetland regulatory purposes. For example, the Maryland Department of Natural Resources and the New York State Adirondack Park Agency have used GIS to help provide some of the information needed for planning and analyzing proposed wetland permits for a number of years. Illinois and New York have developed extensive GIS systems with wetlands as one component. King County, Washington has developed an interactive GIS system for the public. But, use in wetland regulatory contexts has been limited because the output can be no better than the data put into the system, up-front information is often lacking, available data is often not geo-referenced, and inputed data becomes quickly out-dated.

Despite their potential, GIS systems will need to be supplemented by some measure of case-by-case data-gathering on individual permits for the foreseeable future.

Reference Approaches

A number of wetland assessment approaches have been developed in recent years utilizing reference wetlands. These reference-based approaches can provide many types of information useful in wetland regulation. For example, they can:

- Develop profiles on various types of wetlands including their functions and values
- Determine the relative condition (and function) of wetlands in relationship to other wetlands
- Provide guidance for restoration and creation

Two assessment approaches that use reference systems include:

HGM. In 1991 a group of scientists met at Stone Mountain in Georgia. Based on a paper by Mark Brinson, this group decided to develop a new regulatory approach to wetland assessment using hydrologic setting and geomorphological context (HGM).

The key elements of the HGM approach, as described by Mark Brinson, include:

- Grouping (classifying) wetlands by hydrologic and geomorphic setting
- Developing class and subclass profiles and various models for assessing functions through the use of reference wetlands
- Determining the relative condition of wetlands as the basis for determining compensation needs.

HGM is a tantalizing approach. Its stated goals are excellent and consistent with what is needed in regulatory contexts at all levels of government: An "improved approach to allow for better consideration of wetland functions in permit decisions … where time and resources are often limited." The three fundamental factors that HGM is based on are scientifically sound--geomorphic setting, water source (hydrology), and fluctuation of water once in a wetland (hydrodynamics). The three proposed major components of the methods to assess wetlands also make good sense--determine hydrogeomorphic class, determine functions, and use reference to determine the range of functioning in a wetland.

HGM also has weaknesses. Implementing these components with limited financial resources is a formidable challenge. Development of models has proven to be complicated and expensive. Models provide only a small portion of the information needed for regulatory permitting. They oversimplify the factors relevant to regulatory permitting and the determination of compensation ratios.

Indices of Biological Integrity. Many efforts are also underway to develop models for measuring the biological integrity and relative condition of wetlands in specific contexts. These efforts are particularly important in establishing and applying biological water quality standards for wetlands. See, for example, the ORAM assessment method adopted in Ohio.

IBI modeling efforts involve information gathering for particular plant and animal species for a range of similar sites with various levels of anthropogenic impact. Information gathered may pertain to not only plants and animals, but also to hydrogeomorphic setting. Reference sites are identified with no or little disturbance; a suite of similar sites representing various levels of disturbance are also identified. Plants, insects, amphibians, birds and other forms of life are compared at the various sites. Indicator species that can be used to compare the relative condition of sites are identified. Quantitative indices that allow the comparison of sites are developed.

Indices have a number of important uses. First, they can be used for water quality monitoring and to determine impaired wetlands and waters. Second, they can, as suggested above, be used to establish regulatory water quality standards for wetlands. For example, such standards can specify that water quality and other features (e.g. depth, vegetation) cannot be degraded to the point that there will be a loss of specific indicator species in a wetland, lake, or stretch of stream. Alternatively, standards can specify that water quality and other features must be restored to the point that the water body will again support specific indicator species. Emergence of indicator species will indicate success.

Third, biological information may also be useful as a surrogate for the types and magnitudes of other wetland functions (e.g., food chain support, pollution control.)

Biological indices, reference sites used to prepare such indices, and the background information gathered to prepare the indices hold broad promise for improving wetland assessment procedures for habitat. However, development of such indices is proving difficult, time consuming, and expensive. It is also very difficult to develop accurate indices because there are often many ecological zones within a single wetland and these zones shift by season and over a period of years as rainfall varies. Finally, the correspondence between biological integrity and many other wetland functions/values such as flood storage, flood conveyance, erosion control, natural crop production is not so clear in many contexts.

Box 37
Assessment,
Chess and Computers

The best human chess players can, with some exceptions, still beat the computers. This is surprising because a chess game involves a relatively fixed number of moves at each stage of the game and modern computers can carry out millions of rapid computations. But, human beings still have the edge in certain types of learning, complex sorting and strategizing.

Does this have anything to do with wetland assessment? Yes, some.

Assessment of the impact of a particular activity at a wetland/water/floodplain/riparian area site and the adequacy of impact reduction and compensation measures requires a consideration of a **large number of onsite and offsite factors** pertaining to functions/values, hazards, impacts, and measures to reduce or compensate for impacts. Assessment requires weighing of factors and consideration of interrelationships between factors. It requires the development of new information (e.g., a field visit), the sorting of this information, and the development or acquisition of more information (more field visits, studies by a project proponent). In short, it requires a hierarchical, sequenced and interactive process with sorting and learning capabilities.

It has been extremely difficult to create computer models for assessing even limited aspects of wetlands much less the broad range of factors that need to be considered. Computers (including GIS systems) cannot decide to quickly acquire new information, obtain it, and then get hold of some more. They are very good at digesting information placed before them.

The human being is, whatever its other frailties, good at acquiring new information and in sorting, weighing, and considering interrelationships between various types of information. This is what is needed to quickly determine what factors may be relevant in a given regulatory permitting situation (hazards, boundaries, ownership, functions, values, impacts, etc.) and to progressively focus field investigations, hearings, and other investigations on the relevant issues.

A common sense assessment approach must involve lots of little feedback loops and reality checks. Common sense assessment typically requires the use of multiple red flagging, scoping and filtering mechanisms, and sorting followed up with additional data gathering for the most important factors (functions/values, hazards, etc.). It is here where the human mind excels.

Computers are certainly useful for more specific and highly quantified operations, such as projecting and analyzing flood flows (HEC models) and storing and processing certain types of information on a landscape basis (GIS systems), but they cannot replace the human brain.

Conclusion

Up front assessment of wetlands on a state or regional basis can help regulators apply the broad public interest review criteria and similar criteria in state and local regulations. However, detailed and accurate upfront assessments will never be simple because of the varied types of information needed in a specific context and the difficulties gathering such information. There is no silver bullet assessment technique on the horizon for gathering all of the needed information, nor will attempts to ignore many relevant factors for the purposes of simplicity produce rational

and accurate evaluations.
Up front approaches can be useful in red and yellow flagging and overall analysis of permits. Future approaches will need to combine upfront mapping and GIS systems with some measure of continued case-by-case information gathering and analyses. They can be used to evaluate natural processes and functions, and to help assess the importance of wetlands and changes in wetlands to society. The balance between what is gathered up front and what is gathered on a case-by-case basis will need to reflect cost, accuracy, and other considerations.

A hierarchical, case-by-case approach to information gathering can be supplemented and made much more certain and predictable by multipurpose mapping and other up front information gathering. Case-by-case approaches can also be supplemented by many types of hydrologic, biologic and cultural information, as well as by comprehensive land use planning and watershed planning.

APPENDIX A: DEFINITION OF "FUNCTIONS," "VALUES," "FUNCTIONS/VALUES"

In this report we use the term "functions" to refer primarily to natural processes in wetlands. We use the term "values" to refer to the importance society places upon those processes and other wetland characteristics. We use the hyphenated term "functions/values" to more generically refer to the good and services produced by wetlands due to various processes and other characteristics and their value to society. These have also been referred to in other contexts as "functional values", "functions" and "values."

Many regulatory programs, such as the Section 404 program, now require that regulatory permits not result in net loss of wetland function. In many statutes this requires that regulators determine the impact of proposed activities upon flood storage, flood conveyance, fisheries, pollution control and other goods and services provided by wetlands to society, whatever these goods and services are called.

The Conservation Foundation Report, Protecting America's Wetlands: An Action Agenda, first coined the "no net loss of function" goal in 1989. In this report, the foundation used "function" to refer not only to natural resource capability, but also to cultural and aesthetic values. This report led directly to the EPA and Corps of Engineers Memorandum of Understanding, which incorporated the no net loss of function and value standard into Corps regulatory permitting.

Until 1995, "functions" and "values" were often used interchangeably in legal documents at all levels of governance to refer to goods and services provided by wetlands to society, such as habitat for waterfowl, production of fish, habitat for rare and endangered species, control of pollution, storage of flood waters, and cultural and heritage functions (e.g., shell mounds, recreation, historic sites).

In 1995, the Army Corps of Engineers Waterways Experiment Station attempted to more specifically define function in a Hydrogeomorphic Method Procedural Guide. The HGM procedural guide (see Smith et al., 1995) defined functions "as the normal or characteristic activities that take place in wetland ecosystems or simply the things that wetlands do." The HGM procedural guide, in its procedures, more specifically focused (see table 2 in Smith et al., 1995) on the analysis of wetland natural resource processes relevant to the ecological suitability of wetlands. The goal was partly to separate objective investigation of project impacts on wetland processes from more subjective analysis of the value of such changes. A second goal was to permit the determination of relative wetland condition to help determine restoration needs and mitigation ratios.

Unfortunately, HGM efforts over the last eight years to characterize natural processes (there are many models but few have been field validated) through numerical models and the use of surrogates have proven more difficult than originally believed. It has also proven difficult to link natural processes to goods and services and the impact factors listed in the Section 404 permitting criteria, except perhaps for habitat values.

The more specific definition of function in the Procedural Guide, combined with a focus on ecological functions, represented a narrowing of factors considered to be functions in wetland assessment. Previously, the Wetland Evaluation Technique used by the Corps considered both functions and values. WET considered efficiency or capacity, opportunity and social significance. HGM only considers capacity or efficiency.

Use of “Function” to Apply Only to Ecological Processes

However desirable it may be to improve evaluation of ecological processes by separating objective information gathering from more subjective determination of value, a redefinition of “functions” as proposed in HGM causes a variety of problems. A satisfactory term must be found to capture the combination of natural processes, goods and services, and their value to society implicit in the earlier definition of function. Problems with the narrow definition include:

First, the HGM definition of “function,” combined with the HGM procedures on permits, increases the amount and quality of ecological information generated by assessment, but it may decrease the amount gathered pertaining to archaeological, aesthetic, historical and other wetland characteristics also important to society unless similar procedures and guidance are developed for these characteristics. And, redefinition of function to include only natural processes subtly changes the information gathered and available to a regulator in carrying out a public interest review.

As noted above, Section 404 program regulations and many state and local regulatory statutes similarly require determination of project impact on flooding, pollution, erosion and other wetland goods and services that affect people, not only impacts on biological or hydrologic processes (see, e.g., the Section 404 public interest criteria). The ultimate issue is not project impact on processes, but on services and their importance to the public.

Second, a narrow definition of function in assessment leads to inconsistent use of function in HGM assessment, in contrast with the use of function in the broader literature, statutes, regulations, and other guidance materials where the term is used to refer to goods and services and their value to society. This is confusing. Use of a term in a specialized manner inconsistent with general usage should be avoided unless necessary.

Third, while overall distinctions between functions and values may be useful, they also leave a void in terminology for the combinations of natural processes and other characteristics that make a wetland valuable to society. There is no satisfactory alternative term to “function” to describe the ability of wetlands to produce goods or services. Also, what are these combinations of processes and other characteristics to be called if not functions—“functional values,” “valuable functions,” etc.? We use the combined term “functions/values,” but none of the other terms fits very well.

Future Use of "Function"

How, then, should the term "function" be used in various contexts?

The HGM use of function to refer to natural processes is appropriate in scientific contexts as long as users make clear that this is a scientific definition and that other definitions are also in use. We refer to functions in this more narrow sense in this report. If the term is to be used in a limited sense to apply only to natural process, scientists should also make clear that they are not attempting to redefine the scope of Section 404 and similar project review in evaluating such "functions," and that there are other factors needing evaluation as well. Narrowing the concept of "net loss of function" to apply only to changes in natural processes has significant policy implications which deserve open public debate and review, and perhaps public rule-making.

Further, if "function" is to be narrowly used in scientific contexts to refer to natural processes, scientists should further make clear that processes encompass only a portion of what wetlands do. What wetlands do, in even a narrow sense, depends on size, shape, location, surrounding land uses, and other factors, not simply chemical or physical processes.

On the other hand, if scientists wish to select a single term to describe natural processes, why not simply call them "natural processes"?

As noted above, this report refers to such goods and services as "functions/values." However, the continued use of "function" in other nonscientific contexts to refer the ability of wetlands to produce certain goods and services is probably defensible because there is no satisfactory alternative term. In other words, wetlands function to produce waterfowl, timber, natural crops, fish, shellfish, etc. Wetlands also function to produce cultural values such as aesthetic, heritage, and historical values. The continued use of function may also be justified to describe the goods and services produced by wetlands—flood conveyance, flood storage, pollution control, shellfish production, production of natural crops, etc.

Separating or Combining Fact-Finding and Values Analysis

Distinguishing functions and values can help separate objective fact finding from more subjective determination of value. Physical features of wetlands, processes, and impacts can be categorized, studied, described, measured and modeled by scientists, engineers, and other experts with a fair amount of objectivity. Separation of objective from more subjective factors in analysis wetlands can facilitate collaboration between resource agencies, the regulatory agency, and a landowner or his or her consultant. Agreeing on facts can be an important step in reaching later agreement on policy.

Objective fact-finding should, therefore, be an important part of detailed wetland assessment as described in Chapter 3. However, such fact-finding should not be confined to natural processes alone (the principal focus of HGM). A broad range of wetland characteristics and the relationship between these characteristics and society can be, to a greater or lesser degree, described, measured or modeled. Objective fact finding can apply to wetland size, existing uses, adjacent land uses, threats to hydrologic modifications, historic sites, archaeological sites, and a host of other factors relevant to the impact of an activity upon a wetland and the adequacy of impact reduction and compensation measures. Objective fact finding can include use of models to measure the possible impacts of changes in wetlands on people, such as increases in flood heights and possible levee breaches resulting from protection or destruction of a wetland. A critical issue from a regulator's perspective is not only what is happening hydrologically and hydraulically (impact on natural processes) within and without a wetland, but also how this might or will affect particular segments of society (e.g., flooding of specific downstream property owners).

Should objective fact-finding always precede investigation of value? As suggested above, in many instances, a preliminary investigation to determine whether there might be significant project impact can best simultaneously consider physical processes and the significance of those processes to society (e.g., might a proposed permit not only cause pollution of a reservoir, but also affect thousands versus a small number of people?). This can help determine what should be investigated in depth in a particular instance. If there is the possibility of significant impact, more detailed physical fact-finding can then be undertaken. This, in turn, can be followed by more detailed analysis of the importance of these characteristics to society through public hearings and other methods.

APPENDIX B: EXAMPLES OF RED AND YELLOW FLAGS IN OTHER WETLAND RAPID ASSESSMENT METHODS

Box 38
HGM
Red Flag Features

The HGM procedural document suggests the following red flags. See Smith, D., A. Ammann, C. Bartoldus, and M. Brinson. 1995. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices, U.S. Army Corps of Engineers, Waterways Experiment Station, Wetlands Research Program Technical Report WRP-DE-9:

- Areas protected under the American Indian Religious Freedom Act
- Hazardous waste sites identified under CERCLA or RCRA
- Areas protected by a Coastal Zone Management Plan
- Areas providing Critical Habitat for Species of Special Concern
- Areas covered under the Farmland Protection Act
- Floodplains, floodways, or flood prone areas
- Areas of high public use
- Areas with structures/artifacts of historic or archeological significance
- Areas protected under the Land and Water Conservation Fund Act
- Areas protected by the Marine Protection Research and Sanctuaries Act
- National Wildlife Refuges
- Native Lands
- Areas identified in the North American Waterfowl Management Plan
- Areas identified as significant under the RAMSAR Treaty
- Areas supporting rare or unique plant communities
- Areas designated as Sole Source Groundwater Aquifers

Box 39
WET 2
Suggested Red Flags

The WET 2 Method suggests the following red flags. See Adamus, P.R. et al. 1987. Wetland Evaluation Technique (WET), Technical Report Y-87, Volume II. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. These red flags have been reproduced with the omission of some explanatory material. AA refers to the assessment area and IA refers to the impact area.

1. Are there plants or animals known to occur in the AA/IA that are threatened, endangered, or a candidate species, according to state or federal agencies?

2. Is the AA/IA part of a park, refuge, scenic route, water bank or conservation easement, historic site, marine or estuarine sanctuary, wilderness or primitive area, landmark area, public recreation area, research natural area, or similarly designated area under public control or supervised by an organized conservation group for the primary purpose of preservation, ecological enhancement, or low-intensity recreation?

3. Is the AA/IA on a statewide listing of historical or archaeological sites?

4. Is the AA/IA known to have ecological or geological features considered by regional scientists to be unusual or rare for wetlands in the region? Examples include:
   (a) Peat bogs in southern New England
   (b) Fens in some parts of the Midwest
   (c) Cypress swamps in the northern states
   (d) Spring communities in various regions
   (e) Wild rice producing wetlands in the north-central U.S.

5. Does the AA/IA represent most or all of this wetland system (e.g., marine, estuarine, palustrine, lacustrine, or riverine) in this locality?

6. Have substantial public or private expenditures been directed to this area for the creation, restoration, protection, or management of the AA/IA? Examples include: costs for initial purchase, seeding, fencing, maintenance, water quality improvements, installation of fishways or impoundments, and improved accessibility.

7. Are there biological communities in the AA that are stressed by saline springs or abnormally high salinities, or are there wetlands contiguous with the AA where this situation exists?

8. Are there features of social concern or economic value (e.g., incorporated areas, industrial areas, office buildings, hazardous waste landfills, etc.) within or adjacent to the AA that would be inundated by a 100-year flood?

9. Are there features of social concern or economic value within the 100-year floodplain of the area specified or has a dam with the primary purpose of flood control been proposed within 5 miles upstream or downstream of the AA?

10. Are <u>any</u> of the following features present within the area specified?
    (a) Harbors, channels, stormwater detention ponds, or reservoirs that are dredged or cleaned regularly
    (b) Artificial recharge pits
    (c) Known fish spawning areas highly sensitive to siltation
    (d) Commercial shellfish beds
    (e) Areas known to be in violation of Section 401 of the Clean Water Act water quality standards due to suspended solid or toxicant levels

11. Have bodies of water, within the area specified, been targeted by government agencies as "priority areas" for construction of wastewater treatment facilities or other water quality improvement projects?

12. Is there surface water within the AA or the area specified that is a major source of drinking water?

13. Are any of the following features present in the area specified?
    (a) Water bodies known to be especially nutrient-sensitive or subject to regular blooms of algae, aquatic fungi, or oxygen-related fish kills.
    (b) Area known to be in violation of Section 401 water quality standards due to nutrient levels.

14. Are there swimming/bathing areas that are used frequently in the area specified?

15. Does a threatened or endangered species that is wetland-dependent regularly inhabit the area specified?

16. Are any of the following features present in the area specified?
    (a) Sites designated by the U.S. Environmental Protection Agency (USEPA) as Sole Source Aquifers or Class II (Special) Ground Waters.
    (b) Wells that serve at least 2,500 people (people using the well may be living outside the area specified).
    (c) Actively used wells with yields that are greater than the yields shown for this region on the map in Figure 4.
    (d) Wells that are within a major alluvial valley (i.e., watershed area of at least 100 square miles) <u>and</u> have yields exceeding 2,500 gallons per minute.

17. Do well yields in the area specified surpass the criteria described in Question 16(c) <u>or</u> does the AA empty into an area (within 2 miles) where fish or wildlife use has been critically limited by excessively low water flow or low water level during dry years?

18. Are either of the following conditions true for any of Questions 9-17 that were answered yes?
    (a) The AA is the only AA in the watershed of the closest service area.
    (b) The AA is closer to the service area where the service identified in the question is delivered, than any other AA (that could be delineated if desired) in the watershed of the closest downstream service area. For example, in Question 12, the AA is closer to the service area to which drinking water is being supplied than any other AA in the watershed of the closest service area.

19. Does the AA/IA act as a buffer to features of social concern or economic value that are situated in erosion-prone or wave-vulnerable areas?

20. Is any of the following true?
    (a) The AA/IA supports at least one fish species that is on USFWS National Species of Special Emphasis List (Table 1) and is rare or declining in the region.
    (b) The AA/IA has a State or Federal special designation relating to its recognized fishery value.
    (c) There is commercial fishing or shell fishing with the AA/IA.

21. Is any of the following true?
    (a) The AA/IA supports at least one wildlife species that is on USFWS National Species of Special Emphasis List (Table 1) and is rare or declining in the region.
    (b) The AA/IA has a State or Federal special designation relating to its recognized wildlife value.
    (c) A fee is charged at the AA/IA for consumptive (hunting) or nonconsumptive (observation) use of wildlife.

22. Is the AA in a waterfowl use region of major concern as defined by USFWS <u>or</u> has it received a priority rating in state waterfowl concept plans?

23. Does this AA/IA support plant or animal species with exceptionally narrow habitat requirements or of extremely limited occurrence in this region (e.g., desert pupfish)?

24. Is this the closest wetland to a nature center, school, camp, college with a science curriculum, or similar educational facility, <u>and</u> is it within 2,000 feet of a legal parking area?

25. Is the AA/IA part of, and essential to, an ongoing, long-term environmental research or monitoring program?

26. Is the AA and its watershed a "pristine" natural area, in the sense of having no lasting, direct or indirect, human alteration?

27. Is the AA/IA used regularly for recreational or consumptive activities, for which opportunities are otherwise locally deficient as recognized by a local or state plan?

28. Is the AA/IA a major public access point to a recreational waterway?

29. Is the AA located in an urban area?

30. Is the AA located in a state that is losing wetlands at a rate greater than, or equal to, the national annual average of 0.4 percent/year?

31. Is the AA's wetland acreage (expressed as a percent of the acreage of wetlands in the watershed of the closest service area) greater than the annual percentage loss rate of wetlands for the state?

APPENDIX C: PRESUMPTIONS BASED UPON OVERALL HGM CLASSES

Wetlands/related resources are highly complex and various sections within a single wetland have different characteristics. Nevertheless, some generalizations and presumptions about wetland and related waters/floodplain and riparian ecosystems are possible with regard to functions/values, ownership and natural hazards, based on the HGM overall classes. (Note, for the purposes of simplicity, estuarine/coastal are grouped together in the following discussion. Coastal has been added because there are substantial tidal wetlands in shallow water environments along the open Gulf Coast).

Common Denominators

Regulatory jurisdiction under federal, state, local wetland statutes, regulations, and ordinances. Major riverine, lake fringe, and coastal/estuarine fringe wetlands and related waters are subject to federal (Section 404, Section 10) regulations and to state or local wetland regulations in many states. Many larger slope, depressional, and flat wetlands connected by channels to navigable waters are also subject to federal Section 404 regulatory jurisdiction, although individual regulatory permits are not required for some due to nationwide permits. However, most smaller slope, depressional, and flat wetlands not connected to navigable waters are not subject to state or local regulations due to size limitations on regulated wetlands, limitations on the types of regulated wetlands, or because they are not included on wetland maps (mapping is required for exercise of regulatory jurisdiction in many state and local regulatory efforts).

Ownership; public rights. The beds of lake fringe, estuarine fringe, and coastal fringe wetlands and related waters are often partially owned by the state (beds of public water bodies below the high water mark). They are also subject to "public trust" and "navigable servitude." The beds of riverine wetlands are privately owned but they are subject to public trust and navigable servitude. The beds of slope, depressional, and flats are usually privately owned and not generally subject to federal navigable servitude or state public trust.

Landowner recognition that areas are wetlands; delineation of wetland boundaries. Landowners more easily recognize coastal fringe, estuarine fringe, lake fringe, and riverine wetlands as "wetlands" due to their proximity to other waters and more stable water levels. Delineation of boundaries for these wetlands is generally easier than for depressional, slope, and flats in many instances because of more stable water levels, existing wetland maps, visible adjacent water bodies, salinity gradients (estuarine, coastal), and other factors. It is often more difficult to delineate slope, depressional, and flats boundaries which may be wet only a portion of the time.

Other applicable regulations. A broad range of state, local, and federal regulations typically apply to wetlands and related areas adjacent to rivers, lakes, coasts, and estuaries. These include coastal zone management regulations, shoreland and shoreland zoning programs, floodplain regulations, scenic and wild river regulations, public water programs, and various critical area programs. Fewer regulations other than the Section

404 program and local zoning apply to slope, depressional, and flat wetlands, particularly those smaller in size.

Natural hazards, impact of activities on other lands. Riverine, lake fringe, and coastal/estuarine fringe wetlands and related lands are often characterized by natural hazards, such as flooding and erosion. Development in riverine wetlands will often increase flood heights on other lands. Slope, depressional, and flats are also subject to some flood hazards, but hazards are usually less serious.

Fishing and water recreation functions/values. Riverine, lake fringe, and coastal and estuarine fringe wetlands and related floodplain/riparian areas are often characterized by fishing and water recreation functions/values because they contain or are adjacent to open water where fish live and feed. They are also likely to have value in protecting adjacent waters from upland pollution by intercepting pollutants and sediment before they reach adjacent waters and value in removing pollutants from adjacent waters that may pulse into and out of such wetlands (tides, floods, fluctuations in water levels). Slope, depressional, and flats usually do not have fishing and major water recreation functions/values, such as boating and canoeing. They may have important pollution buffering and habitat functions/values.

Susceptibility to watershed alterations. Lake fringe, river fringe, and coastal/estuarine fringe wetlands and related water/floodplain/riparian ecosystems are less susceptible to changes in water regime due to development in the immediate watershed since water levels in these wetlands depend, in large measure, on water levels in the adjacent water bodies. And, water levels in adjacent water bodies often depend on the much broader water regimes (e.g., ocean levels, river watersheds). In contrast, water levels in many slope, depressional, and flat wetlands rely, to a considerable extent, on runoff from the immediate watershed or upon local ground water levels.

Data availability. Much more data is typically available to help evaluate coastal fringe, estuarine fringe, lake fringe, and river fringe wetlands and related areas than slope, depressional, and flat wetlands. Data include National Wetland Inventory Maps, state and local wetland maps, FEMA flood maps, surface water elevation and flood elevation records, fish surveys, recreational use surveys, bird surveys, etc.

Availability of regulatory agency technical assistance personnel. Federal, state, and local regulatory personnel are usually located in towns and cities. Towns and cities are (in general) located on the coasts, estuaries and on larger lakes and streams. This means there are many more wetland regulators near coastal fringe, estuarine fringe, lake fringe, and riverine wetlands waters and related resources. Much fewer regulatory personnel are located in rural areas where many freshwater slope, depressional, and slope wetlands are located.

Characteristics By Wetland Type
(Note, this does not strictly follow the HGM classes)

<u>River Fringe Wetlands</u>

Settings: Wetlands located in rivers, creeks, and stream beds, on river banks, or floodplains along many of the 3.2 million miles of rivers, creeks, and streams. Riverine wetlands are particularly extensive along large, low gradient rivers, but also occur as broken thin bands in and along many smaller perennial creeks, streams, and drainage ditches. They are characterized by unidirectional, flowing water.

Wetland Regulatory Jurisdiction: Most riverine wetlands are regulated by the Section 404 program, although individual permits may not be required in headwater areas. Most larger riverine wetlands are also regulated at state levels by freshwater wetland programs, floodplain, scenic and wild river, shoreland zoning, public water, or other programs. Most riverine floodplain wetlands along major rivers are also regulated by local governments in accordance with floodplain regulatory, shoreland, wetland, or other programs.

Ownership: Some river beds (and wetlands in such beds) are publicly owned to the high water mark. Others are privately held, depending on state law. Regardless of ownership, many wetlands along navigable rivers are subject to navigable servitude and state public trust.

Hazards: Virtually all riverine wetlands are subject to flood hazards by the 100-year flood and many lie within defined floodways. Some riverine wetlands adjacent to large rivers are subject to wave action. Many riverine wetlands along high gradient streams are also subject to erosion during large flood events. Activities in floodways may be subject to particularly deep and high velocity flows. Fills or other structures may block flood flows, causing increased heights on adjacent and upstream lands and increased downstream velocities.

Other Applicable Regulations: Local and state floodplain, local wetland, state dam, public water statutes, scenic, and wild river statutes.

Common Functions/Values:
- Flood conveyance
- Flood storage
- Wave buffer and retardation
- Erosion control
- Pollution prevention and treatment
- Water recreation
- Fishery (larger rivers and streams)
- Waterfowl (larger rivers and streams)

Delineation: Riverine wetlands are identified and delineated since they are located along or in rivers and streams, and many have relatively sharp landward boundaries. However, it is difficult to identify the landward boundary of large, low gradient floodplain wetlands, particularly forested wetlands.

Some Special Characteristics Relevant to Assessment: Determination of boundaries, determination of public/private ownership, and identification of functions and values may be complicated by several factors that need to be considered, depending on the circumstance:

- Natural water regimes have often been altered. Water levels are controlled by dams in many wetlands on major rivers and channelization has taken place on many others.
- Sediment regimes have also often been changed, affecting erosion and depositional processes.
- Wetlands along smaller creeks are particularly susceptible to watershed changes that affect flow rates and water quality.
- Many riverine wetlands have been partially isolated from adjacent waters by levees.
- Many riverine wetlands are subject to severe flooding with resulting temporary removal of vegetation and deposition of sediments or erosion.

Restoration Potential: Often high for riverine marshes and shrub wetlands due to relatively predictable adjacent water sources; more difficult for forested floodplain wetlands due to problems predicting and duplicating sensitive water regimes.

Data Availability:

- NWI maps exist for most wetlands along major rivers in the lower 48 states.
- Many state wetland maps exist for wetlands along major rivers.
- FEMA flood maps exist for major rivers and streams.
- Stream gauging records are available for many larger rivers and streams.
- Water quality information is available for many larger rivers and streams.

<u>Lake Fringe Wetlands</u>

Settings: Great Lakes, smaller inland lakes, reservoirs, and ponds. Most lake fringe wetlands common in the northern tier of glaciated states (e.g., Wisconsin, Minnesota, Michigan, New York), but reservoir fringe wetlands occur elsewhere as well. These wetlands are characterized by multidirectional flows.

Wetland Regulatory Jurisdiction: Wetlands along all major lakes and reservoirs are subject to Section 404 regulation. Virtually all larger lakes and reservoirs are also regulated by states in accordance with water quality statutes, public water statutes, and shoreland zoning statutes. Many privately owned lake fringe wetlands are regulated by local governments.

Ownership: Most large lake beds and some lake fringe wetlands beds (up to the high water mark) are publicly owned. Most others are subject to public trust and/or navigable servitude.

Delineation: Lake fringe wetlands are often easy to delineate due to relatively stable water levels, proximity to visible waters, availability of existing wetland maps, and readily identifiable soil types.

Hazards: Flood hazards are common for lake fringe wetlands along larger lakes, including long-term flooding for groundwater fed lakes and closed basin lakes (e.g., the Great Salt Lake, Lake Elsinor). Lake fringe wetlands may also be subject to wave action and erosion along larger lakes and subject to ice threats in the northern states.

Other Applicable Regulations: Lake fringe wetlands are typically regulated by a variety of local and state floodplain, and state dam, public water, and shoreline zoning statutes and in some instances by local wetland, coastal zone, and other regulations.

Common Functions/Values:

- Fisheries
- Water recreation
- Pollution prevention and treatment
- Water supply protection
- Erosion control
- Bird habitat
- Waterfowl habitat
- Mammal and amphibian habitat

Some Special Characteristics Relevant to Assessment:

- Many lakes have been dammed, controlling water levels, but also reducing lake fringe wetland diversity and long-term sustainability.
- Tight water quality standards have been developed for many lakes because of their use for water-based recreation and water supply.

Restoration Potential: High restoration potential for partially drained lake fringe wetlands. Lake elevations are often known with fair accuracy for larger lakes. This helps establish restoration elevation requirements. Examples of other lake fringe wetlands may also be used to help guide elevation determinations. Seed stock will also be brought in by water from other wetlands along the lakeshore.

Data Availability:

- NWI maps, state and local wetland maps are available for larger lakes in many states.
- Relatively precise lake elevation data is typically available for larger lakes, particularly those with water control structures.
- Good FEMA flood maps are available for Great Lakes, some other larger lakes, and mid-size and smaller lakes with flood problems.

<u>Estuarine and Coastal Fringe Wetlands</u>

Settings: Estuarine and coastal fringe wetlands are located on deltas, behind barrier islands, along shores and estuarine rivers, and at low energy open coastal environments (e.g., Gulf Coast).

Wetland Regulatory Jurisdiction: All estuarine and coastal fringe wetlands are subject to the Section 404 program. Virtually all of these wetlands are also regulated by states in accordance with wetland, coastal zone management, water quality statutes, public water statutes, and shoreland zoning statutes. Some of the privately owned wetlands are regulated by local governments.

Ownership: The beds of most coastal and estuarine lake beds are publicly owned. Even those privately owned are subject to state public trust and federal navigable servitude.

Delineation: It is usually quite easy to identify and delineate estuarine and coastal fringe wetlands due to the availability of existing wetland maps, proximity to coastal or estuarine waters, limited plant species due to salinity, and readily observed fluctuations of the tides. However, there can be problems, particularly for altered wetlands and for larger tidal/freshwater wetlands at the inland boundary.

Hazards: Most estuarine and coastal wetlands are subject to deep flooding and, in some instances, significant wave action and erosion during hurricanes or storms. Inundation to depths of 10-15 feet are common during a 100-year hurricane or storm.

Other Applicable Regulations: Local and state floodplain, local wetland, state public water statutes, and coastal zone management statutes and plans broadly apply.

Common Functions/Values:

- Fisheries and shellfish
- Water-based recreation
- Pollution prevention and treatment
- Wave retardation and erosion control
- Shorebird habitat
- Waterfowl habitat

Some Special Characteristics Relevant to Assessment:

- Tidally controlled at least to the high tide line
- Periodically flushed by hurricanes and coastal storms

Restoration Potential:

High restoration potential for partially drained and diked coastal and estuarine wetlands if tidal action is restored. Tides provide a constant and reliable water supply. Tidal elevations are often known with fair accuracy. Seed stock may be brought in by tides.

Data Availability:

- Good NWI maps, state and local wetland maps in virtually all states
- Recent aerial photography for many areas
- Tide data and coastal flood data available in many locations
- Good FEMA flood maps available for many coastal locations

Slope Wetlands

Settings: Wide range of settings but mainly on the sides or at the bottoms of hills and mountains; also in some river fringe, lake fringe, and coastal/estuarine fringe settings. Ground water and surface water are the principle sources of water.

Wetland Regulatory Jurisdiction: Some slope wetlands are subject to the individual permits in accordance with the Section 404 program. Few smaller slope wetlands are regulated by states and local governments, but they may be regulated by local governments pursuant to broader zoning.

Ownership: Unlike wetlands adjacent to navigable waters, the beds of most slope wetlands are privately owned, except where they are on public lands. Public trust and navigable servitude do not generally apply.

Delineation: Fluctuations in water levels by season complicate delineation. Wetland soils may be poorly developed.

Hazards: Moderate to low although high ground water and ground water discharge may cause some flooding and some slope wetlands may be subject to high velocity surface runoff from adjacent hills or mountains during major storms.

Other Applicable Regulations: Usually few other than local, general zoning.

Some Functions/Values:

- Habitat for mammals, reptiles, amphibians, and endangered species
- Pollution prevention
- Erosion control
- Bird habitat

Some Special Characteristics Relevant to Assessment:

- Dependent on ground water discharge and, to a lesser extent, surface runoff.
- Large numbers throughout landscape in humid and temperate climates particularly in mountain states.
- Many isolated from other waters during normal hydrologic conditions.

Restoration Potential: Varied. Relatively high for partially drained (as opposed to filled) slope wetlands, where the ground and surface water regimes are in tact. However, restoration potential is poor where wetlands are filled or water regimes have been altered.

Data Availability:
- Poorly identified on wetland maps because maps do not show smaller wetlands and are difficult to spot on air photos.
- Flood maps are almost never available for such wetlands.
- Surface water elevations and hydrologic records are almost never available for such wetlands.

<u>Organic and Mineral Flats</u>

Settings: Wide range of settings with moderate to abundant rainfall and low topographic gradients. Include wetlands in old glacial lake beds, coastal plain wetlands, and bogs.

Wetland Regulatory Jurisdiction: Some, but not all, flats are subject to the individual permits pursuant to the Section 404 program. Some larger "flat" wetlands are regulated by states and local governments in accordance with wetland statutes or broader zoning.

Ownership: Most are privately owned except where they are part of large blocks of public lands. Some bogs may be "lakes" and their beds publicly owned.

Delineation: Relatively easy for some (e.g., bogs) with stable water levels and easily observed characteristics. Moderate to difficult for others due to low topographic gradients and fluctuating water levels.

Hazards: Usually low flood hazards, although high ground water levels and ground water discharge or runoff may cause some flooding. Many mineral flats without outlets are subject to long-term fluctuations water levels.

Other Applicable Regulations: Usually few, local zoning.

Common Functions/Values:
- Habitat for mammals, reptiles, amphibians, endangered species
- Pollution prevention
- Flood storage
- In general, not flood conveyance areas, not fisheries habitat, not pollution control, limited water recreation value

Some Special Characteristics Relevant to Assessment:
- Many isolated during normal hydrologic conditions, not during times of floods.
- Many altered, partially drained, and partially filled.
- Most are sinks and particularly susceptible to sedimentation, pollution.
- Highly dependent upon runoff from the immediate watersheds.

Restoration Potential: Varied. Relatively high for only partially drained (as opposed to filled) wetlands with stable water regimes. However, restoration potential is poor where wetlands are filled or subject to high sedimentation or pollution rates.

Data Availability:
- Poorly identified on wetland maps because maps do not show smaller wetlands and are difficult to spot on air photos.
- Flood maps almost never available for such wetlands.
- Surface water elevations and records are almost never available for such wetlands.

Depressional Wetlands

Settings: Wide range of settings but mainly in the northern tier of glaciated states (kettleholes, potholes) where there are millions of depressions in glacial till and moraines created by melting ice blocks during retreat of the glaciers. Some depressional wetlands have also been created by solution (karst), by wind action (Sand Hills of Nebraska), by erosion and deposition (oxbows, vernal pools), and by human activities (e.g., gravel pits, excavation). Some depressional wetlands depend almost entirely on surface water (e.g., vernal pools), others depend on ground water (e.g., potholes), and many depend on a combination of ground and surface waters (e.g., potholes).

Wetland Regulatory Jurisdiction: Some depressional wetlands with links to public waters are subject to the individual Section 404 permits. Some depressional wetlands are regulated by states and local governments pursuant to wetland statutes, public water statutes, or broader zoning statutes.

Ownership: Most beds are privately owned except where they occur on public land. Depressional wetlands are not, in general, subject to state public trust or navigable servitude.

Delineation: Quite easy for wetlands with relatively stable water levels and steep shoreland gradients (many potholes); difficult for vernal pools, potholes, and others with widely fluctuating water levels over a period of years and fluctuations in vegetation. Many are not shown on wetland maps due to small size (hard to see on a small-scale air photo).

Hazards: Flood hazards are moderate to low, although long-term fluctuations in high ground water levels can cause significant flooding (e.g., western Minnesota).

Other Applicable Regulations: Often few other than general zoning.

Some Functions/Values:
- Habitat for mammals, reptiles, amphibians, fish
- Pollution prevention
- Erosion control
- Bird habitat
- Flood storage

Some Special Characteristics Relevant to Assessment:

- Dependent on ground water discharge and surface runoff.
- Large numbers throughout the landscape in some states.
- Many isolated or partially isolated from other rivers, steams during normal hydrologic conditions.

- Many highly susceptible to watershed changes and resulting changes in runoff, sediment regimes, and water quality.

Restoration Potential: Variable. Relatively high for only partially drained depressional wetlands (e.g., partial drainage for agricultural purposes); poor for wetlands filled by sediment, pollutants, or other materials because there is no or limited flushing action or long detention times.

Data Availability:

- Poorly identified on wetland maps because maps do not show smaller wetlands. Such wetlands are also difficult to spot on air photos due to small size.
- Flood maps are rarely available for such wetlands.
- Surface water elevations and records are rarely available for such wetlands.

APPENDIX D: CHARACTERISTICS OF WETLANDS AND THEIR ABILITY TO PRODUCE GOODS AND SERVICES (FUNCTIONS/VALUES)

The following appendix note provides an overview of some of the natural resource and broader wetland characteristics that determine the ability of wetlands to produce goods and services of value to society (termed functions/values in this report). The list of functions/values is derived from various wetland, riparian, and floodplain regulatory statutes, regulations, ordinances, and publications. Habitat functions/values have been subdivided into a number of categories (with resulting overlap), consistent with the typical areas of expertise and input from various resource agencies, academics, and interest groups.

Ecologically or Hydrologically-Based Functions/Values

Function/value:
***Provide flood storage by storing and slowly releasing flood waters*.**

Function/value: Reduce downstream flood heights, velocities and damages; protect health and safety, prevent nuisance, and reduce the economic impacts of flooding and flood damages.

General discussion: Flood storage has been recognized as a wetland and floodplain/riparian area function/value for many years, although there are only a small number of papers and reports dealing specifically with flood storage. Storage has proven difficult to evaluate on a case-by-case basis because the flood storage capability of a floodplain or wetland depends not only upon the size, configuration, and outlet of the floodplain or wetland, but also on the surrounding topography and overall stream characteristics. Flood storage also depends on antecedent conditions, such as water levels. Further, the importance of a given amount of flood storage on downstream water levels depends on the synchronization and desynchronization of flood flows from multiple sources that reach a particular area at a particular point in time. Flood storage is, to some extent, susceptible to quantitative evaluation if adequate time and money are available for detailed topographic mapping and flood flow analysis (e.g., HEC models).

Features determining function/value:

- Existing and reasonably anticipated overall flood/flow regime
- Size (magnitude) of flood
- Nature of floodplain/wetland topographic depression (includes not only floodplain or wetland but surrounding "lip"
- Size of floodplain and surrounding depression
- Outlet size, depth
- Vegetation type and density
- Present or reasonably anticipated flood damage prone to activities at downstream locations

Wetland types: Primarily riverine; some other types.

Difficulty in evaluation: Quantitative evaluation with HEC or other hydrologic models is possible, but time consuming and expensive.

Sources of useful information: NWI maps (vegetation), stream gauge records, other water level records, topographic maps, FEMA, and other flood maps.

Red and yellow flagging (some features to look for):

- FEMA or other flood maps showing deep inundation for floodplain/wetland.
- Physical evidence of deep flooding during floods, fluctuating water levels.
- Much of the watershed is developed, much impermeable surfaces.
- Floodplains/wetlands are rare or relatively rare in a watershed.
- Significant topography in a watershed with resulting steep hydrograph.
- Large floodplain in deep topographic depression with restricted floodplain outlet.
- Upstream from existing or anticipated substantial, low-lying development now suffering flood losses or susceptible to losses.

Sources of expertise: Local floodplain management agency, state floodplain management agency, Corps of Engineers, FEMA, USGS, NRCS, or U.S. Bureau of Reclamation.

Measures to reduce project impacts on function:

- Protect topographic configuration of floodplain/wetland and surrounding depression from filling, grading.
- Protect outlets of wetland.
- Prevent channelization, ditching.

On-site restoration/creation/enhancement potential: Often technically possible to restore storage through contouring fills, revegetation, excavation, restoring, or raising elevation of depressional outlet.

Off-site restoration/creation and mitigation bank potential: It is technically possible to provide flood storage benefits for the same downstream individuals and properties if off-site mitigation is provided on the same river or stream, but a shift to another stream or watershed will shift benefits and burdens.

Function/value:
Convey flood waters

Function/value: Reduce flood heights and velocities at upstream, adjacent, and downstream points; protect health and safety; prevent nuisances; reduce economic damages and losses.

General discussion: Flood conveyance is a function broadly considered in floodplain management for more than 30 years. It is a function that is also subject to quantitative evaluation through “backwater models,” such as HEC. The calculation of flood conveyance requires the calculation of a flood discharge (Q) for a specific frequency of flood and the determination of the valley profile and stream valley cross section. Backwater computations can then be carried out to calculate increases in flood heights that would occur if a wetland or portion of a wetland was filled.

Assessment of this function may be particularly important in addressing “taking” issues because it is one of the few functions subject to clear nuisance implications and quantitative evaluation. Little attention has been paid to flood conveyance by the wetland community for several reasons:

- Only river, stream, and creek wetlands provide this function.
- Flood conveyance is provided not only by wetlands but by stream channels, banks, and floodplain areas more generally (but this is also true for flood storage).
- Flood conveyance appears conceptually contradictory with flood storage (although it is not).

Features determining function/value:
- Hydrologic regime (the quantity of flood waters for particular sizes or frequencies of floods which can be expected to flow through a valley cross section including, but not limited to, wetland areas).
- Location of wetland and floodplain/riparian area in relationship to stream channel.
- Configuration of the wetland relative to the flow regime.
- Topography of not only a wetland but floodplain and stream bed or bank.
- Vegetation (in general, more vegetation results in less conveyance capacity).
- Soils (erodibility).

Wetland types: Riverine.

Difficulty in evaluation: Quantitative evaluation with HEC or other hydrologic models is possible but time consuming and expensive.

Sources of useful information: Topographic maps (stream gradient, topography), air photos (vegetation), FEMA and other federal and state agency flood and floodway maps, NWI maps (vegetation, location), and stream gauging records.

Red flagging and yellow flagging (some features to look for):

- Floodplain/wetland is in a FEMA, Corps of Engineers, USGS, NRCS, state or local mapped floodway.
- Wetland/floodplain in or adjacent to a river or stream with history of deep, high velocity inundation.
- Wetland/floodplain in or adjacent to a river or stream with documented, flashy hydrologic characteristics (stream gauging, flood maps, other flood data).
- Wetland/floodplain in or adjacent to a river or stream in an urban or urbanizing area with an impermeable surface and substantial drainage area.
- Wetland/floodplain in or adjacent to a river or stream in an area of steep topography.
- Wetland/floodplain with large stones and gravel (indicates high velocity flows).
- Narrow valley cross-section with floodplain/wetland occupying much of the cross-section.
- Substantial, low-lying development now suffering flood losses or susceptible to losses or anticipated development in nearby upstream, adjacent, or downstream areas.

Sources of expertise/data: Local floodplain management agency; state floodplain management agency; Corps of Engineers, USGS, FEMA, NRCS, U.S. Bureau of Reclamation, Tennessee Valley Authority, and other agencies.

Measures to reduce project impacts on function:

- Locate all fills as far from the center of a river or stream as possible.
- Contour any fills, other alterations to compensate for loss of hydraulic conveyance.

On-site restoration/creation/enhancement potential: Hydraulic conveyance capacity can often be restored on-site through grading, excavation, etc.

Off-site restoration/creation or mitigation bank potential: Any effort to recreate or restore hydraulic conveyance on other streams or at other locations on a stream will allow increased flood damages to upstream, adjacent, and downstream properties at the original site although improvement may occur at other locations.

Function/value:

Induce waves to break before reaching shore, reducing the force of waves and retarding flows.

Function/value: Reduce wave and erosion damage to back-lying properties, reduce economic losses.

General discussion: Waves may add 3-15 feet or more to standing water flood elevations along some major rivers, streams, lakes and estuaries, and in coastal areas. Waves have large kinetic energy and often damage and/or destroy houses, roads, and other structures. They can also erode foundations and pilings (resulting in building collapse), roads, lawns, parking lots, agricultural fields, etc.

High velocity waves are generated where there is a combination of (1) high winds (particularly common in hurricanes and "northeasters" along the coast), (2) wide "fetch" (width of open water), and (3) at least moderate water depths.

Vegetated floodplains/wetlands can help reduce wave and erosion damage by (1) causing waves to break at offshore locations, and (2) binding and holding the soil.

The Federal Emergency Management Agency has identified high velocity wave zones on some coastal flood hazard maps and requires protection of mangroves in local coastal floodplain regulations where mangroves reduce flood damages.

Features determining function/value:

- Whether a wetland/floodplain is directly adjacent to a major water body.
- Width and depth of adjacent water body including bottom topography.
- Wind and flood history and characteristics for an area.
- Vegetation type, density, and height.
- Location of floodplain/wetland or portion of floodplain/wetland in relationship to an adjacent water body and damage prone back lying areas.
- Size of wetland.
- Existing or potential back lying areas subject to wave/erosion damage.

Wetland types: Coastal, estuarine fringe, some lake and river fringe (Mississippi River) floodplains and wetlands.

Difficulty in evaluation: Moderate.

Sources of useful existing information: FEMA flood maps, flood records, topographic maps, water resource maps, bathymetric maps, air photos (water body characteristics, wetland characteristics).

Red and yellow flagging (some features to look for):

- Wetland/floodplain adjacent to a water body with high wind and flood history, large fetch, and at least moderate near-shore depths.
- Wetland/floodplain with thick wetland vegetation (e.g., mangroves, other trees).
- Existing or potential back lying development or other activities subject to flood/erosion damage, past flood and wave damage (e.g., disaster payments).

Sources of expertise: FEMA, Corps of Engineers, USGS, NRCS, local floodplain management agency; state floodplain management agency, and Soil and Water Conservation

District.

Measures to reduce project impacts on function:

- Replant vegetation where disturbed.
- Install compensatory wave reduction and erosion control measures.

On-site restoration/creation/enhancement potential: Replanting of trees and other vegetation can, over time, help restore wave retardation and erosion potential.

Off-site restoration/creation or mitigation bank potential: It is not usually possible to protect the same back lying properties and individuals by a restoration/creation or mitigation bank some distance from an original site.

Function/value:
Reduce erosion by slowing velocity of water and binding and retaining soil

Function/value: Reduce erosion property losses, ecological damage, and sedimentation of lakes, streams, reservoirs, estuaries, and other wetlands**.**

General discussion: Vegetated floodplains and wetlands may reduce erosion in a broad range of contexts by slowing the velocity of waters and binding the soil. Wetlands located in and adjacent to streams with high velocity waters may be particularly important.

Features determining function/value:

- Overall hydrologic regime including velocity of water at a site (particularly important).
- Type of wetland.
- Location within the wetland/floodplain.
- Vegetation types, densities, and condition.

Wetland types: Primarily river and river fringe (river bed, stream bank, floodplain), but also some lake fringe, coastal and estuarine fringe, and slope wetlands. Often one portion of a wetland is more important than another in reducing erosion.

Difficulty in evaluating: Moderate.

Sources of information: Topographic maps, FEMA and other floodplain and floodway maps, soil maps, and air photos.

Red and yellow flagging (some features to look for):

- Large gravel, boulders in wetland (indicates high velocity flows).
- Wetlands in or adjacent to high velocity stream.
- Wetlands in wave action zones along lakes, rivers, estuaries, and coasts.
- Slope wetlands downstream from high gradient topography (high velocities from runoff are likely).

Sources of expertise: NRCS, USGS, Corps of Engineers, resource agencies, floodplain management agencies, soil and conservation groups and organizations (e.g., Soil Conservation Districts), and academics.

Measures to reduce project impacts on function:

- Replant erosion-prone areas.
- Use rip rap, other erosion control measures.
- Contour fills and other alterations to reduce water velocities.

On-site restoration/creation/enhancement potential: Replanting of trees and other vegetation or natural revegetation can, over time, help restore erosion prevention capacity.

Off-site restoration/creation or mitigation bank potential: It is not ordinarily possible to protect the same back lying properties and individuals by a restoration/creation or mitigation bank some distance from an original site although erosion control may be provided for other sites.

Function/value: ***Provide natural crops and timber***

Function/value: Produce natural crops of commercial value and recreational value, such as cranberries, blueberries, salt marsh hay, timber, and wild rice.

Features determining function/value:

- Water salinity (almost all natural crops are in freshwater wetlands).
- Water quality.
- Water depths and velocities, hydroperiod.
- Soil.
- Size of floodplain/wetland.
- Vegetation type, density, and condition.

Wetland types: Many types, but primarily seasonally flooded freshwater wetlands.

Difficulty in evaluating: Moderate. There are many types of natural crops and wetland forest species with differing requirements.

Sources of information: NWI maps (vegetation, overall hydrologic regime), soil surveys, air photos, and topographic maps.

Red and yellow flagging (some features to look for):

- Visible evidence of cranberry, blueberry, wild rice salt marsh hay, forestry, or other natural crops.

Sources of expertise: NRCS, U.S. Forest Service, Cooperative Extension staff), groups and organizations representing various agricultural groups, environmental not-for-profits, and academics.

Measures to reduce project impacts on functions:

- Maintain the natural hydrologic regime as much as possible.
- Require replanting of disturbed areas.

On-site restoration/creation potential: Moderate if sites are available.

Off-site restoration/creation or mitigation bank potential: Possible, but different properties and individuals will benefit.

Function/value: Prevent and treat pollution

Function/value: Prevent and treat pollution in lakes, streams, estuaries, coastal water, ground waters, etc.

General discussion: Many wetlands serve two related functions:

- Prevent pollution from entering water bodies. Wetlands and vegetated floodplains intercept and trap debris, toxics, nutrients, and other pollutants that would otherwise reach water bodies from upland sources by slowing the velocity of water, causing sedimentation, and providing an opportunity for chemical transformations in wetland soils and water.
- Treat (remove) pollution in water bodies. Wetlands (and some frequently flooded floodplain areas) in water bodies or inundated by fluctuating water levels from such adjacent water bodies (tides, floods) may also, in some instances, remove pollutants which have already reached water bodies. For example, riverine wetlands may slow river velocities, causing precipitation of sediments and attached pollutants. Lake fringe wetlands may buffer lakes from upland sediment and pollution and may also, to some extent, remove pollutants in lakes.

Features determining function/value:

- Overall flow regimes, including detention times, quantity of water, and hydroperiod.
- Sediment regime.
- Type of vegetation, density, and condition.
- Soils.
- Location of wetland in relationship to other water bodies.
- Connectivity of wetlands to other water bodies.
- Existing or reasonably anticipated pollution sources that may be intercepted by wetland.

Wetland types: All types may help prevent pollution for upland sources reaching water bodies if they lay between the pollution sources and the water bodies. Lake fringe, estuarine and coastal fringe, and riverine wetlands may remove pollutants from water bodies.

Sources of information: NWI maps (water regimes, vegetation), topographic maps (water flows), soils maps, air photos (vegetation, flow regimes, land uses), and land use plans (future development).

Red and yellow flagging (some features to look for):

- Slope, flats, river fringe, lake fringe, coastal fringe, estuarine fringe, and other wetlands that lay between an existing or potential pollution source (e.g., nutrients, sediment, toxics) and a water body used for water supply, swimming, and other purposes.
- River fringe, lake fringe, coastal fringe, or estuarine fringe wetland adjacent to a water body with high levels of nutrients, sediment, etc. and fluctuating water levels.
- Sediment deposition visible in a wetland area.
- Wetland with dense vegetation located in an area (agricultural, urban, other) with high pollution potential.

Sources of expertise: NRCS, EPA, Corps of Engineers, USGS, state pollution control agencies, other regulatory and resource agencies, environmental not-for-profits, land trusts, and academics.

Measures to reduce project impacts on function:

- Do not allow drainage, channelization or other measures that decrease water detention time in a wetland.
- Require replanting of vegetation where natural revegetation may not occur.
- Require upland vegetated buffers where wetland buffers may be disturbed.

On-site restoration/creation/enhancement potential: Some measures may be undertaken to compensate for loss of pollution buffering or treatment potential, such as replanting of vegetation, installation of detention and sedimentation ponds, and construction of upland vegetated buffers.

Off-site restoration/creation or mitigation bank potential: Wetlands created at another site will usually not protect the same water body and the same individuals and properties. However, it may be possible to create wetlands off-site in some instances to provide pollution buffers for the same water body (e.g., restoration or creation of a wetland at another location between agricultural land and a lake) or to help treat water in the same water body (e.g., creation of a wetland in the same stream but in a different section).

Function/value:

Provide habitat for fish and shellfish

(Note, this overlaps with other types of habitat).

Function/value: Sport and commercial fisheries, food, recreation, cultural value, and food chain support.

General discussion: The importance of coastal and estuarine wetlands to fish and shellfish are two of the most broadly recognized coastal and estuarine wetland functions/values. The importance of freshwater wetlands to northern pike spawning and other fish is also well-known.

Features determining function/value:

- Fish/shellfish capacity of adjacent waters (depth, salinity, water quality, velocity temperature, substrate).
- Depth of water.
- Salinity.
- Velocity.
- Water temperature.
- Connectivity between wetland and adjacent waters.
- Substrate, soil.
- Water quality (including sediment loading).
- Size of wetland/floodplain area.

Wetland types: Primarily wetlands adjacent to lakes, streams, estuaries, or the ocean where there is open water.

Difficulty in evaluating: Moderate. Location in wetland may be important as well as the type of wetland.

Sources of information: NWI maps (size, water regime, salinity, vegetation type), soils maps, topographic maps, fisheries studies, and instream flow studies.

Red and yellow flagging (some features to look for):

- Wetland/floodplain is adjacent to and connected to a water body with fish/shellfish.
- Adequate depth and size for fish with good water quality.
- Observed fish or shellfish.
- Observed spawning areas.

Sources of expertise: U.S. Fish and Wildlife Service, National Marine Fisheries Service, and other organizations and groups representing commercial and private fisherman, shell fishermen, resource agencies, and academics.

Measures to reduce project impacts on function:

- Insure that connection between wetland and adjacent waters is maintained (essential to passage of fish).
- Insure that adequate depths are maintained in wetland and adjacent water body.
- Require revegetation of fills to reduce erosion and sedimentation.
- Minimize tree cutting and vegetation removal adjacent to wetland and water body where water temperatures are critical.

On-site restoration/creation/enhancement potential: On-site excavation of fill and break of dikes may be used to restore or create wetland spawning areas. Restoration or creation of riffle and pools in rivers is also possible.

Off-site restoration/creation or mitigation bank potential: Off-site restoration, creation or use of a mitigation bank on another water body will not compensate for destruction of fish or shellfish in the original water body. Different individuals and properties will benefit and suffer burdens. However, this problem can be reduced somewhat through restoration or creation or use of a mitigation bank on the same water body.

Function/value:
Provide habitat for amphibian, reptile, mammal, and insect species

(Note, this overlaps with other types of habitat).

Function/value: Provide ecological, heritage, recreation, aesthetic, and cultural values.

General discussion: Wetlands and floodplains provide critical habitat for a broad array of amphibian, reptile, mammal, and insect species. However, functions/values depend not only on wetlands, but also relationship to uplands, other wetlands, and deepwater habitat because most amphibians, mammals, and reptiles spend only a portion of their time in wetlands.

Features determining function/value:

- Water depth, velocity.
- Water level fluctuations.
- Water quality.
- Salinity.
- Sediment regimes.
- Vegetation types, density.
- Size of wetland/floodplain.
- Edge ratio of wetland/floodplain.
- Relationship of wetland to other wetlands, floodplains, water bodies, and upland habitat, availability of corridors and passageways between wetland and other habitat.
- Presence or absence of buffers.

Wetland types: All types of wetlands may be valuable (depending on the circumstances) for reptiles, birds, amphibians, and insects.

Difficulty in evaluating: Difficult due to the extremely large number of habitat ranges and niches for different amphibian, mammals, reptiles, and insects. Different sections of a wetland are often more important for particular species.

Sources of information: NWI maps (vegetation, size, overall water regime, substrate), soils maps, topographic maps, various mammal, reptile, amphibian, and insect surveys.

Red and yellow flagging (some features to look for):

- Directly observed amphibians, reptiles, mammals, insects or observed signs (e.g., tracks, scat, egg cases or pupa shells).
- Wetlands/floodplains are rare in locality or region; wetland type is rare.
- Wetlands/floodplains adjacent to parks, refuges, or other public lands.
- Wetlands/floodplains adjacent to large undeveloped private tracks.
- Wetland/floodplains with significant open water or adjacent to a lake, river, or stream with open water (otter, beaver).
- Undisturbed wetlands/floodplains.

Sources of expertise: Academics, resource agencies, and environmental not-for-profit organizations.

Measures to reduce project impacts on function: Varied, depending on the situation and type of wildlife.

- Maintain wetland/floodplain to wetland/water connections; maintain wetland/ floodplain to upland wildlife corridors and access to wetland/floodplain by wildlife.
- Require erosion control and sediment control measures such as detention areas and grass strips to reduce sediment and pollutant contributions to wetland.
- Require fencing.

On-site restoration/creation/enhancement potential: Onsite restoration potential is varied, depending on the wetland type and species. Often on-site restoration potential is poor in a urbanizing contexts for species that require not only wetland, but also undisturbed adjacent upland habitat and adequate connecting pathways.

Off-site restoration/creation or mitigation bank potential: Varied. Off-site restoration/creation or mitigation bank potential may be better than on-site where the original wetland is in the midst of a large subdivision, road project, etc. However, different individuals and properties will often benefit and suffer burdens where offsite compensation is used.

Function/value:

Provide habitat for waterfowl species

(Note, this overlaps with other types of habitat).

Function/value: Provide food, recreation, aesthetic, economic and cultural value.

General discussion: Waterfowl nesting, resting, and feeding were some of the first, widely recognized functions of wetlands. Adjacent floodplains may also be important nesting and feeding areas. The prairie pothole wetlands and wetlands in various flyways are particularly important. Because waterfowl fly from wetland to wetland they can use many types of isolated wetlands not useful for other forms of wildlife that depend on the ground pathways.

Features determining function/value:

- Salinity, water quality.
- Presence of open water in wetland or floodplain or adjacent open water in a lake, river, stream, estuary, or ocean.
- Types, densities, and condition of wetland and floodplain vegetation.
- Size of wetland and floodplain.
- Water quality.
- Food chain support, availability of nearby sources of food (e.g., corn fields).
- Buffers.
- Presence or absence of predators, numbers.

Wetland types: Principally depressional, lake fringe, river fringe, ocean and estuarine fringe, but other wetlands and floodplains may be important.

Difficulty in evaluating: Moderate.

Sources of existing information: NWI maps (water regime, vegetation, size, substrate, relationship to other waters), soil maps, topographic maps, land cover maps, waterfowl inventories, and special maps.

Red and yellow flagging (some features to look for):

- Wetland or floodplain with significant open water or adjacent to a lake, river, or stream with open water.
- Waterfowl directly observed.
- Wetland in flyway.
- Wetlands and floodplains adjacent to parks, refuges, and other public lands.

Sources of expertise: FWS, NMFS, NRCS, state wildlife agencies, groups representing waterfowl hunters, duck clubs, resource agencies, environmental not-for-profits, and academics.

Measures to reduce project impacts on function:

- Make use of wetlands/floodplains for agriculture only during periods when not used by waterfowl.
- Install nesting boxes.
- Fence wetlands and floodplains.
- Protect wetlands and floodplains from pesticides, nutrients, and sediment through the use of buffer strips.
- Provide buffers and nearby upland food sources.

On-site restoration/creation/enhancement potential: Often quite good if adequate land and funds are available to excavate areas, use dredging, dynamite, or other measures to create open water, control exotic plant species, etc.

Off-site restoration/creation or mitigation bank potential: Often quite good since ducks can fly from one site to another. However, different individuals and properties will benefit and suffer burdens.

Function/value:
Provide habitat for various song birds and other birds

(Note, this overlaps with waterfowl and other types of habitat).

Function/value: Ecotourism, recreation, education, and research.

General discussion: Bird watching has become a widespread activity in the last 20 years with bird watchers often now outnumbering hunters. Bird watching is sometimes important in local economies. A great deal of bird watching takes place in wetlands, floodplains, and riparian areas due to the large numbers of waterfowl, other birds, and upland species that feed in wetland areas.

Features determining function/value: A broad range of features affect the bird-habitat potential of wetlands since birds occupy a wide range of niches:

- Size.
- Open water.
- Water quality.
- Vegetation types, conditions, and densities.
- Other wildlife.
- Public access.
- Rareness of wetlands in the region.
- Rareness of wetland type in region.
- Adjacent upland and deepwater habitat.
- Adjacency of wetland to trails, roads, parks, refuges, and sanctuaries.

Wetland types: Many types of wetlands.

Difficulty in evaluating: Difficult to evaluate based on air photos and one-time visits since birds are too small to be seen on air photos and birds often use wetlands only a portion of a time.

Sources of information: NWI maps (wetland types, vegetation, substrate, proximity to other waters, overall water regime), air photos (vegetation), local birding clubs, and field observations.

Red flagging (some features to look for):

- Rareness of wetlands/floodplains in the region.
- Rareness of wetland/floodplain type in the region.
- Good upland and deepwater habitat.
- Adjacency of wetland/floodplain to trails, roads, parks, refuges, and sanctuaries.
- Public access.
- Wetland/floodplain is well known in a region for bird watching.
- Wetland/floodplain is relatively undisturbed.
- Wetland/floodplain has open water (water birds).

Sources of expertise: FWS, schools, universities, bird watching groups, environmental not-for-profits, land trusts, resource agencies, and museums.

Measures to reduce project impacts on function:

- Require revegetation.
- Require upland screening of fills and structures to protect aesthetic values.
- Install nesting areas.
- Maintain connectivity between open waters and wetland for canoe access.

On-site restoration/creation/enhancement potential: Variable. It is difficult to create the conditions needed for very specific bird species or guilds.

Off-site restoration/creation or mitigation bank potential: See on-site.

Function/value:

Provide habitat for endangered or threatened species of plants and animals

(Note, this overlaps with other habitat categories but has been described separately because of the great interest in endangered or threatened species and the variety of programs directed toward them).

Function/value: Heritage value, protect gene pools, ecotourism, bird-watching, research, education.

General discussion: Many endangered or threatened plant or animal species depend on wetlands. Some spend their entire lives in wetlands, but most use wetlands only some of the time. Therefore, upland and deep water habitat and the connections between wetlands and these other habitats are very important. Connections are also important to provide refuge during droughts and periods of fluctuating water levels. Because of the sensitivity of many of these species and their narrow ecological niches, it is particularly important to protect not only wetlands, but also water regime.

Features determining function/value: A large number of features are relevant to the ability of wetlands to provide habitat for endangered and threatened species since the requirement of individual species vary greatly.

- Scarcity of wetlands in area.
- Scarcity of wetland type in area.
- Adjacent upland and aquatic habitat; connections with broader habitat.
- Soils.
- Substrate.
- Size.
- Vegetation.
- Water depth, velocity, and quantity.
- Salinity.
- Water temperature.
- Buffers (if any).

Wetland types: All types may be important. Many endangered plant and animal species are located in rare wetland types such as bogs, vernal pools, and saline ponds.

Difficulty in evaluating: Difficult due to the number of habitat ranges and niches of different endangered species and because endangered and threatened species are usually difficult to locate and observe.

Sources of information: NWI maps (overall vegetation, water regime, substrate, connections with other wetlands), air photos (vegetation), lists of sites in federal inventories, state inventories, nature conservancies, and other inventories for endangered, rare, or threatened species.

Red and yellow flagging (some features to look for):

- Wetlands/floodplains for wetland/floodplain type is rare in a locality, region, or state.
- Wetland/floodplain is a type and in a general location known to serve as habitat for endangered species.
- Sitings of endangered or threatened species in similar wetlands.

Sources of expertise: FWS and other resource agencies, environmental nongovernmental organizations, academics.

Measures to reduce project impacts on function:

- Use buffers, detention basins, or other measures to protect water quality and reduce intrusions in remaining areas.
- Fence.
- Control exotic species; provide other active management.

On-site restoration/creation/enhancement potential: The potential for onsite restoration of wetland habitat for endangered species is often low to moderate given the very narrow habitat requirements of most endangered species.

Off-site restoration/creation or mitigation bank potential: Offsite restoration potential is often very low, given the very narrow hydrologic and habitat requirements of most endangered species including, in many instances, the need for adjacent upland and/or aquatic habitat.

Function/value:
Recharge ground water

Function/value: Maintain and enhance quantity and quality of ground water supplies for domestic, commercial, industrial, agricultural, wildlife protection and other purposes; maintain base flow of rivers and streams.

General discussion: In general, wetlands and floodplains are not recharge areas. Some depressional, lake fringe, and river fringe wetlands and other seasonally flooded wetlands and floodplains may be recharge areas at least a portion of a year or may serve as both recharge and discharge areas.

Features determining function/value:

- Ground water levels in comparison with wetland/floodplain water levels.
- Yearly fluctuations in ground water levels compared with yearly fluctuations in wetland/floodplain water levels.
- Whether the bottom of a wetland is sealed by organics, silt, etc.
- Overall porosity and permeability of wetland soils.
- Amount of impermeable surfaces in the watershed.
- Proximity of wetland to water supply wells.

Wetland/floodplain types: Most wetlands/floodplains are discharge areas (slope, riverine, lake fringe, coastal and estuarine fringe, depressional). However, some depressional and flats act simultaneously as recharge areas (discharge on side, recharge on other) or act as recharge areas a portion of the year when wetland elevations exceed ground water elevations due to precipitation or surface runoff. For example, many prairie potholes, flats, and riparian wetlands may be recharge areas during the spring or after a heavy spring, summer, or fall.

Difficulty in evaluating: Very difficult, time-consuming, and expensive to conduct detailed studies. May require long-term studies with the use of piezometers.

Sources of information: Topographic maps; water level records for wetlands or adjacent lakes, stream, ground water levels for well logs or piezometers.

Red and yellow flagging (some features to look for):

- Wetland has inlet and no outlet.
- Seasonal fluctuations in wetland/floodplain water levels (particularly long-term fluctuations).
- Sand or gravel substrate.
- Nearby water supply wells.

Sources of expertise: USGS, NRCS, state water supply agencies, geologic agencies, other resource agencies, and academics.

Measures to reduce project impacts on function:
Maintain natural fluctuations in wetland water levels, and make sure wetland water levels continue to exceed adjacent ground water levels at least some of the year.

On-site restoration/creation/enhancement potential: It is technically possible to create both wetland recharge areas, although it has often proven difficult to maintain natural infiltration capacity in wetlands because the bottoms of wetlands and other detention areas tend to quickly seal with organics and sediment.

Off-site restoration/creation or mitigation bank potential: (See on-site above.) It is theoretically possible to locate recharge wetlands at some distance from the original wetland/floodplain and provide recharge to of a regional aquifer. However, often shifting recharge to another site will involve loss of benefits to nearby landowners or ecosystems.

Function/value:

Discharge ground water

Function/value: Prevent damaging increases in ground water levels (e.g., flooding of basements); maintain wetland and adjacent water levels and flow regimes

General discussion: Many depressional, slope, lake, estuarine, and river fringe wetlands are ground water discharge areas much of the year. If a wetland is filled, reducing ground water discharge, ground water levels in the surrounding landscape may rise, flooding basements rendering septic tanks, soil absorption systems inoperative, and causing other problems.

Features determining function/value:

- Wetland surface water elevation versus groundwater elevation in nearby upland areas (piezometric surface).
- Wetland outlet level.
- Permeability and porosity of wetland soils.

Wetland types: Slope, depressional, organic and mineral flats, other wetlands.

Difficulty in evaluating: Discharge may be directly observed in some instances (e.g., springs in wetland/floodplain); otherwise difficult.

Sources of information: NWI maps (overall water regime, wetland type), topographic maps, well logs, and USGS maps.

Red and yellow flagging (some features to look for):

- Visible springs.
- Wetland water temperature during fall and winter in northern climates is higher than expected (suggests ground water input).

Sources of expertise: USGS, state geologic and water resource agencies, consultants, academics.

Measures to reduce project impacts on function:

- Minimize dams and structures that would increase water levels in a wetland, decreasing discharge.
- Reduce or prevent fills.

On-site restoration/creation potential: Ground water discharge can sometimes be restored at a site by recreating wetlands or digging wells, channels, pits, and open water areas.

Off-site restoration/creation or mitigation bank potential: Ground water discharge for a regional aquifer may be restored or created at another site, but problems of high ground water will continue at the original site.

Function/value:
Modify micro-climate

Function/value: Reduce temperatures in nearby areas by cooling air (or preventing temperature rises), increasingly circulation due to differential pressure gradients.

General discussion: Wetlands and floodplains along with other open spaces moderate temperatures and affect circulation patterns and humidity, particularly in urban areas.

Features determining function/value:

- Size
- Vegetation type and amount
- Presence or absence of open water
- Location

Wetland types: All types of wetlands/floodplains and open space.

Difficulty in evaluating: Difficult.

Sources of information: NWI maps (wetland size, location, type, vegetation, open water, other wetlands and waters), detailed climatological data, and topographic maps.

Red and yellow flagging (some features to look for):

- Location adjacent to an urban area
- Size
- Other features

Sources of expertise: Academics, resource agencies.

Measures to reduce project impacts on function:

- Replant.
- Maintain alternative open spaces.

On-site restoration/creation/enhancement potential: Onsite restoration is possible if open space vegetation areas can be restored or created.

Off-site restoration/creation or mitigation bank potential: Also moderate to good but benefits will be shifted to a new location.

ENVIRONMENTALLY BASED FUNCTIONS/VALUES
(Humans more significantly enter the picture--accessibility, and other factors).

Function/value:
Provide recreation and ecotourism opportunities and experiences

Function/value: Health, economic value, fisheries, ecotourism, and tourism.

General discussion: Water and nonwater-based recreation are among the most important uses of wetlands and related water and floodplain resources to society and include both water-based recreation such as fishing, canoeing, boating (in some instances) and land-based recreation, such as bird watching, nature watching, jogging along trails, etc.

Features determining function/value: An extremely broad range of physical processes are important to recreation, including:

- Size
- Type
- Vegetation
- Bird species (bird watching)
- Animal species including endangered species (wildlife watching)
- Fish species (fishing)
- Waterfowl species (hunting)
- Rarity of wetlands in a state or region
- Rarity of wetland type in a locality, state
- Open water (boating, canoeing)
- Public access
- Adjacency to other waters
- Adjacency to roads, bike paths, etc.
- Adjacency to parks, refuges, and sanctuaries

Wetland types: Many types have recreational and ecotourism potential. However, wetlands adjacent to lake, river, and estuarine/coastal waters are more important for water-based recreation.

Difficulty in evaluating: Difficult to evaluate because there are many types of recreation and because functions/values are not based on ecological considerations alone. For example, accessibility and location are relevant.

Sources of information: State and local recreation plans and surveys; NWI maps and other wetlands maps; public land ownership maps.

Red and yellow flagging (some features to look for):

- Observed use of wetlands by canoeists, birders, and other recreation users.
- Adjacency to other waters.

- Public access through roads, trails, boat launching sites, and public waters.
- Proximity to urban centers.
- Large size.
- High water quality (swimming, boating, wildlife).
- Rarity of wetlands in state region.
- Rarity of wetland type in locality, state.
- Open water (relevant to canoeing).
- Bird species important for bird watching.
- Animal species including endangered species important for wildlife watching.
- Fish species important for fishing.
- Waterfowl (hunting).

Sources of expertise: FWS, NPS, state park and recreation agencies at all levels of government, environmental not-for-profits, and land trusts.

Measures to reduce project impacts on function:

- Maintain connectivity between open waters and wetlands for boat access.
- Require revegetation.
- Require upland screening of fills, structures to protect aesthetic values.

Restoration/creation/enhancement potential: Variable, depending on the types of recreation.

Off-site restoration/creation or mitigation bank potential: Off-site potential is variable in part because of the many different types of recreation. However, in general, different individuals or populations will benefit even if overall recreational capabilities are restored.

Function/values:
Provide historical, archaeological, heritage, aesthetic opportunities and experiences

Function/value: Heritage, cultural, educational, research, tourism, and aesthetic.

General discussion: Some wetlands and floodplains have important historical or archaeological value. Examples include the confluence of the Mississippi River where Lewis and Clark began their westward journeys, the Concord Marshes, and the Everglades. Many others have heritage and cultural value for biodiversity, rare and endangered species, and open space.

Features determining function/value:
An extremely broad range of ecological processes are relevant. However, value does not derive from ecological processes alone. Relevant features include:

- Archaeological sites in or adjacent to a wetland/floodplain.
- Historical use of wetland (battles, etc.).
- Aesthetic features of wetland/floodplain including vegetation, open water, and edge ratio.
- Size of wetland.

- Wildlife.
- Diversity of plants/animals.
- Public access.
- Adjacency to parks, historical monuments, sanctuaries, and preserves.

Wetland types: All types (not dependent on natural resource considerations alone).

Difficulty in evaluating: Moderate.

Sources of information: Lists of archaeological sites, historical sites, heritage sites, and park maps.

Red and yellow flagging (some features to look for):
- Shell mounds.
- Historical markers.
- Adjacency to historic, archaeological, park, and other areas.
- Rarity of wetlands, wetland type.
- Biodiversity.
- Endangered and threatened species.

Sources of expertise: NPS, state Heritage Programs, schools, universities, environmental not-for-profits, land trusts, resource agencies, and museums.

Measures to reduce project impacts on function:

Varied, depending upon functions/values and impacts.

On-site restoration/creation/enhancement potential: It is generally impossible to create a historic or archaeological site. Aesthetic sites may be recreated or restored.

Off-site restoration/creation or mitigation bank potential: See onsite.

Function/value: ***Provide education and interpretation opportunities***

Function/value: Educate students at all levels; provide public education.

General discussion: Many types of education and nature interpretation are carried out in wetlands and floodplains at K-12 levels and adult education levels. These range from observation of frogs and birds to sophisticated restoration projects by university students. Many boardwalks and interpretative centers have been constructed in wetlands.

Features determining function/value: An extremely broad range of physical processes give rise to various characteristics important to education. Some include:
- Vegetation type and wildlife including diversity of wildlife.
- Presence of endangered, threatened, or rare plants or animals.
- Degree of alteration or disturbance.
- Rarity of wetland/floodplain type.
- Rarity of wetlands/floodplains in the locality, region.
- Proximity to schools, urban centers.
- Public access, ease of access.
- Boardwalks, trails.

Wetland types: All types.

Difficulty in evaluating: Difficult to evaluate potential education and interpretation potential since education and interpretation needs are diverse and depend on opportunity and social significance as well as natural resource characteristics.

Sources of information: NWI maps (size, vegetation, water regime), maps of public lands, lists of interpretative trails and centers, rare and endangered species maps.

Red and yellow flagging (some features to look for):

- Boardwalks, interpretative facilities in or near a wetland/floodplain.
- Experiments going on in a wetland.
- Wetland is habitat for rare or endangered species.
- Wetland is in or adjacent to parks, refuges, or marine sanctuaries.
- Public trails near wetland/floodplain or wetland/floodplain readily accessible to the public by canoe.
- Schools and colleges nearby.
- Rare wetland type in locality, state, or region.
- Wetlands rare in locality, state, or region.
- Wetland unaltered, in natural condition.

Sources of expertise: Schools, universities, environmental not-for-profits, land trusts, resource agencies, and museums.

Measures to reduce project impacts on function:

Varied, depending on education, interpretation needs and interests.

On-site restoration/creation/enhancement potential: Often quite poor because most teachers and other educators want unaltered wetlands for educational purposes and sites become less interesting if disturbed. There are successful examples of wetland restoration sites being used for education and interpretation (e.g., Tifft Farms, Buffalo, Hackensack Meadowlands, South Platte).

Off-site restoration/creation or mitigation bank potential: See on-site above.

Function/value:

Provide scientific research opportunities

Function/value: Advance scientific knowledge, improve understanding of natural systems.

General discussion: Schools, universities, resource agencies, and nonprofit organizations carry out a large amount of scientific research in wetlands and floodplains.

Features determining function/value: A broad range of physical processes may be important to research (which is highly varied):

- Vegetation types and wildlife including biodiversity.
- Presence of endangered, threatened, or rare plants or animals.
- Degree of alteration, condition.
- Rarity of wetland/floodplain type.
- Rarity of wetlands/floodplains in the locality, region.
- Degree of disturbance.
- Proximity to schools, urban centers.
- Proximity to public lands such as parks, refuges, and sanctuaries.
- Public access, ease of access.
- Boardwalks, trails.
- Previous research studies (establishing baseline conditions).

Wetland types: All types.

Difficulty in evaluating: Moderate to difficult due to many potential types of research.

Sources of information: NWI maps, maps of endangered or threatened species, maps or lists of natural areas, soils maps, or maps showing locations of schools.

Red and yellow flagging (some features to look for):

- Visible evidence of ongoing experiments.
- Wetland is in or adjacent to parks, refuges, or marine sanctuaries.
- Public trails near a wetland or wetland readily accessible to the public by canoe.
- Schools or colleges nearby.
- Wetlands/floodplains are rare in a locality, state, or region.
- Wetland/floodplain type is rare in a locality, state, or region.

Sources of expertise: Resource agencies, schools, universities, environmental not-for-profits, land trusts, and museums.

Measures to reduce project impacts on function:

Varied by type of wetland and research type.

On-site restoration/creation/enhancement potential: Often quite poor after alteration occurs because most researchers want to work with undisturbed or relatively undisturbed wetlands. There are exceptions, such as the Des Plaines River restoration site.

Off-site restoration/creation or mitigation bank potential: Not great (see onsite) since most researchers seek undisturbed or relatively undisturbed wetlands. However, there are exceptions.

APPENDIX E: SELECTED READINGS

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