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ALASKA DEPARTMENT OF TRANSPORTATION

Synthesis of Practice for Rapid Wetland Assessment in Alaska

Prepared by: HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503

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Alaska Department of Transportation
Statewide Research Office
3132 Channel Drive
Juneau, AK 99801-7898

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HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503

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HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503

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The research team screened existing wetland assessment methods through a process that considered the essential features identified by the project advisory team. Nine methods had the essential features and were examined more closely. From these methods, the team sought approaches that use simple language, use models to assess functions, allow comparison among wetland types, consider social values as well as ecological functions, and employ concepts of the hydrogeomorphic approach to wetland assessment. The research team found additional features that seemed particularly beneficial and recommended that these be part of ADOT&PF's method: categorization of wetlands for management purposes, use of "red flags" to identify the highest value wetlands quickly, and use of intuitive and transparent systems for rating wetlands.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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Executive Summary

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is seeking a way to assess wetlands potentially affected by its routine projects. "Routine" projects are loosely defined as those for which an Environmental Assessment or Categorical Exclusion would be the appropriate level of documentation.

Wetland assessments can achieve a wide range of objectives. ADOT&PF's purposes for assessing wetlands include: regulatory compliance, description of wetland functions and their value to society, understanding and disclosure of the effects of a project that alters wetlands, comparison of project alternatives, and identifying appropriate ways to mitigate projects' adverse effects.

The research team identified desirable characteristics of an assessment method through discussion with an interagency Technical Advisory Group, interviews with other wetland practitioners, and consideration of regulations and policies with which ADOT&PF projects must comply. ADOT&PF's rapid assessment method must:

- Aid in impact analysis
- Be applicable to freshwater, non-tidal wetlands
- Require less than one day for evaluation of each wetland
- Evaluate hydrologic, water quality, and fish and wildlife habitat functions
- Be repeatable and objective
- Be supported by well documented rationale
- Be useful for pristine wetlands as well as disturbed wetlands
- Consider wetlands in their watershed context

The research team screened existing wetland assessment methods through a process that considered the essential features listed above. Nine methods had the essential features and were examined more closely. From these methods, the team sought approaches that use simple language, use models to assess functions, allow comparison among wetland types, consider social values as well as ecological functions, and employ concepts of the hydrogeomorphic approach to wetland assessment. The research team found additional features that seemed particularly beneficial and recommended that these be part of ADOT&PF's method: categorization of wetlands for management purposes, use of "red flags" to identify the highest value wetlands quickly, and use of intuitive and transparent systems for rating wetlands.

The Montana Wetland Assessment Method, prepared for the Montana Department of Transportation, is one that could incrementally and relatively easily be adapted for use in Alaska. With few modifications, it could be tested in Alaska immediately. ADOT&PF should adopt certain concepts from other methods as well. A list of steps to adapt the Montana method is included in this report.

At the request of the Technical Advisory Group, the study team briefly considered the utility of Geographic Information Systems (GIS) for wetland assessment. Use of GIS merits further investigation. GIS can offer many advantages for speed and consistency of wetland analysis. However, its usefulness and accuracy depend on the type, level of detail, and accuracy of available datasets. The analytical benefits of GIS can be realized sooner on a corridor-level planning effort than on a detailed, site-specific wetland assessment. Existing datasets allow broad-scale identification of certain high-value wetlands in much of Alaska with a modest investment of effort. Development of the detailed datasets and the models needed to predict individual wetlands' functions would require a substantial investment. The study team recommends a pilot investigation of the opportunities for, and limitations of, detailed GIS-based wetland assessment on a corridor-scale project; the outcome of that study could show the conditions needed for GIS-based analysis to be feasible on routine projects.

The study team recommends that ADOT&PF consider the following:

- After seeking permission from the Montana Department of Transportation, prepare minimal guidance for use of the Montana method in Alaska and implement the method on several upcoming projects.
- Work with interested agencies to categorize wetlands for management purposes. Develop management strategies for each category. Refine Montana's criteria for placement of wetlands into categories.
- Develop a preliminary list of "red flag" conditions that indicate wetlands of the highest value. Seek agency consensus on this list.
- Challenge a team of wetland scientists and GIS analysts to use GIS for wetland assessment on a large project. That team could identify the opportunities for, and limitations of, using GIS to satisfy ADOT&PF wetland assessment needs.
- Complete documentation of the rationale behind the Montana method. Identify deficiencies in the rationale and fill those gaps through literature review or basic research. Improve the Montana models as information is gained.
- Add steps to the Montana method to further reduce the reliance on professional judgment and increase objectivity of the assessment.
- Decide which aspects of wetlands' wildlife support functions ADOT&PF should evaluate. Modify the wildlife section of the Montana method accordingly.
- Consider developing a checklist or flowchart that illustrates how wetland assessment fits into ADOT&PF's project development process.

1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is seeking a way to assess wetlands potentially affected by its routine projects. "Routine" projects were loosely defined as those for which an Environmental Assessment or Categorical Exclusion would be the appropriate level of documentation. ADOT&PF has hired HDR Alaska, Inc. (HDR) to identify and recommend an appropriate wetland assessment method for ADOT&PF use, and to define the information needed to implement the assessment protocol statewide. The term "wetlands" is used in this project in the strict sense, as regulated by the Corps of Engineers; simply put, it refers to vegetated wet areas, not to open water bodies such as streams or lakes. Note that "assessment", as referenced throughout this project, is distinct from wetland delineation and from mitigation of projects' effects on wetlands.

A plethora of wetland assessment methods exists. Wetland assessments can achieve a wide range of important objectives, but no existing method can meet all objectives. Similarly, the various methods require a wide range of data input, technical expertise, training in use of the method, and time to perform. Most methods have been developed with the intent of applying them to a limited suite of wetland types, or within certain geographical areas, but most can be adapted to broaden their applicability. Some methods assess just ecological functions; others document social values and other management considerations.

The purpose of this project is to understand the current status of wetland assessment in Alaska, compile a bibliography of documents related to wetland assessment in Alaska, review the options for wetland assessment, and to recommend a wetland assessment method for ADOT&PF to use for its routine projects. The steps for implementing use of that method are to be defined, along with any related policy decisions that ADOT&PF must consider.

2.0 Objectives of Wetland Assessment

The research team identified the reasons for assessing wetlands and the desirable characteristics of an assessment method based on the results of:

- discussion with members of the Technical Advisory Group (TAG) convened by ADOT&PF;
- interviews of other wetland professionals in the public and private sectors; and
- consideration of the requirements of various policies and regulations that could potentially be met through wetland assessment.

The results of this effort are described in the Technical Memorandum in Appendix B. Wetland assessment may fulfill a number of purposes, including: regulatory compliance, description of wetland functions and their value to society, understanding and disclosure of the effects of a project that alters wetlands, comparison of project alternatives, and identifying appropriate ways to mitigate projects' adverse effects.

Many types of assessment methods exist that can meet the above purposes, and they differ in major and subtle ways. The research team worked with interviewees to identify characteristics of methods that seemed most desirable. Based on these interviews and their experience with ADOT&PF projects, the HDR study team made substantial judgments about which features were essential, and prioritized other non-essential features. The rapid wetland assessment method must:

- Aid in impact analysis
- Be applicable to freshwater, non-tidal wetlands
- Require less than one day for evaluation of each wetland (1/2 day in the field)
- Evaluate hydrologic functions (flood attenuation, water supply, surface/subsurface water courses, erosion control)
- Evaluate water quality functions (turbidity, sedimentation, pollutants)
- Evaluate fish and wildlife habitat functions
- Be repeatable, and limit subjectivity and reliance on Best Professional Judgment
- Document the rationale behind the method
- Be useful for pristine wetlands as well as for human-affected wetlands
- Consider wetlands in their watershed context
- Identify "red flags" – wetland features that indicate an exceptionally important wetland

The research team considered it desirable, but not essential that the method:

- Use common terminology, present rationales clearly, and show the rating process transparently
- Allow comparison among different wetland types
- Consider whether the wetland has the **opportunity** to perform certain functions
- Address social values (subsistence, reduction of flood hazard, recreation, uniqueness, aesthetics, education)
- Be applicable to tidal wetlands
- Forward the intent expressed in the multi-agency Memorandum of Understanding Concerning the Development of a Wetland Functional Assessment Method and Guidebooks: The Hydrogeomorphic Approach (HGM) signed in 2000
- Help define mitigation requirements

- Apply to open-water environments (streams, ponds)
- Rate wetland functions relative to reference wetlands

3.0 Method Screening

The research team reviewed previous evaluations of wetland assessment methods (Bartoldus 1999, Fennessy et al. 2004), and employed the approach presented by the U.S. Army Corps of Engineers' Ecosystem Management and Restoration Information System (EMRIS; USACOE 2005) to compare functional assessment methods to the project objectives, and screen out methods that would not suit ADOT&PF's purposes. The EMRIS process for selecting a wetland assessment method is summarized briefly below. The team used Bartoldus' 1999 information for the screening described below, and only obtained and reviewed updates of the methods remaining after the screening. (References cited in this report are listed in the Bibliography in Appendix A.)

The first step in the EMRIS selection procedure is to define the goals of the assessment. The team defined impact analysis as the primary use for the assessment method, and eliminated from further analysis all methods that would not aid in impact analysis. Rejected methods include those aimed at inventory and planning, those which describe wetland integrity or condition, and methods used to compare landscape units such as watersheds. Some of the methods carried forward are also designed to establish mitigation requirements such as compensation ratios. Table 1 (at the end of this report) lists the methods that were not dismissed in this first step of the screening.

Table 1 summarizes the next eight steps of the EMRIS screening process and their outcomes. We considered some of these steps important for ADOT&PF purposes and other less important. The shaded cells in the second row of Table 1 are the features that EMRIS evaluated that we considered to be essential. Other features considered in the EMRIS process are less critical for meeting ADOT&PF needs.

Step 2 of the EMRIS procedure separates methods reliant on Best Professional Judgment from those that use models to develop conclusions. Using a model-based method, a user would select the best answers to a series of questions and those answers would lead to a conclusion regarding each function evaluated. Reducing reliance on Best Professional Judgment, in order to increase repeatability of an assessment, is a key objective of the ADOT&PF team. Models that estimate hydrologic, water quality, and habitat functions are all of interest to ADOT&PF, and the team considered them essential features of the selected method.

EMRIS' Step 3 considers geographical applicability of existing methods. Knowing few methods can be applied directly to Alaska situations, we did not screen out methods based on geography. Step 4 considers the type of wetland or waterway each method can evaluate. While a method that could evaluate tidal wetlands, non-wetland waters, and even uplands would be desirable, the team deemed it essential only that a method be applicable to non-tidal wetlands. In Step 5, only methods requiring less than one day of work per wetland (on average) were selected because ADOT&PF aims to adopt a *rapid* assessment method. The remaining steps of the EMRIS procedure addressed criteria that do not relate to critical objectives, so none of these steps was used to eliminate methods from further consideration.

Through the EMRIS screening procedure, the team identified fourteen wetland assessment methods that might meet ADOT&PF needs. These methods are identified in the last column of Table 1, and are listed in the first column of Table 2.

During the first phase of this project, interviewees recommended three wetland assessment methods that were not examined by EMRIS. The team added these three methods to Table 2 for evaluation through the remainder of the screening process.

The EMRIS procedure did not consider all of the factors of interest to ADOT&PF, including some critical features. Table 2 lists five additional features considered essential by the research team, other features that are desirable but not critical, and a few other characteristics that would not be deciding factors. The table lists the assessment method features in approximate priority order, as judged by the research team.

Seventeen candidate assessment methods were then screened with respect to the remaining essential features, after which nine methods remained as candidates for use by ADOT&PF. Methods that include the essential features identified through the above screening are:

- Evaluation for Planned Wetlands (Bartoldus et al. 1994)
- Guidance for Rating the Values of Wetlands in North Carolina (North Carolina Department of Environment and Natural Resources 1995)
- Hydrogeomorphic Approach (Smith et al. 1995, Lee et al. 1999, Hall et al. 2002, Powell et al. 2003)
- Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM) (Minnesota Board of Water and Soil Resources 2004)
- Montana Wetland Assessment Method (Berglund 1999)
- A Technique for the Functional Assessment of Nontidal Wetlands in the Coastal Plain of Virginia (Bradshaw 1991)
- Washington Methods for Assessing Wetland Functions (Hruby et al. 1998 and Hruby and Granger 1998)
- Washington State Wetland Rating System for Western Washington (Hruby 2004b)

- Wetland Evaluation Technique (Adamus et al. 1987, 1991)

4.0 Individual Method Review

4.1 Review of Individual Methods Identified through Screening

The study team reviewed the nine methods identified through the screening process in more detail to determine their usefulness for routine ADOT&PF projects. Short descriptions and some of each method's assets and less useful aspects are presented below.

4.1.1 Evaluation for Planned Wetlands

While it was originally developed for comparison of planned wetland to existing ones, it can be used on existing wetlands to determine their functional capabilities. It was developed to meet mitigation needs.

Pros:

- The method uses terminology and approach similar to HGM.

Cons:

- The method was designed to evaluate a planned wetland, or as a guide to design.
- It does not consider flood attenuation functions, and only addresses a "uniqueness" value.
- It is not reference based.

4.1.2 Guidance for Rating the Values of Wetlands in North Carolina

The method uses a series of graphic flowcharts to step the user through questions about the ability of a wetland to perform each of six functions, as well as questions about the opportunity the wetland has to perform those functions. Each flowchart rates the wetland on a scale of 1 to 5 for each function, and it calls these "values".

Pros:

- It is easy to see how the results are derived.
- The method considers the opportunity for a function to be performed.
- The rationale is well documented.
- The graphic method of scoring each function is easy to follow.

Cons:

- The assessment is not reference based.
- The numeric output would not easily be translated into something like functional capacity units that could be used to “quantify” impacts, compare alternatives, or define compensation needs.
- The method does not consider some of the functions or values that ADOT&PF may want to consider.

4.1.3 Hydrogeomorphic Approach

The HGM approach entails:

- classifying wetlands into one of seven categories based on their position in the landscape, their dominant source of water, and the dynamics of the water in the wetland;
- for each subclass of wetland, identifying and describing the functions of that subclass, primarily through Best Professional Judgment of an interdisciplinary team;
- developing a data set for the range of characteristics of that subclass that can serve as a reference to which other wetlands of that subclass can be compared; and
- assessing wetlands’ functions by measuring characteristics of the subject wetland and comparing them to the characteristics of the best-functioning reference wetlands.

The results are expressed numerically for each function on a scale of 0 to 1, and can be used to establish compensation requirements.

Pros:

- Guidebooks, models, and reference data exist for some of the most common wetland types in southcentral and interior Alaska.
- The HGM system of wetland classification is intuitive and widely accepted and used.
- The method is specific to wetland types and regions.
- The lists of functions associated with each major HGM class are useful.
- The numerics in each complete guidebook are based on data collected in that specific wetland type and region; that is, the approach is reference based. The documentation of how the numerics were derived is clear.
- Directions for data collection are generally clear.
- The method’s output is numeric, which makes it easier to “quantify” functions and impacts and determine compensation requirements.

- There is a federal initiative to implement HGM, and federal and state agencies in Alaska have agreed to do so.

Cons:

- The method does not provide a mechanism for comparing wetlands of different HGM types to each other.
- The full method requires that a guidebook and specific models exist for each of the project area wetlands' HGM subclasses. Models are expensive and time-consuming to create. Guidebooks, models, and reference data do not exist for the most common wetland types in southeast, western, northern, or southwestern Alaska.
- The method uses complicated concepts and its terminology is specialized and difficult to understand.
- It may be difficult for users to see how the model outputs are derived; that is, the conversion of the input data through formulas to achieve numerical results can seem like a figurative "black box". Conversion of field-derived data into model inputs requires cross-referencing that may be confusing to the casual user.
- The method is more useful for comparing disturbed against undisturbed wetlands than for comparing among undisturbed wetlands.
- The method does not relate the functions to human society (that is, address values), nor does it consider whether the wetland has the opportunity to perform each function.

4.1.4 Minnesota Routine Assessment Method for Evaluating Wetland Functions

The method produces a rating for each function that considers wetland, neighboring area, and watershed characteristics. The user chooses among conditions described for each input variable. Output scores convert to ratings of low, medium, high, and exceptional. Special "red flag" conditions override the output scores when appropriate. The method leads to classification of each wetland into a management category. A document describes how the scores obtained through the rapid assessment method are used to place wetlands into management categories, and lays out the management strategies for each category.

Pros:

- The method and underlying rationale are well documented.
- The method considers both capacity and opportunity to perform a function or provide a value.
- The method uses many variables to rate each function or value, which may make it more accurate than a method that uses fewer variables.

- The method's output is numeric, which makes it easier to "quantify" functions and impacts and determine compensation requirements.
- The method describes how GIS can be used for a small portion of the assessment.

Cons:

- The formulas for rating each function are long, so outputs are most easily calculated by computer. The complexity of the formulas gives it some of the "black box" character. That is, it is difficult to see how results are derived.
- There is no description of how to use the method for describing project impacts.
- It requires some professional experience and judgment.
- The method is not reference based.

4.1.5 Montana Wetland Assessment Method

A worksheet steps through questions to develop ratings for 12 functions or values. The summary sheet uses a combination scores for individual functions and the sum of scores to place the subject wetland into one of four management categories.

Pros:

- The method was developed for use on state transportation projects.
- The assessment is intuitive and easy to complete.
- The rationales behind the indicators used in the assessment are explained clearly.
- The method would allow comparison among types of wetlands.
- It considers opportunity and social significance.
- The documentation demonstrates how to calculate project impacts using functional units. These could also be used to establish compensation requirements.
- The method assesses most of the functions originally considered in the Wetland Evaluation Technique (see below), using the same names for them, so reviewers would be familiar with the terms used.
- The method scores each function on a scale from 0 to 1, which is the same scoring system as used by HGM. Use of those units helps the reviewer easily see how a wetland rates relative to the highest functioning wetland for each function. Those units are also easily translated to functional units by multiplying by wetland area.
- The method keeps the scores for each function separate so it is easy to see which functions are performed better.

Cons:

- The literature review to back up the assessment is limited.
- The assessment is not reference based.

4.1.6 A Technique for the Functional Assessment of Nontidal Wetlands in the Coastal Plain of Virginia

Pros:

- The method is well documented, simple, and easy to understand.

Cons:

- The results are not presented numerically.
- The variables are fairly location specific to coastal Virginia.
- The assessment is not reference based.

4.1.7 Methods for Assessing Wetland Functions – Washington State

This method is similar to HGM, with concepts of other wetland assessment methods also incorporated. The output is a rating between 0 and 1 for the capability to perform each of many functions.

Pros:

- The assessment is reference based.
- It uses many concepts of HGM.
- The method is well documented.
- The steps between data input and results output are easy to follow, so there is little “black box” effect.
- The output is numeric and can easily be converted to functional units. This makes it easier to “quantify” project impacts and specify mitigation requirements.
- The method does not attempt to model opportunity because simple models that were also accurate could not be devised; however, it includes steps to rate opportunity qualitatively.

Cons:

- Models must be developed for each regional subclass, and these require fifteen-month-long studies of each regional subclass before application of the method in the field.

- Substantial training in use of the method is recommended.
- The method does not consider values.
- The method does not allow comparison of results among different wetland types.
- The method may take more than one day to use for many wetlands.

4.1.8 Washington State Wetland Rating System for Western Washington

This method aims to differentiate among wetlands in western Washington based on their rarity, sensitivity to disturbance, functions, and ability to be replaced. It identifies wetland types and other wetlands with special characteristics that are automatically placed in a protective management category – a "red flags" approach. For remaining wetlands, the user classifies the wetlands by HGM type, asks a series of questions for each HGM class that helps define the wetland's capability to perform each function, and asks a similar set of questions to characterize opportunity to perform the function. The wetland receives a total score of 1 to 100. Based on this score or special characteristics, it is placed in one of four management categories.

Pros:

- The rationale is well documented.
- It is easy to see how the scores are developed while completing the scoring sheets.
- It uses the HGM classification system and the analyses are done by HGM type.
- It uses easily observable indicators.
- Identifying critical wetland types that will always receive the highest level of protection is intuitive and is more direct than running models to reach the same end.

Cons:

- The method does not translate the numeric output into functional units that would make it easier to "quantify" impact and determine mitigation requirements.
- The method is not reference-based, but has been field-tested extensively.
- The method sums the scores for individual functions into three categories, then sums those scores to place the wetland into a management category. The user must go to the scoring sheets to understand how well the wetland performs specific functions.
- Each function has a different possible number of total points, so it is more difficult to see how well a wetland performs that function relative to the highest level of functioning.

4.1.9 Wetland Evaluation Technique

This method is one of the earliest methods, and its rationale, functions, and indicators serve as the basis for many other methods. The user defines the assessment area, then answers many questions about the area. The user enters the data into a computer program for output, or run models by hand. The method rates the likelihood:

- that the wetland could effectively perform each of several functions;
- that the wetland has the opportunity to perform each of those functions; and
- that there is some social significance to the wetland's performance of that function.

Pros:

- The method is well known.
- It is somewhat intuitive.
- It includes social values.
- The rationale behind the models is very well documented.
- It rates effectiveness, opportunity, and social significance separately.

Cons:

- It is a coarse tool, designed to apply to all wetland types throughout the 48 coterminous states.
- It requires some training to implement and interpret.
- The output would not easily be translated into something like functional capacity units that could be used to "quantify" impacts, compare alternatives, or define compensation needs.
- It calculates its results in a "black box" of formulas.

4.2 Discussion of the Additional Method Features

Through review of the above methods, the research team developed opinions on whether certain features would be desirable or undesirable in the approach adopted or adapted by ADOT&PF. These characteristics are presented briefly below, and then related to the reviewed methods.

- Among ADOT&PF staff, regulatory and resource agency staff, other wetland professionals, and the public, there is often consensus regarding certain wetland types that are most important to ecosystem health and to human society. Often, ADOT&PF and the agencies are prepared to discuss how a particular wetland should be managed based on their intuitive analysis of a wetland's functions and values, and without a formal assessment. One step of wetland assessment should be simply to screen each wetland for "red flag" characteristics that indicate a wetland is of high value. "Red flag" characteristics might include a wetland's known support of a threatened or endangered bird, its location adjacent to an anadromous fish stream in an urban area, or its classification as an "A" wetland in the Anchorage Wetlands Management Plan. Such "red flag" screening could be incorporated into any assessment method. Similar screening questions could also be used to identify the lowest-value wetlands. Reviewing agencies may be able to agree that wetlands identified as particularly important or unimportant do not require further functional assessment.

The Western Washington rating system and the Minnesota method both include "red flag" questions that rate certain wetlands as high-value regardless of scores they receive in the remainder of the assessment of other functions or values. See pages 1 and 18-21 of the Western Washington rating system in Appendix E of this document for an example of red flags or "special characteristics" and how those are used to categorize wetlands.

- Several assessment methods use the results of functional ratings or "red flag" screening, or both, to place each wetland into one of several management categories. The Technical Advisory Group expressed interest in this approach in the September 19, 2005, teleconference. ADOT&PF and resource and regulatory agency staff spend a great deal of time and effort discussing the type and degree of impact mitigation (avoidance, minimization, compensation) that are reasonable and appropriate for each wetland on each project. All parties could benefit from investment of their agencies' time in upfront agreement on appropriate mitigation for each of several categories of wetlands. For example, this could range from requiring the most stringent avoidance and minimization measures and full compensation at a 2:1 ratio for unavoidable losses of Category 1 wetlands to no deviation from standard design and no compensation for impacts on Category 4 wetlands. Such categorization could be added to any assessment method. ADOT&PF should incorporate wetland categorization into its wetland assessment process, and should seek agreement among agencies on the appropriate types of mitigation for category.

  The Wetland Rating System for Western Washington, the Minnesota method, and the Montana method each specifies how wetlands should be categorized for management purposes based on the function ratings or red flags screening.

- The assessment method should be transparent. That is, it should be reasonably easy for casual users and for assessment reviewers such as regulatory staff to understand how the results are derived. The calculations or steps taken to go from data input to a rating for a function should, literally, be visible; that is, on the data forms. "Black box" calculations should be avoided. Users should understand exactly what information has contributed to the rating. This would also remind users that the answer is not a direct measurement of function, but that it is an estimate based on consideration of a number of factors.

The Minnesota method, HGM, and Wetland Evaluation Technique each calculates results through relatively long formulas (and, for HGM, conversion from field measurement to index score to a formula) that make it a little more difficult to see how input variables affect the output ratings (the "black box" effect). The Montana method, Virginia method, North Carolina method, and both of the Washington approaches calculate ratings directly on the data sheets so it is easy to see how each variable affects the rating.

- The method must consider whether a wetland has the *capacity* to perform each function, but it also must consider whether the wetland has the *opportunity* to perform that function. For example, most of the methods rate whether a wetland would be likely to retain sediments or other pollutants delivered to it, and many wetlands in Alaska would probably do this well. However, many of the wetlands evaluated for ADOT&PF projects do not receive pollutants because they are in remote locations (at least until the project is constructed). It does not make sense to ascribe a function to a wetland unless the wetland actually has the opportunity to perform the function.

  Neither of the Washington methods rates wetland opportunity to perform functions, although both provide information for the user to make a qualitative assessment.

- The method chosen by ADOT&PF should consider both *functions* and *values*. While the Technical Advisory Group initially was more interested in assessing wetland functions, how people benefit or perceive benefit from different wetlands is also important. The distinction between wetland functions and values is not always clear; the functions we choose to recognize and assess reflect our values. Therefore, it seems reasonable and intuitive to not attempt to distinguish between functions and values and to consider them both.

  HGM and the Washington Methods for Assessing Wetland Functions do not consider wetland values.

- The methods should address functions and values typically ascribed to wetlands, and those suggested in FHWA guidance and other pertinent guidance: groundwater recharge or discharge, flood attenuation, shoreline and sediment stabilization, pollutant removal, detritus export or food chain support, fish habitat, wildlife habitat, and social values such as recreation, education, aesthetics, and subsistence. Functions or values missing from any method could easily be added.

The North Carolina and Virginia methods each did not address all the standard functions that ADOT&PF should consider.

- A numerical system of describing the estimated levels of wetland function and value, versus high/medium/low rankings, would provide a uniform system for calculating changes in function upon construction of a project. Typically, functional ratings are multiplied by acreage affected to determine changes in "functional capacity units". A numerical summary of the impact is useful for determining the appropriate level of compensatory mitigation. With a transparent method, there would be less danger that reviewers would lose sight of the meaning of numerical ratings -- that they are not a measurement, but an estimate. The HGM system of rating the level of function on a scale of 0 to 1 is widely used and easily understood. Almost any method could be modified to use a 0 to 1 rating scale.

  The Evaluation for Planned Wetlands, HGM, Minnesota method, Montana method, and the detailed Washington Methods for Assessing Wetland Functions all use numerical ratings on a scale of 0 to 1 for each function.

- Some assessment methods, particularly those that are reference based, require upfront investment of a great deal of time and money to develop and calibrate models of functions for a particular subset of wetlands. Considering the number of different wetland types in Alaska, the investment needed to develop models to serve the majority of ADOT&PF's routine projects would be tremendous. It is not clear that the increased accuracy or objectivity gained from using those methods on routine projects, versus simpler methods, could produce a good return on the investment.

  HGM and the Washington Methods for Assessing Wetland Functions require a great investment in developing models for each subset of wetland types.

5.0 Recommendations

5.1 Recommended Method

Most methods can be adapted to incorporate the features that may be important to ADOT&PF; no method already includes them all. The research team considered two methods to be fairly close to the type of method that would meet ADOT&PF's needs for routine (and perhaps also complex) projects:

- Washington State Wetland Rating System for Western Washington
- Montana Wetland Assessment Method

The Minnesota method and the Alaska HGM guidebooks also include many useful ideas that could be adopted and included in Alaska's method for routine projects.

The Montana method could be used with only slight modifications on an interim basis. Immediate changes should include the way in which wetlands are categorized according to their function scores (alter to reflect Alaskans' values) and the rating for fish habitat (change to give lower value to habitat used by certain introduced species). The Montana method rating form is shown in Appendix E of this report.

The Washington method could be implemented with several initial modifications. ADOT&PF would need to consider whether to give wetlands scores for the potential to perform a function when it does not have the opportunity to perform it. ADOT&PF would need to consider adding questions to score some wetland functions not rated in the Washington method, including groundwater discharge, production export, and fish habitat. The "red flags" part of the method would need to be reworked to be applicable in Alaska. The scoring sheet should be changed to record the scores for individual wetland functions, and to convert those scores into a proportion of the total number of points possible. The categorization of the wetlands into four management classes should be reworked to reflect Alaskans' values.

Both methods could be altered to better consider the wetland's context within a watershed and region. The larger context—for example, whether wetlands are dominant or relatively scarce in a watershed—might alter scores for certain functions, or might affect the scores needed to put a wetland into one management category or another.

Because the Montana Wetland Assessment Method could be useful in Alaska with so few changes, the research team recommends that the method serve as the starting point for a method that will incrementally be customized for ADOT&PF use. It could be implemented on an interim basis or experimentally with almost no modification. Over time, the method could be improved in many ways to better meet ADOT&PF's needs.

As the method was improved, it would be important to keep the method from becoming substantially more complicated. It must remain intuitive and should not become so intricate that the user loses sight of how the ratings are derived. It must remain clear that the scores are calculated using word models developed largely by best professional judgment—that they do not represent actual measurements of function.

The Montana method seems versatile. It could be equally appropriate for use on larger, more complicated projects as on small, routine projects. This method could also be used without a site visit, relying on aerial photography, ground photos taken by others, existing information, review of topography, and a ration of best professional judgment to estimate what the wetland is actually like on the ground.

The following are steps ADOT&PF should take to implement the rapid wetland assessment method, in approximate order of priority. The list is not comprehensive.

1. Consider the information presented in Section 5.2 of this report regarding use of Geographic Information Systems (GIS) for wetland assessment. Decide whether to invest in a GIS approach, or whether to continue investing in the traditional approach considered in this research project, or both. The research team suggests that both approaches will be useful: the traditional approach for smaller projects and those for which GIS expertise or data are not available, and the GIS approach for larger projects, for screening large areas for high-value wetlands, and for areas where sufficient digital data are available. A GIS approach merits further exploration.

2. Review the Montana method and determine whether this method approximates the approach ADOT&PF was seeking. If so, talk with the Montana Department of Transportation about its willingness to allow ADOT&PF to adapt the Montana method for Alaska use. Few assessment methods are truly original; most rework the concepts originally presented in the Wetland Evaluation Technique and HGM. The Montana method reworks concepts presented many times before; its use of small tables to rate each function is unique. Obtain permission to copy and distribute the method via the ADOT&PF website.

3. Adapt the Montana method slightly for interim or experimental use by developing a memorandum to Alaska users describing the initial changes for Alaska use. For example: skip section 14B; for question 14D.iii, delete the "introduced game fish" line; for question 14L, add "subsistence" to recreation and education uses; in the summary rating, delete lines B and K and add "subsistence" to line L; make preliminary changes to the table that categorizes wetlands. Modify section 14F (short- and long-term surface water storage) by eliminating overbank flooding, since that is addressed under section 14E (flood attenuation); or combine the two. Evaluate and modify the table that categorizes the wetlands at the end of the assessment. The threshold scores in the Montana method differ among functions; customizing those thresholds is a way of weighting the functions according to their importance to Alaskans. Formalize the method of calculating functional units and use those units for determining the appropriate level of compensatory mitigation. Test the method on selected ADOT&PF projects.

4. Decide whether placing wetlands in management categories would save time and effort in project development. Estimate whether the investment in gaining agency buy-in to those categories and associated management strategies would be worth the effort required to gain interagency agreement. If so, continue this step. Develop preliminary management strategies associated with each category. Negotiate these with regulatory and resource agencies. For example, category 1

wetlands require use of the most stringent avoidance and minimization measures including shifting the alignment, and using vertical walls or steepest possible slopes and full compensation for wetland functional capacity lost; wetland preservation used as compensation shall be done at a ratio of 2:1. Category 4 wetlands do not require a deviation from design standards or decrease in functionality of the ADOT&PF project to avoid or minimize wetland impacts; no compensatory mitigation is appropriate. Develop a table that describes how wetland classes used in local land use plans convert into the ADOT&PF management categories. For example, wetlands classified as "A" wetlands in the Anchorage Wetlands Management Plan should be placed in Category 1 (the most protective level of management).

5. Develop a series of "red flag" questions that put unique and very high-value wetlands into the highest category. Consider developing a similar list for wetland types that would automatically be placed into the lowest category. (For example, a wetland might be in category 4 if it is under a certain size and surrounded by development and without native vegetation.) Initiate consultation with agencies regarding the categorization through use of red flags.

6. Develop a table that lists the variables used in the function rating models and the sources of information that support the use of each variable. Use this as a tool both to document the rationale behind the method and to identify the variables and models most in need of further research or literature review to improve our level of confidence in the variable or model. Functions most needing further literature review or addition of indicators may be groundwater discharge and recharge, long-term water storage, fish habitat, and production export. Other wetland assessment methods provide a wealth of examples of variables useful for each function, as well as useful literature citations.

7. Initiate focused literature reviews to address items identified in the step above. Based on literature reviews, improve the models and identify basic information gaps.

8. Consider whether any of the models need to be changed to address conditions that differ among regions of the state. Make those changes, based on literature review or research or best professional judgment.

9. Add questions to each section of the method (14D, 14F…) to identify wetlands to which that section does not apply (score =N/A). These questions would ensure all users are considering similar factors to evaluate whether a wetland lacks the potential or opportunity to perform a certain function. For example, for section 14G, "Is there human alteration of the landscape upslope of the wetland, or natural soil erosion or instability? If Yes, continue. If No, rating is N/A."

10. Consider ways to alter the method to best evaluate the wetland in its watershed or regional context. Factors that might be pertinent include proportion of watershed that is wetland, the level of existing or projected development in that watershed, and rarity of that wetland type in the watershed or region. Consideration of the context might be incorporated where wetlands are assigned to management categories, or it might be addressed for individual functions.

11. Consider reincorporating section 14B, which could consider animal species listed as Endangered or Species of Special Concern by the Alaska Department of Fish and Game, federal species of conservation concern, and plants and animals tracked by the Alaska Natural Heritage Program. While these species do not have regulatory standing, they should factor into the value of the wetland. Develop an appendix that lists the above species that may use wetlands, and provide habitat descriptions and distribution maps that would help users with the evaluation.

12. Re-work the wildlife section. Both the Washington and Montana methods rate a wetland's wildlife habitat functions, with higher ratings generally going to wetlands that have greater habitat diversity and thus would support a higher diversity of wildlife species. They would not give as high a rating to a wetland that provided ideal habitat for fewer species. Also, they are only loosely, if at all, aimed at wetland-dependent wildlife. ADOT&PF, with assistance from wildlife agencies, must decide what aspects of a wetland's use as wildlife habitat should be considered. The following are examples of changes that could be made.

    - Make the questions more quantitative, so the answers will be more consistent between observers.

    - Add special habitat features, similar to questions in section H1 and H2 in the Western Washington rating system.

    - Add questions to rate the wetland for *wetland-dependent* species or groups of animals: waterfowl, shorebirds, wetland-dependent furbearers, and amphibians.

13. Start field testing and ask all users to provide feedback on the wetland assessment method in a specific format.

14. Put the method on ADOT&PF website, along with appendices and other useful resources and website links. Include "last updated [DATE]", and what was updated.

The research team found some confusion among the people it interviewed regarding the concept of wetland assessment. Wetland assessment can be confused with wetland delineation, or permitting, or compensation for impacts, and its application to water bodies is also confusing. ADOT&PF might benefit from a checklist or a flowchart that shows the necessary steps in project development with respect to wetlands. For example, the checklist could define how wetlands should be considered in large-scale transportation planning, when an on-site delineation is needed, how to determine when and what type of wetland assessment is needed, and how the results of wetland assessment feed into alternatives analysis and identification of appropriate mitigation measures.

5.2 A GIS Approach for Assessing Wetlands

During Technical Advisory Group review of the draft report for this project, the TAG expressed substantial interest in using GIS technology for assessment of wetlands. This section describes opportunities for rapidly assessing wetlands in a GIS environment. Rapid wetland assessment using GIS is potentially useful in a variety of settings, including:

- Project evaluation. How do the wetlands potentially affected by a project function within the natural landscape and the human environment? Which wetlands in the project area are most important? How can the proposed project be changed to minimize adverse effects? How do the effects of different alternatives compare?
- Assessment of landscape context for impact studies. What is the role and importance of a specific wetland within its watershed or region? What is the relative rarity of a given wetland type in the broader landscape?
- Site selection for new facilities and transportation corridors. Where should a potential project be located to minimize effects on high-value wetlands?
- Fieldwork planning. Where should expensive, time-consuming field visits be concentrated to maximize their utility?

GIS software offers an attractive tool for rapid wetland assessment. With GIS, multiple information sources can be drawn upon for a single analysis, using clear and repeatable criteria to efficiently assess wetlands across broad landscapes. The utility of this approach will vary based upon each project's scope and needs. Small, site-specific projects may not require, nor justify, extensive use of GIS; its use may be limited to display of graphic information and calculation of areas. Large corridor-scale analyses, however, may justify extensive investment in GIS data, tools, and analyses.

An approach to use of GIS for wetland assessment on a large project is presented below. The steps in a GIS-based rapid wetland assessment include *data acquisition*, *unit delineation*, *unit attribution*, and *wetland assessment.*

5.2.1 Data Acquisition

The level of detail and accuracy achieved by a rapid wetland assessment will depend on the type, detail, and accuracy of input data. In practice, the datasets (GIS layers) available for a rapid assessment of wetlands will typically include some subset of the following:

- Aerial photography (monochromatic, true color, or color infrared)
- Satellite imagery (monochromatic, true color, or multispectral)
- Topography (USGS topographic maps, LIDAR, other sources)
- National Wetland Inventory mapping, including attributes for system, class (vegetation), and hydrologic regime
- Surface hydrology maps (streams, shores, and floodplains from USGS and FEMA mapping)
- Soil mapping (NRCS)
- Land ownership, land use, and conservation status maps (from government agencies and others)
- Data on species concentration and rarity (including both wildlife and plants, from ADF&G, the Alaska Natural Heritage Program database, herbarium records, and other sources)

The obvious first step in a GIS-based approach is the acquisition of all available data layers. This task alone can be challenging and time consuming. Efficiency in the data acquisition process is promoted by maintenance of a managed GIS data archive, whether maintained in-house by ADOT&PF staff (and shared via the Alaska Engineering Design Information System website) or provided by outside consultants. The archive need not be comprehensive, but it should be managed by a GIS analyst familiar with, and competent in, the rapidly-evolving world of spatial data.

The adequacy of available data will be evaluated in the context of each project's scope and needs. Smaller projects may not justify the acquisition of additional data layers beyond what is immediately and freely available, and data gaps may be most economically addressed by site visits or other techniques. Conversely, large projects (in terms of landscape coverage), remote sites (where fieldwork is especially costly), or the prospect of multiple upcoming projects in the same vicinity may justify substantial investment in the acquisition of additional data obtainable without fieldwork. Fee-based satellite imagery, in particular, offers the opportunity for rapid assessment of areas poorly covered by more traditional data sources. Prominent among current data products are IKONOS imagery (1 m panchromatic and 4 meter multispectral), Quickbird imagery (0.6 m panchromatic and 2.4 m multispectral), OrbView imagery (1 m panchromatic and 4 m multispectral), and IRS imagery (5 m panchromatic and color). Digital elevation models can be extracted from these data sources.

5.2.2 Unit Delineation

In the GIS environment, wetland boundaries and types and functions can be inferred from any indicators discernible in the available data. In most cases, these indicators will include some combination of: 1) vegetation characteristics, based upon color and texture in raster imagery; 2) hydrologic characteristics, based upon color and shape in raster imagery, and upon existing NWI/USGS/FEMA mapping; and 3) topography, based upon digital elevation models.

The next step in a GIS analysis is delineation, based on these indicators, of homogeneous landscape units. With appropriate GIS software, analysts can develop models that examine all indicators simultaneously, subdividing the landscape into areas of relative homogeneity. “Training” the software to do this properly (that is, working with the software and data to determine how to direct the software to delineate homogeneous units that the analyst considers important) and consistently is the challenge. The study team is developing the capacity to do this classification modeling with two plug-in extensions for the ArcView GIS environment: the 3D Analyst and the Feature Analyst. The 3D Analyst allows automated recognition and delineation of flat areas, slopes (of varying steepness and aspect), drainage patterns, watershed boundaries, and contour patterns such as breaks in slope and depressions. Feature Analyst allows automated recognition and delineation of hydrologic and vegetative features (e.g., ponds, rivers, gravel bars, trees, and shrubs), as well as other images such as roads and buildings. In combination, these tools provide the opportunity to rapidly delineate vegetative and hydrogeomorphic units over vast tracts of landscape, and to associate each of these units with a broad suite of characteristics (e.g., slope, aspect, spectral signature, land use, and ownership).

5.2.3 Unit Attribution

Separate from and subsequent to the above process, delineated units must be classified on the basis of wetland (or upland) type. The nature and level of detail in this classification will again depend upon project scope and available data. In any case, classifications of vegetation type or wetland type require subjective interpretation, and this phase of the process requires substantial user inputs. Trained analysts will design a GIS-based model that links objectively measurable criteria (slope, aspect, spectral signature, etc.) with the chosen classification scheme. Existing NWI or NRCS soil maps, if available, may assist with development of this model, but it is ultimately the responsibility of the analyst to design and iteratively revise the model. Once the model is complete, however, GIS software automates attribution of a single category in the chosen classification scheme to each landscape unit. The efficiency of this technique thus scales with project size: on larger landscapes, time savings associated with attribution phase can be very substantial.

5.2.4 Wetland Assessment

The chosen landscape unit classification might include some or all of the indicators of wetland function: geomorphic setting, hydrologic conditions, soil characteristics, and vegetation characteristics. Just by the way the homogeneous units are classified through the steps above, certain more important wetlands could be identified. In conjunction with other commonly available data, this classification can be used for more fine-tuned screening for higher-value wetlands – an analysis scientists routinely perform for study corridors, areas potentially affected by project development, and community planning areas. This would be similar to the "red flag" screening recommended for inclusion in ADOT&PF's routine assessment method. For example, high-value wetlands in southcentral Alaska might be those that have any of the following attributes:

- NWI systems: estuarine intertidal, lacustrine littoral, riverine
- NWI classes: open water, emergent (not in combination with another class), aquatic bed
- NWI hydrologic regimes: permanently flooded, intermittently exposed, any tidal regimes
- Within 100 feet of, and directly adjacent to, a mapped anadromous fish stream
- Within any FEMA-mapped floodplain
- Directly adjacent to impaired waterbodies
- Containing a point indicating the location of a sensitive plant or animal species
- Within a preservation unit shown on land use, zoning, or ownership maps
- Classified as high-value under a local plan

If sufficiently detailed datasets exist – especially high-resolution imagery and detailed topography – GIS models can also identify relationships among units. Examples of such relationships include 1) defining the probable path of water flow to and from a wetland; 2) comparing the size of a wetland to the size of the watershed, or to the watershed's total wetland area; and 3) identifying human developments (or other features) upslope or downslope of a wetland. Thus, GIS models can be used to generate the information needed not only for wetland classification, or screening for high-value wetlands, but also, in theory, for assessment of each wetland's functions and values using indicators and models similar to those in the methods reviewed in this research project.

The quality of a rapid wetland assessment depends, again, on the accuracy and level of detail of the input datasets. The availability of high-quality, detailed datasets for most of Alaska is poor, and this would seriously limit the ability to accurately assess wetland functions on a detailed scale in most parts of the state using GIS. Importantly, accurate wetland assessment also depends on the quality of the models used. Numerous methods, described throughout this report, have already been developed to link landscape indicators with wetland functions and values. The models proposed here would take the additional step of automating that linkage with GIS technology. GIS models associate quantitative attributes with wetland functions and values, and then rate each landscape unit on the basis of multiple attributes derived from the processes described above. The consistency and speed of automating this process with GIS would reduce the total amount of time needed for a project. There would still be a need for fieldwork to 1) supplement the information derived from existing data, and 2) perform post-analysis accuracy assessment. While the potential benefits of using GIS technology for this analysis would be great, the modeling needed to associate attributes with each wetland unit, then to use those attributes to rate levels of wetland function, would be substantial.

ADOT&PF should conduct further research on the potential utility of GIS for large, corridor-level projects. At a minimum, where there is a moderate level of data available, it should be possible to screen a planning area for high-value wetlands. This might suffice for initial project planning purposes. For a more detailed assessment of how each wetland in a planning area may function, input dataset needs would likely be substantially more, as would the need for development of models to tease the necessary information from the existing data. ADOT&PF should investigate the potential for GIS-based wetland assessment by attempting such assessment in a project area where excellent datasets exist. Through this effort, the wetland scientists and GIS analysts would determine what functions they can fairly accurately assess, identify minimum data needs, identify data limitations, identify potential sources of the necessary data, consider alternative ways to estimate functions for which input data are not available, analyze how readily models developed for one project area could be used for a different project area, calculate the potential time savings and accuracy that could be gained through a GIS approach, and define thresholds over which a GIS-based approach may be most effective. Through such an effort, ADOT&PF would also be able to determine the conditions under which an approach using the truly analytical features of GIS would be effective for small and routine projects.

Table 1. Steps Followed in EMRIS Process for Selecting a Wetland Assessment Method, Limited to Methods Suitable for Impact Analysis

	Step 1b		Step 2				Step 3	Step 4				Step 5	Step 6	Step 7	Step 8	Step 9	**Outcome**	
Rows: Assessment Methods / **Columns: Capabilities of Methods. Shaded Capabilities are Essential**	Designed to aid with impact analysis[1]	Designed to aid in setting mitigation requirements/compensation ratios	Uses models to estimate function, or function and opportunity (versus BPJ)[1]	Function: Hydrology[1]	Function: Water Quality[1]	Function: Habitat[1]	Has been applied in Alaska	Non-tidal wetlands[1]	Uplands	Tidal wetlands	Aquatic areas	Maximum <1 day per wetland[1]	Size a consideration	Social categories	Measure of functions combined (1=sep 2=comb)	Comparison between different wetland types/ geographic regions	**Methods without "fatal flaws"**	
Avian Richness Evaluation Method	X	X	X			X		X					X	X	2			Avian Richness Evaluation Method (Adamus 1993)
Descriptive Approach	X			X	X	X	X	X		X		X		X	1	X		Wetland Functions and Values: A Descriptive Approach (USACOE 1995)
Evaluation for Planned Wetlands	X	X	X	X	X	X	X	X		X		X	X	X	1	X	**X**	Evaluation for Planned Wetlands (Bartoldus et al. 1994)
Habitat Assessment Technique	X					X	X	X	X	X	X	X	X	X	1	X		Habitat Assessment Technique (Cable et al. 1989)
Habitat Evaluation Procedures	X	X	X			X	X	X	X	X	X		X		1	X		Habitat Evaluation Procedure and Habitat Suitability Indices (USFWS 1980, USFWS 1981)
Hollands-Magee Method	X		X	X	X	X		X				X		X	2		**X**	A Method for Assessing the Functions of Wetlands (Hollands and Magee 1985)
Hydrogeomorphic (HGM) Approach	X	X	X	X	X	X	X	X		X		X	X	X	1		**X**	Hydrogeomorphic Approach (Smith et al. 1995, Hall et al. 2002, Powell et al. 2003, Lee et al. 1999)
Index of Biological Integrity	X						X	X	X	X	X	X			1			Index of Biological Integrity (Karr 1981)
Indicator Value Assessment	X		X	X	X	X	X	X		X		X	X	X	1	X	**X**	Indicator Value Assessment (Hruby et al. 1995)
Interim HGM	X	X	X	X	X	X	X	X		X		X	X	X	1		**X**	Interim HGM (described in USDA NRCS 1997)
MN Rapid Assessment Method	X		X	X	X	X		X				X		X	1		**X**	MN Routine Assessment Method for Evaluating Wetland Functions (MN Board of Water and Soil Resources 2004)
MT Wetland Assessment Method	X		X	X	X	X		X				X	X	X	1, 2	X	**X**	Montana Wetland Assessment Method (Berglund 1999)
New Eng. Invert. Monitoring Protocol	X					X		X						X	1			New England Freshwater Wetlands Invertebrate Biomonitoring Protocol (Hicks 1997)
NC Guidance	X		X	X	X	X		X				X		X	2		**X**	Guidance for Rating the Values of Wetlands in NC (NC Dep't of Environment and Natural Resources 1995)
PA Habitat Evaluation Procedure	X	X	X			X		X	X	X	X		X		1	X		Pennsylvania Modified 1980 Habitat Evaluation Procedure (Palmer et al. 1985, Palmer 1995)
Rapid Assessment Procedure	X	X	X	X	X	X		X				X	X	X	1		**X**	A Rapid Procedure for Assessing Wetland Functional Capacity (Magee 1998)
VIMS Method	X		X	X	X	X		X				X			1		**X**	A Technique for the Functional Assessment of Nontidal Wetlands in the Coastal Plain of Virginia (Bradshaw 1991)
WA Methods	X	X	X	X	X	X		X		X		X	X		1		**X**	Washington Methods for Assessing Wetland Functions (Hruby et al. 1998, Hruby and Granger 1998)
WEThings	X		X			X		X		X		X			1	X		WEThings (Whitlock et al. 1994a,b)
Wetland Evaluation Technique	X		X	X	X	X	X	X		X				X	1	X	**X**	Wetland Evaluation Technique (Adamus et al. 1987, Adamus et al. 1991)
Wetland Quality Index	X	X	X	X	X	X		X				X	X		2		**X**	Wetland Quality Index (Lodge 1995)
Wetland Rapid Ass't Procedure	X		X	X	X	X		X		X		X	X		2		**X**	Wetland Rapid Assessment Procedure (Miller and Gunsalus 1997)
Wetland Value Assessment Method	X	X	X			X		X		X		X	X		1			Wetland Value Assessment Methodology (Environmental Work Group 1998)
Wildlife Community Habitat Eval'n	X		X			X		X					X		1			Wildlife Community Habitat Evaluation (Schroeder 1996)
Wildlife Habitat Appraisal Procedure	X		X			X		X	X	X		X	X		1	X		Wildlife Habitat Appraisal Procedure (Frye 1995)
Wildlife Habitat Ass't/Mgt. System	X		X			X		X	X	X			X		1	X		Wildlife Habitat Assessment and Management System (Palmer et al. 1985, 1993; Palmer 1995)
WI Rapid Assessment Procedure	X			X	X	X		X				X		X	1	X		Wisconsin Rapid Assessment Methodology (Wisconsin Department of Natural Resources 2001)

EMRIS = U.S. Army Corps of Engineers' Ecosystem Management and Restoration Information System (http://el.erdc.usace.army.mil/emrrp/emris)

[1]Shaded column headings are considered essential features of an ADOT&PF rapid wetland assessment method.

Table 2. Features of Wetland Assessment Methods Identified as Potentially Suitable through EMRIS[1] Process

Rows: Assessment Methods / Columns: Capabilities of Methods.	Essential Features						Other Desirable Features[2]										Other Features			
	Steps in the method minimize the reliance on user's Best Professional Judgment (BPJ)	Highly repeatable	Good documentation of rationale, assumptions exists	Useful for pristine and human-affected wetlands	Considers wetland's watershed, surrounding land uses	**Methods with all essential features**	Easy to understand - terminology, how scores are derived	Uses models to estimate function, or function & opportunity (vs BPJ)	Allows comparison among different wetland types	Considers opportunity to perform certain functions	Evaluates social categories	Applicable to tidal wetlands	Employs concepts of HGM	Designed to aid in setting mitigation requirements/ compensation ratios	Applicable to streams	Calibrated to reference wetlands	Measure of functions combined or kept separate? (1=sep 2=comb)	Designed for use in Alaska	Size a consideration	
Methods Evaluated by EMRIS Process:																				
Evaluation for Planned Wetlands	X	X	X	X	X	X	X	X		X	X	X	X	X		X	1		X	Bartoldus et al. 1994
Hollands-Magee Method	X	X		X	X			X	X	X	X					X	2		X	Hollands and Magee 1985
Hydrogeomorphic (HGM) Approach	X	X	X	X	X	X		X		X		X	X	X	X	X	1	X	X	Smith et al. 1995, Lee et al. 1999, Hall et al. 2002, Powell et al. 2003
Indicator Value Assessment				X	X		X	X	X	X	X	X					1		X	Hruby et al. 1995
Interim HGM	X	X			X			X				X	X	X	X		1	X		USDA NRCS 1997
MN Routine Assessment Method	X	X	X	X	X	X		X		X	X	X	X	X		X	1			Minnesota Board of Water and Soil Resources 2004
MT Wetland Assessment Method	X	X	X	X	X	X	X	X	X	X	X			X			1, 2		X	Berglund 1999
NC Guidance	X	X	X	X	X	X	X	X	X	X	X	X		X			2		X	NC Dep't of Environment and Natural Resources 1995
Rapid Assessment Procedure	X	X		X	X			X		X	X		X				1		X	Magee 1998
VIMS Method	X	X	X	X	X	X	X	X		X	X						1			Bradshaw 1991
WA Methods for Assessing Wtld Functions	X	X	X	X	X	X	X	X		X		X	X				1		X	Hruby et al. 1998, Hruby and Granger 1998
Wetland Evaluation Technique	X	X	X	X	X	X		X	X	X	X	X					1		X	Adamus et al. 1987, Adamus et al. 1991
Wetland Quality Index		X	X		X		X	X						X			2		X	Lodge 1995
Wetland Rapid Ass't Procedure		X	X	X	X		X	X				X		X			2		X	Miller and Gunsalus 1997
Other Methods Referenced by Technical Advisory Group or Alaska Interviewees:																				
Ohio RAM			X		X		X	X	X	X	X		X	X		X	2		X	Mack 2001
Washington State Rating System	X	X	X	X	X	X	X	X					X	X		X	1		X	Hruby 2004b
WSDOT Linear			X	X	X		X		X	X	X	X					1			Null et al.2000

Appendix A
Bibliography

Bibliography

Reviewed or Referenced Methods

Adamus, P.R. 2001. *Guidebook for hydrogeomorphic (HGM)-based assessment of Oregon: statewide classification and profiles*. 168pp.

Adamus, P.R., E.J. Clairain, R.D. Smith, and R.E. Young. 1987. *Wetland evaluation technique (WET), Vol. II: methodology.* Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi. NTIS No. ADA 189968.

Adamus, P.R., L.T. Stockwell, E.J. Clairain, M.E. Morrow, L.D. Rozas, and R.D. Smith. 1991. *Wetland evaluation technique (WET), Volume I: literature review and evaluation rationale.* Technical Report WRP-DE-2, U.S. Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi. 287 pp.

Adamus Resource Assessment, Inc. 1987. *Juneau wetlands: functions and values; Rapid assessment method for southeast Alaska.* Prepared for the City and

American Society for Testing and Materials. 1999. *Standard guide for assessment of wetland functions.* Subcommittee E50.05.

Bartoldus, C.C., E.W. Garbisch, and M.L. Kraus. 1994. *Evaluation for planned wetlands (EPW)*. Environmental Concern Inc., St. Michaels, Maryland.

Berglund, J. 1999. *Montana wetland assessment method*. Prepared for Montana Department of Transportation and Morrison-Maierle, Inc.

Bradshaw, J.G. 1991. *A technique for the functional assessment of nontidal wetlands in the coastal plain of Virginia*. Special Report No. 315 in Applied Marine Science and Ocean Engineering. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

Brinson, Mark M. 1993. *A hydrogeomorphic classification for wetlands.* U.S. Corps of Army Engineers. Washington D.C.

Cable, T.T., V. Brack, Jr., and V.R. Holmes. 1989. *Simplified method for wetland habitat assessment*. Environmental Management 13:207-213.

Environmental Work Group. 1998. *Wetland value assessment methodology and community models*. Environmental Work Group, Coastal Wetland Planning, Protection, and Restoration Act (CWPPRA).

Euler, D. L., J.F.T. Carreiro, G.B. McCullough, E.A. Snell, V. Glooschenko, and R.H. Spurr. 1985. *An evaluation system for wetlands of Ontario south of the Precambrian Shield.* Ontario Ministry of Natural Resources and Canadian Wildlife Service. Ontario, Canada.

Frye, R. 1995. *Wildlife habitat appraisal procedure (WHAP)*. Texas Parks and Wildlife Department, Austin, TX.

Hall, J., J. Powell, S. Carrick, T. Rockwell, G. Hollands, T. Walter, and J. White. 2002. *Operational draft guidebook for assessing the functions of slope/flat wetland complexes in the lower Kenai River drainage basin using the HGM approach.* Alaska Department of Environmental Conservation.

Hicks, A.L. 1997. *New England freshwater wetlands invertebrate biomonitoring protocol (NEFWIBP).* The Environmental Institute, University of Massachusetts, Amherst, MA. 42 pp.

Hollands, G.G., and D.W. Magee. 1985. *A method for assessing the functions of wetlands.* Pages 108-118 in J. Kusler and P. Riexinger (eds.), Proceedings of the national wetland assessment symposium, Association of Wetland Managers, Berne, NY.

Hruby, T. 2004a. *Washington State wetland rating system for eastern Washington -- Revised*. Washington State Department of Ecology Publication #04-06-15.

Hruby, T. 2004b. *Washington State wetland rating system for western Washington -- Revised*. Washington State Department of Ecology Publication #04-06-025.

Hruby, T. and T. Granger. 1998. *Methods for assessing wetland functions. Volume II: Procedures for collecting data in the lowlands of western Washington*. Washington State Department of Ecology Publication #98-107. 51 pp. + appendices.

Hruby, T., T. Granger, K. Brunner, S. Cooke, K. Dublanica, R. Gersib, L. Reinelt, K. Richter, D. Sheldon, A. Wald, and F. Weinmann. 1998. *Methods for assessing wetland functions. Volume I: Riverine and depressional wetlands in the lowlands of western Washington*. Washington State Department of Ecology Publication #98-106, July 1998. 455 pp. + appendices.

Karr, J.R. 1981. *Assessment of biotic integrity using fish communities*. Fisheries 6(6): 21-27.

Karr, J.R. and E.W. Chu. 1997. *Biological monitoring and assessment: Using multimetric indexes effectively*. EPA 235-R97-001. University of Washington, Seattle, WA.

Lee, L.C., M.C. Rains, J.L. Cassin, S.R. Stewart, R. Post, M. Brinson, M. Clark. J. Hall, G. Hollands, D. LaPlant, W. Nutter, J. Powell, T. Rockwell, and D. Whigham. 1999. *Operational draft guidebook for reference based assessment of the functions of precipitation-driven wetlands on discontinuous permafrost in interior Alaska.* Alaska Department of Environmental Conservation and U.S. Army Corps of Engineers Waterways Experiment Station. Technical Report WRP-DE. Anchorage, Alaska.

Lodge, T.E., H.O. Hillestad, S.W. Carney, and R.B. Darling. 1995. *Wetland quality index (WQI): A method for determining compensatory mitigation requirements for ecologically impacted wetlands*. Proceedings of the American Society of Civil Engineers South Florida Section Annual Meeting, Sept 22-23, 1995, Miami, FL.

Mack, J. J. 2001. *Ohio rapid assessment method for wetlands. Manual for using version 5.0.* Ohio EPA Tech Bulletin Wetland/2001-1-1. Ohio Environmental Protection Agency, Division of Surface Water, 401 Wetland Ecology Unit. Columbus, Ohio.

Magee, D.W. 1998. *A rapid procedure for assessing wetland functional capacity.* Normandeau Associates. Bedford, New Hampshire.

Miller, R.E., and B.E. Gunsalus. 1997. *Wetland rapid assessment procedure (WRAP)*. Technical Publication REG-001. South Florida Water Management District, Natural Resource Management Division, West Palm Beach, FL.

Minnesota Board of Water and Soil Resources. 2004. *Minnesota routine assessment method for evaluating wetland functions (MNRAM). Draft version 3.0*. St. Paul, Minnesota.

Municipality of Anchorage. 1991. *Anchorage wetland assessment method.* Anchorage, Alaska.

Natural Resources Conservation Service (NRCS). 1997. *Interim guidance for making wetland minimal effect/mitigation decisions for USDA programs in Alaska (Aug. 1997)*. Web site: http://159.189.24.10/wlistates/alaska.htm

North Carolina Department of Environment and Natural Resources. 1995. *Guidance for rating the values of wetlands in North Carolina*. Raleigh, NC. 57 pp.

Null, W., G. Skinner, and W. Leonard. 2000. *Wetland functions characterization tool for linear projects.* Washington State Department of Transportation, Environmental Affairs Office.

Palmer, J.H. 1995. *Wildlife assessment and management PAM HEP habitat suitability index model manual*. Pennsylvania Game Commission, Bureau of Land Management, Harrisburg, PA.

Palmer, J.H., M.T. Chezik, R.D. Heaslip, G.A. Rogalsky, D.J. Putman, R.W. McCoy, and J.A. Arway. 1985. *Pennsylvania modified 1980 habitat evaluation procedure instruction manual*. U.S. Fish and Wildlife Service, State College, PA.

Palmer, J.H., R.H. Muir, and T.M. Sabolcik. 1993. *Wildlife habitat assessment and management system: Habitat evaluation procedure technology for wildlife management planning*. Pennsylvania Game Commission, Bureau of Land Management, Harrisburg, PA.

Powell, J., D. D'Amore, R. Thompson, T. Brock, P. Huberth, B. Bigelow, and M.T. Walter. 2003. *Wetland functional assessment guidebook; Operational draft guidebook for assessing the functions of riverine and slope river proximal wetlands in coastal southeast and southcentral Alaska using the HGM approach.* State of Alaska Department of Environmental Conservation.

Roth, E., R. Olsen, P. Snow, and R. Sumner. 1996. *Oregon freshwater wetlands assessment methodology.* Oregon Division of State Lands, Wetlands Program.

U.S. Army Corps of Engineers, Alaska District. 1998. *Southeast Alaska freshwater wetland assessment method.* Juneau Regulatory Field Office.

U.S. Army Corps of Engineers, New England Division. 1995. *The highway methodology workbook supplement; Wetland function and values; a descriptive approach.* NEDEP–360–1–30a.

U.S. Fish and Wildlife Service (USFWS). 1980. *Habitat evaluation procedure (HEP) manual (102 ESM).* U.S. Fish and Wildlife Service, Washington, DC.

Wetland Evaluation Working Group. 1994. *TAGS wetlands evaluation technique.* Joint Pipeline Coordinators Office. Anchorage, Alaska.

Whited, M. 1997. *The NRCS interim hydrogeomorphic approach to functional assessment: What should it entail?* Natural Resources Conservation Service. Web site: http://159.189.24.10/wlinews/editin5a.htm

Whitlock, A.L., N.M. Jarman, J.A. Medina, and J.S. Larson. 1994a. *WEThings: Wetland habitat indicators for nongame species*. Volume I. TEI Publication 94-1. The Environmental Institute, University of Massachusetts, Amherst, MA. 45 pp.

Wisconsin Department of Natural Resources. 2001. *Rapid wetland assessment methodology for evaluating wetland functional values.*

Wolfson, L., D. Mokoma, and G. Schultink. 2002. *Development and use of a wetlands system for assessing wetland functions.* Lakes and Reservoirs: Research and Management. Pp. 207-216.

WRP. 1994. *Methods for evaluating wetland functions.* Technical Note WG-EV-2.2.

Reviews of Wetland Assessment Methods

Bartoldus, C. 1999. *A comprehensive review of wetland assessment procedures: A guide for wetland practitioners.* Environmental Concern, Inc.

Fennessy, M.S., A.P. Jacobs, and M.E. Kentula. 2004. *Review of rapid methods for assessing wetland condition.* EPA/620/R-04/009. U.S. Environmental Protection Agency, Washington, D.C.

National Park Service. 2005. *Compendium of ecological assessment methods*. National Inventory/Survey; Tools for Ecological Assessment. <http://ecosurvey.gmu.edu/index.html.>

Schempf, J.H. 1992. *Wetland classification, inventory, and assessment methods: An Alaska guide to their fish and wildlife application.* Alaska Department of Fish and Game, Habitat Division. Juneau, Alaska.

U.S. Army Corps of Engineers. 2005. *The process of selecting a wetland assessment procedure: steps and considerations.* <http://el.erdc.usace.army.mil/emrrp/emris/emrishelp6/the_process_of_selecting_a_wetland_assessment_procedure_steps_and_considerations.htm>

Laws, Regulations, Guidance, Agreements

16 U.S.C. §§ 661-667e, as amended 1946, 1958, 1978 and 1995. March 10, 1934. Fish and Wildlife Coordination Act.

33 U.S.C. §§ 1251-1387, as amended 1973-1983, 1987, 1988, 1990-1992, 1994, 1995 and 1996. October 18, 1972, Federal Water Pollution Control Act (Clean Water Act).

Alaska Department of Environmental Conservation; Alaska Department of Fish and Game; Alaska Department of Natural Resources; Alaska Department of Transportation and Public Facilities; U.S. Department of Interior, U.S. Fish and Wildlife Service and U.S. Geological Survey; U.S. Army Corps of Engineers, Alaska District; U.S. Environmental Protection Agency; U.S Department of Agriculture, Natural Resource Conservation Service and U.S. Forest Service, Alaska Regional Office; and U.S. Department of Transportation, Federal Highway Administration. 2000. *Memorandum of understanding concerning the development of a wetland functional assessment method and guidebooks: The hydrogeomorphic approach (HGM).*

Executive Order 11990. May 24, 1977. *Protection of wetlands.* 42 FR 26961.

Federal Aviation Administration. 1985. *Airport environmental handbook.* Washington DC.

Federal Highway Administration. October 30, 1987. *Guidance for preparing and processing environmental and section 4(f) documents*. Technical Advisory 6640.8A.

U.S. Army Corps of Engineers. November 13, 1986. *Regulatory programs of the Corps of Engineers; Final rule.* 33 CFR Parts 320-330.

U.S. Army Corps of Engineers. 1997. *National action plan to implement the hydrogeomorphic approach to assessing wetland functions.* 62 FR 33607.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. *Interim guidance for making wetland minimal effect/mitigation decisions for USDA programs in Alaska*. http://www.pwrc.usgs.gov/wlistates/alaska.htm

U.S. Environmental Protection Agency. December 24, 1980. *Guidelines for specification of disposal sites for dredged or fill material.* 40 CFR Part 230.

Additional Resources

Association of State Wetland Managers. 1998. *Common questions pertaining to wetland assessment.*

Boggs, K., S. Klein, G. Tande, J. Michaelson and J. Lenz. 1998. *Wetland information for southern Alaska: Wetland environmental indicators, bibliography, and wetland communities.* Environmental Protection Agency, Region 10, Alaska Operations Office, Anchorage, Alaska; in review. 119 pp.

Cole, C. and J.G. Kooser. 2003. *HGM: Hidden, gone, missing?* SWS Bulletin. June 2003: 9-12.

Cowardin, L.M.; V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of wetlands and deepwater habitats of the United States.* FWS/OBS-79/31. U.S. Fish and Wildlife Service, Office of Biological Services. Washington, D.C.

Kusler, J. 2003a. *Assessing functions and values*. Association of State Wetland Managers.

Kusler, J. 2003b. *Integrating wetland assessment into regulatory permitting.* Association of State Wetland Managers.

Kusler, J. 2003c. *Reconciling wetland assessment techniques.* Association of State Wetland Managers.

Kusler, J. 2003d. *Wetland assessment in the courts.* Association of State Wetland Managers.

Kusler, J. and W. Niering. 1998. *Wetland assessment: Have we lost our way?* National Wetlands Newsletter Vol. 20, No. 2.

Mitsch, W.J., and J.G. Gosselink. 1993. *Wetlands.* Van Nostrand Reinhold: New York.

Novitzki, R.P., R.D.Smith, and J.D. Fretwell. 1997. *Restoration, creation, and recovery of wetlands; Wetland functions, values, and assessment.* National Water Summary on Wetland Resources. United States Geological Survey Water Supply Paper 2425.

Post, R.A. 1996. *Functional profile of black spruce wetlands in Alaska.* Report EPA910/R 96-006 prepared for U.S. Environmental Protection Agency, Region 10. Alaska Department of Fish and Game. Fairbanks, Alaska.

Smith, R.D., A. Ammann, C. Bartoldus, and M.M. Brinson. 1995. *An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices*. Wetlands Research Program Technical Report WRP-DE-9. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. 88 pp.

U.S. Fish and Wildlife Service. 1984. *An overview of major wetland functions and values.*

Appendix B
Technical Memorandum #1: Agency Interviews Regarding Purpose and Objectives of Wetland Assessment

ONE COMPANY
Many Solutions℠

Memo

To: Clint Adler, Alaska Department of Transportation and Public Facilities, Resarch and Technology Transfer	
From: Anne Leggett	Project: Synthesis of Practice for Rapid Wetland Assessment in Alaska
Date: July 28, 2005	Job No: HDR Project #07072/23460 ADOT&PF Project #T2-04-03

RE: Task 1 – Agency Interviews Regarding Purpose and Objectives of Wetland Assessment

Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is seeking a way to assess wetlands potentially affected by its proposed projects. ADOT&PF has hired HDR Alaska, Inc., (HDR) to identify and recommend an appropriate wetland assessment method for ADOT&PF's use, and to define the information needed to implement the assessment protocol statewide. "Assessment", as discussed throughout this project, is distinct from wetland delineation and from mitigation of wetland effects.

A plethora of wetland assessment methods exists. Wetland assessments can achieve a wide range of important objectives, but no existing method can meet all objectives. Similarly, the various methods require a wide range of data input, technical expertise, training in use of the method, and time to perform. Most methods are applicable only to a limited suite of wetland types, and to certain geographical areas, but most can be adapted to change or broaden their applicability. Some methods assess just ecological functions; others document social values and other management considerations. To select an appropriate method for use in Alaska, we must specify and prioritize the objectives ADOT&PF wishes to achieve.

The purpose of Task 1 of this project, Agency Interviews, is to begin to define the purpose of wetland assessment; that is, what questions do we want the wetland assessment method to answer and what requirements should it fulfill? The choices among possible objectives will become clearer during Task 2, Literature Review, when the objectives of the myriad available methods are identified. Task 1 also entails defining how current practices are not meeting ADOT&PF or agency needs.

Methods

Task 1 was begun by meeting with the project's Technical Advisory Group (TAG). Questions were posed to the group to stimulate discussion on the basic objectives of wetland assessment. The questions related to: the purpose of assessing wetlands, the current practices, how current practices are and are not meeting ADOT&PF and needs, and desirable characteristics of an assessment method. Other questions posed relate to Task 2, during which we will consider potentially applicable methods. The questions and responses are shown in a meeting record in the appendix. Some of the members of the TAG were unable to attend the meeting and were interviewed separately. Members of the TAG who provided input include:

Clint Adler, ADOT&PF Research, Fairbanks
Bill Ballard, ADOT&PF Statewide, Juneau
Mac McLean, Alaska Department of Natural Resources, Office of Habitat Management and Permitting, Fairbanks
Phil North, Environmental Protection Agency (EPA), Soldotna
Bill Pearson, U. S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), Anchorage
Jim Powell, Alaska Department of Environmental Conservation, Juneau
Carol Sanner, ADOT&PF Central Region, liaison to Corps of Engineers, Anchorage

A second set of agency professionals was contacted to discuss the potential objectives of ADOT&PF wetland assessment. Additional ADOT&PF personnel were interviewed because they prepare and review wetland assessments; hear feedback when they provide those assessments to regulatory, resource, or funding/oversight agencies; and respond to information requests from agencies. Other interviewees represent agencies that request that assessments be made for ADOT&PF projects, review wetland assessments, or are interested in the topic. Records of these conversations are also included in the appendix. Agency professionals contacted include:

Heather Dean, EPA, Anchorage
Paul Garrett, FHWA, Colorado
Mike Holley*, Corps of Engineers, Anchorage
Chuck Howe, ADOT&PF Northern Region, Fairbanks
Chris Meade, EPA, Juneau
Joe Moore*, NRCS, Palmer
Kevin Morgan, Corps of Engineers, Anchorage
Laurie Mulcahy, ADOT&PF Statewide, Anchorage
Mary Lee Plumb-Mentjes, Corps of Engineers, Anchorage
Patti Sullivan, Federal Aviation Administration
Van Sundberg, ADOT&PF Southeast Region, Juneau
Jerry Tande, USFWS NWI, Anchorage
Bill Wood, Natural Resources Conservation Service (NRCS), Anchorage

* Deferred to other professionals

Many of the above interviewees will be re-contacted to clarify objectives or to discuss specific methods as this project progresses. Contacts were also begun with other professionals regarding their experience with assessment methods and the state of the practice in their geographical areas. The results of these contacts will be reported in the next technical memorandum. Some of the conversations documented in the appendix also touch on specific methods.

Results

We received input on many topics related to selecting the “right” wetland assessment method for ADOT&PF projects. The comments are compiled and summarized by category below.

Legal/regulatory/policy requirements for wetland assessment

Wetland assessments play a role in fulfilling various agencies' mandates under the following:

- Executive Order 11990 – This order requires that federal agencies' actions incorporate all practicable measures to avoid and minimize adverse effects to wetlands. Minimizing project effects on wetlands sometimes involves choosing among wetlands to be affected, which can be aided by wetland assessment.
- National Environmental Policy Act (NEPA) – This law requires disclosure of the predicted environmental effects of federal undertakings.
- Regulations implementing Section 404 of the Clean Water Act, and the Section 404(b)(1) Guidelines – The Corps of Engineers must evaluate whether it is in the public interest to issue each permit. To do so, in part, it must understand enough about the affected wetland's characteristics to be able to evaluate the potential impacts of the proposed project and alternatives. The Corps must describe the project's effects in many categories. Wetland assessment could provide much of the basic necessary information for this analysis.
- FHWA Technical Advisory 6640.8A – This guidance for FHWA implementation of NEPA requires analysis of wetland functions, importance of the wetland within a broad context, wetland uniqueness and other pertinent factors, and the severity of a project's impact on wetlands. The guidance recommends a specific method for wetland assessment, but other methods are also acceptable.
- Federal Aviation Administration (FAA) Order 5050.4A – This guidance for FAA implementation of NEPA states that wetland impacts to be considered include: water quality, water supply and recharge capability, interference with surface and subsurface water courses, siltation and sedimentation, biotic community disruption, flood and storm hazards, development of secondary (induced) activities or services, and construction.
- Fish and Wildlife Coordination Act – Wetland assessment could provide information on wildlife habitat and resources that is needed for interagency review of projects.
- Coastal Zone Management Act and implementing programs – Wetland assessment may aid in determining whether a project complies with standards of coastal zone management plans.
- Other federal agencies' NEPA and EO11990 implementing regulations – When ADOT&PF projects require actions of other federal agencies (e.g., a road project on National Park Service lands), wetland assessment may be needed to fulfill those agencies' requirements.
- Local ordinances and programs, such as wetland management plans – Wetland assessment may help determine whether local program requirements are met.

Purposes of employing a wetland assessment method

Interviewees cited many potential purposes for ADOT&PF wetland assessment:

- Comply with laws/regulations/policies (above)
- Define wetlands' ecological functions
- Define how a wetland functions within a landscape
- Help document how a project affects a wetland
- Define wetland functions that must be replaced when a wetland is adversely affected
- Define wetlands' social values
- Help evaluate and decide among project alternatives
- Disclose the effects of a project for the public and decision maker

- Help identify ways to avoid or minimize adverse effects on a wetland
- The TAG emphasized that this project's aim is to identify a method for use on routine projects with a relatively small potential effect on wetland.

Desirable characteristics of a wetland assessment method

Several interviewees commented on specific characteristics of wetland assessments that they think are or are not important:

- Wetland must be assessed within its landscape context. (repeated many times)
- User should be able to use the method without collecting field data, if necessary.
- Method must explain the assumptions and rationale behind it.
- It is important to address social values, particularly for urban projects. Initially, the TAG thought the method should only look at wetland functions; but that will be reconsidered through the course of the project.
- Method selected by this project should be quick to use.
- Level of detail should be appropriate for the scale of project. (*Point to clarify: It's not clear whether the intent is for a larger project to provide more detail or less*.)
- There may be different methods for different scales of projects.
- Method must be repeatable by others, so multiple users would reach similar conclusions.
- Method must be appropriate to the region of the state in which it is being applied.
- Method that uses GIS technology could provide data-driven analysis using existing water and habitat modeling tools.
- Method needs to address upland functions as well, to determine least environmentally damaging practicable alternative. Upland functions are often neglected. Some wetland functions also depend on what is occurring in adjacent uplands. Impact of nearby development should be addressed.
- There should be some recognition that wetland alternatives may be less damaging than upland alternatives.
- Method could identify "red flags" associated with the wetlands (or uplands).
- Method needs to address connectivity with other wetlands and uplands.
- Some thought that the method should be rigorous enough that it would require training.
- If numerical ratings are used, there must be sufficient explanation of the basis for those numbers.
- Numbers give a false sense of precision; they should be used with caution.
- A numerical system is helpful when dealing with compensation.
- Some didn't care for each wetland polygon to be assessed; want more landscape context or overall watershed functions.
- Productivity and scarcity are important wetland characteristics. In at least some parts of Alaska, wetland practitioners have informally defined a ranking of importance of various wetland types.
- Some expressed interest in a method applying to "waters" other than wetlands as well, to satisfy overall Section 404 needs.
- The method could help define exactly what type of jurisdiction the Corps has, including isolation.
- A method that allows differentiation among functions and values of different areas within a wetland has benefits.
- The method should be designed to support the Corps of Engineers' 404(b)(1) analysis.
- The method could include a checklist that defines what type of analysis is necessary.
- A method developed based on field work, not theory, is desirable.

- A locality-specific method is most useful.
- Pattern within a wetland should be considered.

Existing wetland assessment practices in Alaska

The interviewees and HDR participants identified the following methods that have been used in Alaska. The list is not exhaustive.

- No assessment done
- Best Professional Judgment, presented as a narrative
- WET2 (Adamus et al. 1987) – often adapted or used loosely for specific projects
- Corps of Engineers method for Southeast Alaska (U.S. Army Corps of Engineers, Alaska District 1998)
- Juneau Wetland Management Plan method (Adamus Resource Assessment, Inc. 1987)
- Anchorage Debit-Credit Method (U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and Municipality of Anchorage 1999)
- Anchorage Wetland Assessment Method (Municipality of Anchorage 1991)
- New England Descriptive Method (U.S. Army Corps of Engineers New England Division 1995)
- Hydrogeomorphic Approach (Hall et al. 2002, Powell et al. 2003, State of Alaska Department of Environmental Conservation/U.S. Army Corps of Engineers 1999)
- A Rapid Procedure for Assessing Wetland Functional Capacity (Magee 1998)
- Methods developed for specific projects

How existing practices are not meeting the needs for wetland assessment

- On many ADOT&PF projects, no wetland assessment is done; just delineation and enumeration of acreage affected.
- Agencies continually debate which method is appropriate for use on individual projects. Often, agencies are not consulted in advance on what method should be used. Users should "buy into" the method.
- There is insufficient attention paid to the broader ecosystem – the wetland's context.
- For HGM, no guidebooks exist for most of the state. There are no established methods specific to most of Alaska.
- There is some thought that methods developed for use in the Lower 48 states do not apply to Alaska.
- Some methods (e.g., HGM) are too slow and complicated to be applied to small, simple projects.
- The rationale and assumptions underlying the method are often not sufficiently documented.
- Elements of established methods are sometimes used out of context.
- Some methods are more appropriate to use in degraded wetlands than in undeveloped ones.

Implications of the Interview Results

During Task 2, Literature Review, HDR will examine several reports that review wetland assessment methods. Each of those reviews identifies the purpose for which each method is most suitable, and briefly describes major traits of the methods. Becoming familiar with what other wetland managers have considered when developing wetland assessment methods, and what they have been able to accomplish, will help us clarify the objectives that ADOT&PF should strive to meet. The HDR team will then clarify and prioritize the purposes and the desirable characteristics of a method that we have heard from the TAG and others. Then, using the information in the reviews, we will screen the myriad available assessment methods to identify the more promising methods for potential use for ADOT&PF projects. We will check back with the TAG after the screening to determine whether we have accurately characterized the most important objectives for ADOT&PF's purposes.

References

Adamus, P.R., E.J. Clairain, R.D. Smith, and R.E. Young. 1987. Wetland Evaluation Technique (WET); Vol. II: Methodology. Operational Draft Technical Report Y-87-__. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Adamus Resource Assessment, Inc. 1987. Juneau Wetlands: Functions and Values; Rapid Assessment Method for Southeast Alaska. Prepared for the City and Borough of Juneau, Department of Community Development. Juneau, Alaska.

Hall, J. V., J.E. Powell, S. Carrack, T. Rockwell, G. Hollands, T. Walter, and J. White. 2002. Operational Draft Guidebook for Assessing the Functions of Slope/Flat Wetland Complexes in the Lower Kenai River Drainage Basin Using the HGM Approach. State of Alaska, Department of Environmental Conservation/

Magee, D.W. 1998. A Rapid Procedure for Assessing Wetland Functional Capacity. Normandeau Associates, Bedford, NH.

Municipality of Anchorage. 1991. Anchorage Wetland Assessment Method. Anchorage, AK.

Powell, J. E., D.V. D'Amore, R. Thompson, P. Huberth, B. Bigelow, M.T. Walter, and T. Brock. 2003. Wetland Functional Assessment Guidebook, Operational Draft Guidebook for Assessing the Functions of Riverine and Slope River Proximal Wetlands in Coastal Southeast and Southcentral Alaska Using the HGM Approach. State of Alaska, Department of Environmental Conservation / U.S. Army Corps of Engineers Waterways Experiment Station Technical Report: WRP-DE-__.

State of Alaska Department of Environmental Conservation/U.S. Army Corps of Engineers Waterways Experiment Station Technical Report Number: WRP-DE-_. 1999. Operational Draft Guidebook for Reference Based Assessment of the Functions of Precipitation-Driven Wetlands on Discontinuous Permafrost in Interior Alaska. Anchorage, AK.

U.S. Army Corps of Engineers, Alaska District. 1998. Southeast Alaska Freshwater Wetland Assessment Method. Juneau Regulatory Field Office.

U.S. Army Corps of Engineers New England Division. 1995. The Highway Methodology Workbook Supplement; Wetland Function and Values; A Descriptive Approach. NEDEP–360–1–30a.

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and Municipality of Anchorage. 1999. A Method for Determining Development Debits and Mitigation Credits for Aquatic Areas in Anchorage, Alaska. DRAFT.

Appendix

Meeting Records
Technical Advisory Group
Carol Sanner, ADOT&PF

Telephone Conversation Records and Emails
Heather Dean, EPA
Paul Garrett, FHWA
Chuck Howe, ADOT&PF
Mac McLean, DNR OHMP
Chris Meade, EPA
Kevin Morgan, Corps of Engineers
Laurie Mulcahy, ADOT&PF
Mary Lee Plumb-Mentjes, Corps of Engineers
Patti Sullivan, FAA
Van Sundberg, ADOT&PF
Bill Wood, NRCS

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Meeting Notes

Subject: Technical Advisory Group Discussion/ Project Kick-off Meeting			
Client: AK Dept. of Transportation and Public Facilities			
Project: Rapid Wetland Assessment Method		Project No: 07072/23460	
Meeting Date: March 14, 2005		Meeting Location: HDR Alaska, Inc. - Anchorage	
Notes by: Jeff Schively/Anne Leggett			

Attendees:
Clint Adler (DOT&PF), Bill Ballard (DOT&PF) (on telephone), Anne Leggett (HDR), Phil North (EPA), Bill Pearson (USFWS), Jim Powell (DEC) (on telephone), Jeff Schively (HDR), Jerry Tande (USFWS)

Topics Discussed:
This meeting was intended to serve as a kick-off meeting for the DOT&PF Rapid Wetland Assessment Method Project. It attendees included members of the projects technical advisory group (TAG) and project team members from HDR. Each attendee was given a set of questions/discussion points to help facilitate discussion that would identify the goals of the project.

Action/Notes:
Included below are the series of questions/subjects that were discussed at the meeting (taken directly from the handout given to the TAG at the meeting). Wherever possible I have attempted to put the person's initials beside his/her comment.

1. What is the purpose of employing a wetland assessment method?
- To satisfy regulatory purposes/laws (EO 11990, 404(b)(1) guidelines, etc.) [AL, BB]
- Understand how a wetland is functioning [PN]
- Identify how a wetland fits into the landscape [PN, JP]
- Help document impacts of a project on a wetland [AL, JP]
- Helps agencies and project team make decisions such as avoidance, minimizing impact, protecting critical habitat areas [BP]
- Helps drive project alternative decisions [BB]
- Recognizes different types of wetlands and different functions [JP]

2. What specific parts of laws/regulations/policies should the assessment method help us satisfy?
- Local government regulations (MOA, Homer, Fairbanks)
- Coastal Zone regulations
- NEPA – understand environment impacts
- 404(b)(1) guidelines
- EO 11990
- NPS wetland policies (other federal agency policies?)
- FAA – 5050.4A
- Fish and Wildlife Coordination Act [BP]

3. How are current practices NOT satisfying those needs?
- Speed and scale issues (small projects don't fit larger, high-resolution methods) [JP]
- Guidebooks don't exist for much of the state (re: HGM) [JP].
- Use of an appropriate method. Most lower-48 methods don't fit Alaska [JP]
- Generally there is no wetland function assessment done with most projects. Most projects delineate wetlands and provide impact acreages but fail to apply a functional assessment to their analysis [PN].
- There is continuing debate over defining an acceptable method that is applicable to AK [BB].
- Projects will attempt to modify methods and use parts of them, but that often takes concepts/practices out of the context they were originally intended to be in [PN]

- Effort needs to be placed on looking at the system, not individual wetlands [PN].
- On larger projects (i.e., roadways projects covering many miles) an assessment method protocol for fieldwork needs to be efficient. Interpreting wetlands in GIS and ground-truthing those boundaries generally works. [BB}
- There should be different processes for different scales of projects [BB]
- Agencies are not consulted on assessment.
- Assessments lack a landscape context and become just numbers or individual polygons on paper [PN].
- There needs to be better definition of the logic involved in assessing wetland functions [PN].
- HGM brings a wetland assessment into landscape context [JP].

4. What practices are being employed?
- Best professional judgment/descriptive approach.
- Anchorage method (Ontario-modified).
- Ralph Thompson method is commonly used in southeast AK.
- Juneau method (Adamus).
- Magee and Hollands.
- NRCS – an HGM-like process (more information from Michelle Schumann).
- New England (Icon method).
- AJ Mine (using an Adamus method).
- HGM (used in mitigation banking for southeast Alaska) – Pros: brings landscape context, incorporates land uses, high resolution, many people are trained (200+ in AK), reference based method, regionally based; Cons: cumbersome, time consuming, few classes which aren't very descriptive, numerical scaling system is not well validated and has a lot of assumptions, there is a disconnect between the guidebook and actually using the method.

5. What methods do you know of that seem promising?
- Oregon method (developed by Adamus) – HGM driven, classifies wetlands into HGM classes, this is likely a stepped down version from the existing guidebooks [JP].
- Using GIS technology will allow for a data-driven analysis using water/habitat modeling tools [PN].
- Contact Ralph Tiner to discuss methods being used in the northeast U.S.
- Contact Mike Gracz to discuss his work on the Kenai Peninsula, he plans on attaching functional indicator modifiers to NWI mapping codes.

6. What are some ideal characteristics of the assessment method?
- The method should be rapid.
- Appropriate to scale – detail of method should be tailored to size of project, should be different for large/small projects.
- Method should asses the context of wetland in its landscape.
- Identify "red-flags" such as eagle nests, salmon streams, etc.
- Method should account for different AK regions.
- Method should be repeatable.
- Method should address connectivity to other wetlands and uplands.

7. Should the method be limited to wetlands (vegetated waters)?
- To address NEPA and identify least environmentally damaging impacts, agencies need to understand upland functions as well [PN].
- Would like to see the methods extend into uplands [PN].
- Projects need to now what's happening off site (in uplands) that may affect wetland functions [JP].
- With ignoring uplands, the assessment doesn't take into account reality [PN].

8. Who else should we interview?
-Carol Sanner, Ralph Tiner, Paul Adamus, Paul Garrett, Heather Dean, Ted Rockwell, Ralph Rogers (Seattle), Chuck Howe, Mike Gracz.

9. How important is it that the selected method is…

-Numerical rating:
- If necessary, provide enough justification for the basis behind the ratings.

-Are helpful when dealing with compensation or mitigation banking.
- Gives a false sense of precision [PN].
- Should only be used if based on scientific measurements [PN].

- *Good documentation of rationale and assumptions behind method:*
-Very important.

- *Inclusion of social values:*
- Yes, even though its qualitative [JP].
- Originally the scope limited this project to only functions [CA].

- *Usability without formal training:*
- Yes, formal training should be necessary, it will likely be (and should be) complex [JP].

- *Based on field-collected data:*
- Method can't be based on field data [JP]
- The method should be flexible enough that you don't have to go out into the field, but should be based on project size [BB].
- Based on scaling or sensitivity.

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Meeting Notes

Subject:	Discussion with Carol Sanner regarding Rapid Wetland Assessment Method		
Client:	AK Dept. of Transportation and Public Facilities		
Project:	Rapid Wetland Assessment Method	Project No:	07072/23460
Meeting Date:	April 7, 2005	Meeting Location:	HDR Alaska, Inc. - Anchorage
Notes by:	Jeff Schively		

Attendees:
Carol Sanner (DOT), Anne Leggett (HDR), Jeff Schively (HDR)

Topics Discussed:
Existing wetland assessment methods, deficiencies in past assessments, and wetland function assessment information needed by agencies for their review of projects throughout Alaska.

Action/Notes:

Carol Sanner, a member of the technical advisory group (TAG) for the project, was unable to attend the project kick-off meeting held at HDR on March 14th, 2005. Therefore to incorporate her ideas and suggestions regarding the project, we met with Carol at HDR to discuss questions and issues that were covered during the earlier held project kick-off meeting with other members of the TAG.

Initially, we discussed what the purpose of employing a wetland assessment method was. Carol stated that a wetland assessment method should fix existing deficiencies in the U.S. Army Corps of Engineers (USACOE) wetland permit application process. Specifically, a wetland assessment needs to include enough information for the USACOE to determine if the project meets Section 404(b)(1) guidelines. Furthermore, she stated that by gathering sufficient information on an areas wetlands (the purpose of a wetland assessment), allows the USACOE to determine if sites meet the criteria for being designated as sites where additional regulations and restrictions apply (such as Special Aquatic Sites, Navigable Waters of the U.S., Wildlife Refuge lands, etc.).

In regard to defining what a wetland assessment method should contain, Carol stated that smaller projects (for instance, those with less than 10 acres of wetland) should be able to be completed without extensive ground truthing. A possible method she discussed was developing an initial checklist of criteria that would be completed before a wetland assessment was begun. This checklist would define which method (rigorous assessment with extensive fieldwork or broader office-based assessment) is appropriate to address the project size and its impacts to wetlands. She stated that a checklist could include such criteria as occurrence of red flags (T&E species, bald eagle nests, etc.), occurrence of regionally designated "high-value" areas (estuarine, coastal fringe), and a checklist of available resource information for the area. After completing the checklist, the project team would then acquire additional information if required. If a field investigation is deemed necessary, the project team should accurately delineate wetland boundaries (using techniques such as paired plots, visiting representative sites, etc.), identify interspersion of wetlands and uplands, and collect sufficient information on the likely occurrence of wetland functions (habitat qualities, hydrology information, etc.). She did mention that information related to uplands should be collected as well because certain wetland functions may be dependent on what is going on in uplands. Additionally, she mentioned that it can be important to understand and identify ecotones between uplands and wetlands which may provide project reviewers information in determining the likelihood of whether certain functions were being performed or not.

Carol mentioned that she does like the Anchorage functional assessment method (a modified version of the Ontario method). Specifically, she stated that the method, which scores wetlands based on a variety of characteristics, uses large enough numerical class ranges in it that lead to an accurate assessment without being too subjective. She said that the class ranges (i.e. 20-40 points is low value, 40-60 points is medium value, etc.), which account many different scored variables added up to a single number, are wide enough to obtain a good, clear representation of the ecological and social value of the wetland.

Carol also mentioned that she has used the WET2 functional assessment method on the Kenai Peninsula in the past. She stated that the method seemed to work well but it should be further calibrated for use in Alaska. Carol is also familiar with the HGM assessment method but cautioned that the method tends to rely heavily on a wetlands hydrology and lesser on other functions. The HGM method also requires extensive, in-depth fieldwork and typically works better with larger projects than with smaller ones.

Carol recommended that we track down the wetland assessment that was recently completed for a DOT&PF project at the Talkeetna Airport. She also mentioned that it may be worthwhile to talk with Terry Carpenter of the USACOE who reviews a lot of projects on the North Slope.

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	May 4, 2005	Subject:	Disscussion of wetland assessment methods
Call to:	Heather Dean, EPA	Phone No:	(907) 271-3490
Call from:	Jeff Schively, HDR Alaska, Inc.	Phone No:	(907) 644-2016

Discussion, Agreement and/or Action:

Heather returned my voice message I had left with her regarding obtaining input from her for the DOT wetland assessment method project. I initially asked her what wetland function assessment methods she was familiar with and if she felt those methods where appropriate in identifying and assessing wetland functions. Heather stated that she was most familiar with the Anchorage method (which coincided with the development 1996 Anchorage Wetland Master Plan and attributed wetlands as A, B, or C-type wetlands). She stated that advantages of the Anchorage method was that it was fast, rapid method that didn't require fieldwork (could be done using only aerial photographs). The methods primary weakness is that it can't be used to assess a particular function or assess the reduction of a function being impacted by a project component.

Heather also stated that the Anchorage method is based on a set of assumptions, but if you accept all of the assumptions (which are laid out in the method) than it does in fact characterize most functions. She does support the scoring system used in the method and feels that the ranges are large enough and that enough information is put into to get a clear picture of the relative value of a wetland in the Anchorage area.

She stated that she is also somewhat familiar with the concepts and practices involved in HGM and feels that if all of the models and reference datasets were in place that it would be a useful tool.

In regard to an "ideal" wetland function assessment method, she stated the following criteria that should be included with it:

- It should identify what extent or how a function is being impacted.
- It should identify how a function will be replaced.
- It should include a field investigation.
- It should attempt to place a monetary value on wetland functions.
- It should take into account the financial value of wetland functions.
- It should include a rating system of some sort (Heather mentioned that by having a "High-, medium-, low-value" system in place would help guide the NEPA process and meet the requirements set forth by NEPA)

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	4-11-05	Subject:	DOT&PF rapid wetland assessment
Call to:	Paul Garrett, FHWA	Phone No:	720/963-3071
Call from:	Anne Leggett	Phone No:	907/644-2038

Discussion, Agreement and/or Action:

What is the purpose of employing a wetland assessment method?
Identify wetland functions
Identify wetland values
Be able to prepare NEPA analysis
Be able to prepare a complete Section 404 permit application

He sees some need for a standardized approach that will help Corps make more consistent decisions, particularly with respect to compensatory mitigation.

Methods actively being used, methods that seem promising:
Every state seems to be using its own method.
Many practitioners are just using descriptive approaches. He thinks that's as good as any if the wetlands are well described – good physiographic description, description of drainage.

WashDOT method for linear projects – has some holes, good for riparian/riverine. Would provide a good framework for AK to build on.
HGM – reference based, good for replacement of wetlands, not so good for undisturbed wetlands, the AK versions haven't been able to scale from 0 to 1 very well because of the predominance of undisturbed wetlands.
MinRAM
WET2 – good for riparian/riverine

Who else to interview:
WashDOT: Marion Carey 360/705-7404; Paul Wagner 360/705-7406
Montana DOT: Larry Urban 406/444-6224 or -7632
ORDOT: Sue Chase
WY DOT: Bob Bonds 307/777-4379
FHWA division office: Elton Chang 503/587-4710 – ask for name of Oregon person

Any method that uses landscape approach?
no

Any method that assesses uplands also?
No. WET does that as well as any method.

What is he teaching in Fairbanks this spring?
WET2
WashDOT linear method
HGM – interior guidebook

Paul's email: paul.garrett@fhwa.dot.gov

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	April 20, 2005	Subject:	Disscussion of wetland assessment methods
Call to:	Chuck Howe, DOT&PF	Phone No:	(907) 451-2238
Call from:	Jeff Schively, HDR Alaska, Inc.	Phone No:	(907) 644-2016

Discussion, Agreement and/or Action:

I called Chuck to discuss the project, his experience with wetland assessment methods, and obtain feedback on what he felt should be included in a wetland assessment method. He stated that he had seen a variety of methods used in the past but was not familiar with a lot of the specifics of each one.

Chuck did note that a major flaw within most of the existing methods is the broad opportunity for subjectivity. He stated that an appropriate method should be repeatable and defendable. He felt that a way to develop a less subjective method would be to identify specific parameters which would be used to define the different functions (for example, what parameters can be observed which indicate whether groundwater was being recharged or not). Those parameters could then be given different rankings which would document how an assessment came to its conclusions.

Chuck also stated that it is important to set up the scientific framework of a project before the analysis or site specific studies are started. For instance, he stressed the need for projects to consult with the Corps of Engineers before the application process to iron out specific issues regarding the project. He felt that an initial consultation would allow for the agencies and DOT to agree on which components should be necessary in an assessment method. Agreements should also be made on the level of sampling effort and the specific parameters which would be investigated in the field. This initial consultation could also determine whether a field investigation is needed or not.

Another idea that Chuck discussed was the importance of collecting preliminary data for a project area before specific studies are carried out. He stated that he likes to see an analysis done on a project area's vegetation cover types to get an initial idea of what different types of wetlands, habitat, cover types will need to be sampled. A good approach would be to complete a quick delineation of cover types (or use NWI mapping if available), sit down with the Corps of Engineers and validate the needed level of field sampling, validate the important wetland functions, and identify any red flags that should be looked for in the field.

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	4/8/2005	Subject:	
Call to:	Mac McLean	Phone No:	
Call from:	Becky Shaftel	Phone No:	644-2118

Discussion, Agreement and/or Action:

Mac has not used any formal methods for assessing wetlands, but he is familiar with HGM.
He has used BPJ during reviews of COE permits.
He did not have any input or information on various methods.
Suggested calling Wayne Dolezal, remainder of habitat program with ADF&G in Anchorage.

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	April 7, 2005	Subject:	Disscussion of wetland assessment methods
Call to:	Chris Meade, EPA	Phone No:	(907) 586-7622
Call from:	Jeff Schively, HDR Alaska, Inc.	Phone No:	(907) 644-2016

Discussion, Agreement and/or Action:

I called Chris to discuss wetland assessment methods he has seen used in the past and provide insight on what he looks for in a wetland assessment. He mentioned that he was familiar with WET2, the Juneau method (by Adamus), Anchorage method, and the HGM method (or components of each) being used on Alaska projects. The most commonly used practice he was aware of was the use on best professional judgment in developing wetland assessments and describing wetland functions. Chris stated that using one or another particular method is not a decisive issue in EPA's review of a project. He is open to projects using any of the common methods (WET2, HGM, etc.) as long as they are used objectively.

I asked Chris whether he likes or dislikes numerical ranking systems of a wetlands importance. He stated that he is open to either using a ranking system or simply using a narrative approach. If using a narrative approach (which he most commonly sees used in AK), it needs to provide clear, thorough information which is easily interpreted by the agencies. Likewise, if a ranking system is being used, the document should include accurate, clear guidance supporting the ranking classes. He did mention that there is a false sense of accuracy when numerical ranking systems are being used, and wasn't sure if using numbers in a rating system were appropriate in some cases.

We discussed what features he looks for in a wetland assessment and what wetland functions are most important when he reviews a project. He stated that the importance of any one function over another is typically determined in a case by case basis, but he tends to stress the most importance on protecting fish and wildlife habitat and ecological diversity for most projects. Regarding wetland assessments in general, he doesn't like for them to get bogged down on details of each individual wetland polygon. Instead, he prefers a wetland assessment analyze the landscape context of wetlands or discuss the overall watershed functions rather than detailing each separate, individual wetland.

Chris stated that when he reviews projects impacts to wetlands, he generally looks at the productivity and scarcity of a particular wetland type in the region to base many of his decisions on. For example, in southeast AK he typically places much more concern on estuarine wetlands and beach fringe habitats than he does on more ubiquitous forested wetlands. When he reviews a project he initially finds out what type of wetlands would be impacted and then bases his review time/effort on that. If only forested wetlands would be impacted then he may lessen his review time.

Chris mentioned that not only wetlands are important in his project reviews. He stated that although many of the federal agencies are mandated by 404(b) guidelines to first find upland only alternatives, there is enough wiggle room in the regulations to allow for development in wetlands in efforts to protect more valuable upland habitat. By law, projects must find the least environmentally damaging alternative which typically requires projects to avoid wetlands altogether. However there is a modifying clause in the 404(b) guidelines that allow projects to avoid higher quality habitats (which can be upland) and impact lesser quality habitat (which may be wetland) if so determined by contributing agencies. For instance, many coastal projects in southeast AK have the potential to impact upland beach fringe habitats where eagles tend to nest because they attempt to avoid more common forested wetland. He sees these projects as examples of when it is more suitable to impact wetlands than uplands. Chris e-mailed me a PDF file of the 404(b)(1) guidelines and explained where that clause in the regulation exists.

Telephone Conversation Record

Project	Synthesis of Practice for Rapid Assessment in Alaska	Project No.	07072-23460; client project no. T2-01-03
Time	2:50 pm	Date	April 7, 2005
Call to	Kevin Morgan, USACE — 753-2709 (Phone No.)	Call from	Anna B. Jones, HDR — 644-2008 (Phone No.)

Discussion, Agreement and/or Action

I stated to Mr. Morgan that the DOT is interested in researching available wetland assessment methods and evaluating their applicability to Alaska wetlands. Mr. Morgan and I then discussed assessment methods used in Alaska and the Corps' opinion on their functionality.

- longstanding debate regarding functions and values when applying a methodology for wetland assessment, and that a problem arises when clear boundaries between low, medium, and high values are not established.
- based on the use of "best professional judgment" (BPJ), which in his opinion is not likely to be the method desired by DOT.
- assessment values vary depending on agency, society, and public.
- DOT is the appropriate origin for determining what parts of laws/regulations/policies an assessment method should help satisfy. Depends on who the DOT is working with.
- HGM is the preferred methodology of the Corps
- Believes HGM is a good technique, but often takes a lot of time and effort to develop guides
- Alaska's diversity makes for a problem with establishing one assessment method
- Doesn't see a lot of true assessment, mostly BPJ.
- Thinks the assessment method should be applied to all aquatic resources, not just vegetated waters (wetlands). Especially when dealing with the Corps.
- Training should be provided once a specific methodology is established.

Mr. Morgan suggested we contact Glen Justice, Chief of the East Section USACE; and Bill Keller, Chief of South Section USACE. He took down my phone number and said he would pass it on to Mr. Justice and Mr. Keller.

Leggett, Anne

From: Laurie A. Mulcahy [laurie_mulcahy@dot.state.ak.us]

Sent: Monday, May 16, 2005 8:03 AM

To: Leggett, Anne; Carol Sanner

Subject: [Fwd: Ohio Wetland Assessment Method]

Anne and Carol: This is what I received from Ohio DOT. Laurie

-------- Original Message --------
Subject: Ohio Wetland Assessment Method
Date: Wed, 11 May 2005 07:21:44 -0400
From: Bill Cody <Bill.Cody@dot.state.oh.us>
To: laurie_mulcahy@dot.state.ak.us
CC: Tim Hill <Tim.Hill@dot.state.oh.us>

Ms. Mulcahy,

Tim Hill ask me to discuss Ohio's assessment method for wetlands with you. I am not sure how are method relates to the one being used in Arkansas. Basically, ODOT, along with anyone seeking authorization under 404 or 401 in Ohio, must assess the functions and values of an impacted wetland using the Ohio Rapid Assessment Method (ORAM) by Ohio EPA. ORAM designates wetlands into three Categories , with Category One being the lowest quality wetlands and Category Three wetlands being the highest quality. ODOT calibrates every impacted on our projects utilizing the ORAM method of assessment.

Mitigation ratios have been developed based on the ORAM category of the impacted wetlands.That is impacts to higher quality wetlands demand higher mitigation ratios. The best overall description of Ohio's wetland regulations and rules can be found at the website for Ohio EPA's Wetland Ecology Section (http://www.epa.state.oh.us/dsw/wetlands/WetlandEcologySection.html). Links to the Ohio EPA training manual for ORAM and the actual field form for calibrating the wetlands can be found at http://www.epa.state.oh.us/dsw/401/401.html#ORAM.

Should you have any further questions or comments please give me a call at the number below.
Thanks,
Bill

William R. Cody, L.A.
Assistant Environmental Administrator
Office of Environmental Services
Phone (614)466-5198 Fax (614) 728-7368

Leggett, Anne

From: Laurie A. Mulcahy [laurie_mulcahy@dot.state.ak.us]
Sent: Tuesday, April 19, 2005 8:47 PM
To: Leggett, Anne; Carol J Sanner
Cc: Vinson, Edrie; Clint Adler
Subject: [Fwd: RE: Agency Interview Report - Rapid Wetland Assessment]

Hey Carol and Anne: I am at an AASHTO SCOE conference out of state this week, and today the Ohio and Arkansas DOTs gave a brief presentation overview about their 404 streamlining efforts, indicating that they were both using the Charleston, South Carolina Corps District, Rapid Assessment Model. Actually Arkansas is currently using it with their Corp Liaison position, and Ohio has just drafted their agreement to be signed mid-May 2005 and they are largely patterning after Arkansas for their Corps Liaison positions. Boy that sparked my attention because when I was doing my master's thesis and did my research for the Draft Anchorage Debit/Credit Wetlands Mitigation Model and its application and comparative analysis of the "C" Street project (Anne - also thanks to all of your help and assistance) - the two procedures that I narrowed down to were the Charleston Standard Operating Procedure (SOP) and another SOP version adopted and adapted by the Savannah, Georgia Corps District. I don't have any of the details with me on my hard drive and I know that I basically only focused on those models for comparison with the Anchorage Debit/Credit Model so it doesn't go into rapid assessment discussion details. Carol you have a copy of my document - who knows, maybe the Charleston model may be worthwhile to check into.

Anne: I am not able to open your report because I don't have compatible software - so I don't have any comments - sorry. Laurie

Telephone Conversation Record

Project	Synthesis of Practice for Rapid Assessment in Alaska	Project No.	07072-23460; client project no. T2-01-03
Time	9:15 am	Date	April 8, 2005
Call to	Mary Lee Plumb-Mentjes, USACE — Phone No. 753-2712	Call from	Anna B. Jones, HDR — Phone No. 644-2008

Discussion, Agreement and/or Action

Ms. Plumb-Mentjes and I spoke largely about the Anchorage Wetlands Management Plan and the Debit-Credit Method. Her thoughts regarding this method and wetland assessment methods include:

- Likes that the Debit-Credit method allows users to differentiate between areas of various value and importance, instead of applying one label for a broad area
- Allows for site-specific evaluation
- Likes that the Debit-Credit method accounts for the importance of buffers and the effect of nearby development
- Views the Debit-Credit method as a fine tipped tool
- Likes that the Debit-Credit method aids in translating damages associated with development into mitigation, preservation, or dollars
- Likes that the Debit-Credit method is local
- Wishes there were an introduction and definitions included in the WMP to aid users. WMP has been developed based on actual cases, and hasn't allowed time for definitions and instruction on its use
- Likes that the WMP grew out of field work, not theory
- Feels the WMP creates consistency in its application, since users typically don't understand it and often have to refer to a WMP author for clarification
- A similar approach for a statewide program is desirable; however, different landforms would effect the method differently than in Anchorage
- Feels much can be gained from local application and development of local methodology
- Feels principles in the WMP are good ones
- Strength in WMP is that it had local buy-in from those who would be using it; Outside methods often aren't applicable and don't apply to Alaska
- Feels it is important that methodology users feel connected to the method
- Feels the method should be able to include all water resources, not just vegetated waters
- Major problem with including/excluding water bodies in method is inconsistency with statistics depending on who collected data and what they included. Model should be expandable to include all water resources

- Doesn’t like that NWI doesn’t differentiate between areas of local importance (for example, areas that have palatable vs. non-palatable vegetation); feels it is a gross characterization that needs to be more investigative
- Pattern in wetland habitats is important; doesn’t know that any assessment methods take pattern into account
- A fine scale view application of assessment methods is helpful for local application; not sure can be possible for looking at entire state.

Ms. Plumb-Mentjes suggested we contact Thede Tobish, Heather Dean, Mark Schroeder, and Cheryl Moody. Suggested individuals who deal with permits would be a good resource.

Meeting Notes

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Subject:	Discussion with Patti Sullivan regarding Rapid Wetland Assessment Method		
Client:	AK Dept. of Transportation and Public Facilities		
Project:	Rapid Wetland Assessment Method	Project No:	07072/23460
Meeting Date:	April 20, 2005	Meeting Location:	FAA (Federal Building) - Anchorage
Notes by:	Jeff Schively		

Attendees:
Patti Sullivan (FAA), Anne Leggett (HDR), Jeff Schively (HDR)

Topics Discussed:

Action/Notes:
We met with Patti Sullivan to discuss ADOT&PF's Rapid Wetland Assessment Method project and get feedback from her as to what assessment methods she is familiar with, what challenges she has experienced with other AK projects doing wetland assessments, and have her identify any criteria which she thinks should be included in a wetland assessment method.

We initially asked her what regulations (FAA-mandated or other) drive the need to complete a wetland assessment for a project. She stated that there are no clear FAA specific guidelines in place which require a wetland assessment to be completed, but other federal regulations (including Executive Order 1190, 404(b)(1) guidelines, Fish & Wildlife Coordination Act, Floodplain Executive Order, etc.) provide sufficient guidance for FAA to require projects to complete wetland assessments.

Regarding wetland assessments that Patti has seen completed for previous projects, she stated that they typically are over-focused on habitat functions. Although contributing agencies tend to focus on habitat, she was concerned that other important wetland functions such as groundwater recharge/discharge, sediment/toxic retention, flood storage, and water quality functions commonly get overlooked. She mentioned that impacts to other functions (other than habitat) would likely be of public concern when a project is reviewed by the public. A good idea may be that wetland assessments address the other functions in greater detail than they have in the past in an effort to educate the public about the full suite of functions that wetlands perform, which in turn, would allow for greater public comment on impacts to functions other than just habitat. Patti stated that thorough wetland function assessments could likely raise the general awareness of functions and impacts to functions among developers and politicians as well.

Patti mentioned that a good direction for a wetland assessment method would be to have it adapted to address different types of wetland systems (i.e., palustrine, riverine, estuarine, etc.) separately. This would be important because wetland systems function differently and social values between them tend to vary greatly.

We discussed the multi-agency wetland MOA for airports in Alaska and whether it indirectly served as guidance for attempting to identify and address certain wetland functions. Patti stated that the MOA (and its associated checklist) had no direct objective to identify wetland functions; however, it did include several important "red-flags" that lead the user to supply further information about the project. One thing the MOA addressed was guidance for projects to collect habitat information for the surrounding project area to supply to reviewing agencies. This habitat information tends to satisfy USFWS and ADF&G with sufficient resource information for a project. However, she feels that the strength of the habitat information may overlook other functions and make it hard to compare other wetland functions (i.e., an area with high-quality wildlife habitat and low-value hydrology functions compared to an area with low-value wildlife habitat and high-value hydrology functions).

Patti briefly discussed the Juneau functional assessment method and it being adapted for use in estuarine wetlands. She felt the method tends to overrate fisheries functions and overlook other possibly important functions.

We asked her whether she felt fieldwork was necessary to complete a wetland assessment. She stated that it's typically hard to rely on aerial photographs alone and felt that fieldwork is usually necessary. She recommended that any functional assessment fieldwork should coincide with fieldwork for a projects wetland delineation (collect all the field data at once).

Patti stressed that an appropriate method should recognize the connections/interrelationships between wetland and waterbodies to understand the context of project site wetlands within the region. She also mentioned that a method should evaluate the economic benefits of wetlands in the immediate area (I.e., a projects impact to local fisheries, cost of artificial water treatment systems, etc.) if wetlands were to be eliminated by a project. Cost analysis could also relate to recreation, community importance of wetlands, floodplain impacts, water quality impacts, downstream impacts, and identify site-specific issues related to wetlands.

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	April 8, 2005	Subject:	Disscussion of wetland assessment methods
Call to:	Van Sundberg, DOT&PF	Phone No:	(907) 465-4498
Call from:	Jeff Schively, HDR Alaska, Inc.	Phone No:	(907) 644-2016

Discussion, Agreement and/or Action:

I called Van to discuss his experience with wetland function assessment methods used in Alaska. He stated that he was familiar with two methods that are commonly used on projects in southeast Alaska; the Juneau method (developed by Paul Adamus) and the Ralph Thompson method. However, he said that many projects that he works on in SE AK never actually complete wetland function assessments and rarely do agency reviewers request them unless it is a project impacting important habitats (i.e., estuarine habitats, salmon streams, etc.). He also mentioned that when one of the two methods are applied in assessments, that it was usually just the concepts of the methods or pieces of the method that are used, not the actual full method (i.e. completing field data forms).

I asked him whether he saw any benefits or limitations among either of the two methods he is familiar with. Van stated that the methods were used rather infrequently and it was hard to fully understand how well they were or weren't working. One drawback he mentioned was that the methods tend to ask only yes or no questions and don't fully address why or when a certain function exists in a wetland.

Van further discussed the different wetland types in SE AK and stated that estuarine beaches and freshwater marshes were generally valued as being the most important followed by tall fens, sphagnum emergent, and then forested wetlands being the least important types. Within those wetland types, he stated that biological functions (fish and wildlife habitat, eelgrass beds, goose-tongue flats, etc.) were typically the most important functions that projects try to avoid impacting.

Van mentioned that typically the issue of wetland functions only arises when a project proposes to complete some form of compensatory mitigation. There seems to be an understanding among agencies in SE AK, the public, and DOT&PF that compensatory mitigation projects don't involve creating new wetlands for because of the high frequency of wetlands throughout the region. Instead there is focus on completing culvert repair projects, supporting recreational or educational facilities, or paying fee in-lieu compensation to a land trust (SEAL land trust).

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	4/19/05	Subject:	
Call to:	Bill Wood	Phone No:	761-7761
Call from:	Becky Shaftel	Phone No:	644-2118

Discussion, Agreement and/or Action:

Bill is currently working on an Interim Functional Assessment Procedure. This procedure will be used to make Minimal Effects Determinations for landowners that want to modify a wetland on their property. The method is cited in Appendix 526 of the National Food Security Act Manual (NFSAM). They will be evaluating the wetlands based on four parameters: biogeochemistry, hydrology, plant condition and wildlife habitat. Within the four categories will be factors. A reference site will be used that operates similar to the agricultural land to make a comparison. There will be a formula for evaluating the level of impacts to biogeochemistry and hydrology. For example, biogeochemical cannot be reduced more than 20%. Evaluating the effects to plant condition and wildlife habitat may be based on best professional judgment; there is not currently an objective methodology established. The interim method has not been used in Alaska before. Bill hopes to complete the methodology in the next 3-4 weeks in order to make a minimal effects determination on a property in Glenallen.

NRCS will attend a National Environmental Policy workshop this summer in Sacramento during which Bill hopes that questions in adopting the interim method can be answered. Other states that have completed an Interim Method and which also have final HGM methods have continued to use the Interim method.

Citation for minimal effects determination: 180-v-NFSAM, 3rd ed., amendment 2, Nov. 96

*** See follow-up by Anne Leggett, 7/15/05

Appendix C
Other Telephone Conversation Records

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Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	04/20/05	Subject:	
Call to:	Rick Black, Kris Gruwell, Mike Perkins	Phone No:	801-743-7831, Rick Black
Call from:	Becky Shaftel	Phone No:	644-2118

Discussion, Agreement and/or Action:

Methods that have been used in Utah include HGM and WET.
Amy Defreese with COE is leading beta testing of three methods:

Nancy Keats method – a method developed by a state biologist. Rick and Mike both said they thought this method was not streamlined and its usefulness under a diversity of conditions is unclear. She is with UDNR, not sure which division.

Modified MT method – this was developed by Terry Johnson with UDOT along with Utah State. Rick was not sure how the method was modified beyond changing species lists, adding wetland types specific to Utah, etc. HDR staff did not attend this beta test.

CA method – the beta test for this method will be performed on April 26 and HDR staff will attend. Rick will email a copy of this method.

HDR staff were asked by COE to volunteer their time on the testing of these three methods and provide input along with other participating agencies.

Methods that HDR has used include the MT method in Idaho. The Idaho DOT accepted this method. It was required for them to do a functional assessment along with the delineation but the method was not identified specifically.

They also worked on a large project, a few thousand acres, for UDOT (Legacy Highway) where they used a modified HGM. For large projects, Mike thinks HGM can work, but it is too cumbersome on smaller projects. Rick thinks the weakness of HGM is that the final output is a number which can be hard to understand or retrace when there is a gut feeling that it is wrong. With the MT method, when a specific category, e.g. wildlife habitat, comes out high when it is obviously low, it is easy to retrace on the 3-page form where a number was entered wrong and redo the calculation. HGM is too unwieldy to be able to perform simple QA/QC.

Mike feels that UDOT is going towards having the COE approve using the modified MT method for all transportation projects. Amy DeFreese with COE likes the method for linear projects but not for non-linear projects. (They both think it's fine for non-linear projects.) COE does not like HGM because it is too cumbersome.

The need for functional assessment stems from replacing wetlands with wetlands of the same value. Right now, projects might impact 1 acre of low-value wetlands and have to replace them with 4 acres in kind. Functional assessment will enable agencies to replace impacted wetlands with similar wetland types.

USFWS feels that none of these methods properly address wildlife habitat. A private firm, Heidi Hoven of SWCA, is working with Special Area Management Planning to develop a functional assessment model that addresses wildlife concerns better.

Leggett, Anne

From: Emery, Sarah L
Sent: Monday, April 11, 2005 10:44 AM
To: Leggett, Anne
Cc: Emery, Sarah L; Moreira Bruce B.
Subject: FW: wetland assessment methods
Follow Up Flag: Follow up
Due By: Tuesday, April 12, 2005 12:00 AM
Flag Status: Red

Hi Anne-
I added my two-cents to Bruce's email. Let us know if you need more info on Midwest methods.
Take care.
Sarah

Sarah L. Emery, P.G.
HDR
ONE COMPANY | ***Many Solutions***
6190 Golden Hills Drive | Minneapolis, MN | 55416-1518
Phone: 763-591-5475 | Fax: 763-591-5413
Email: sarah.emery@hdrinc.com

From: Moreira Bruce B.
Sent: Monday, April 11, 2005 8:44 AM
To: Emery, Sarah L
Subject: RE: wetland assessment methods

Anne,
Here is a more complete set of answers to your questions:

My immediate questions for you:
1. Are you (or someone in your office potentially not on the wetlands mailing list) involved in wetland assessment, enough to be able to describe the state-of-the-practice in your area?
Bruce completed a one day training in the MnRAM 3.0 system in Spring of 2004 and has used it in field assessments and permits in the metro area.

Sarah had a course in it in 2004 and around 2000. I have used Mn/Ram in only a few occasions. For DM&E we created an assessment tool based on the Wisconsin Rapid Assessment Method. I have further information on that method -- if needed (http://www.dnr.state.wi.us/org/water/fhp/wetlands/documents/RapidWetlandAssessment.pdf). I have also used HGM in the prairie potholes for about a dozen wetlands.

2. If so, may we interview you by phone? Yes (both Sarah and Bruce)

Would sometime yet this week be convenient? Or do you prefer next week?
4/14 and later would be fine. (I will be in the field 4/12-4/13) - Bruce
After 4/11 - Sarah
(A list of draft questions is presented below, in case you'd prefer to just jot down and email your answers.)

3. Can you recommend other professionals who could describe the state-of-the-practice in their areas?
Nathasha Devoe is the staff member with BWSR (the managing state agency) in charge of the database and project.
natasha.devoe@bwsr.state.mn.us.

Draft interview questions for non-Alaskan wetland practitioners:
1.What wetland assessment method or methods do you typically employ? (If we are not familiar with the method, can you give us enough of a citation or a contact so we can find the document?)
MnRam 3.0 is the standardized method for the state.
2.Are you **required** to use any particular method? Different methods for different clients/types of projects/reviewing agencies?
We are not required to use MnRAM for delineations. If the wetland will be impacted and we are creating mitigation (off-site or on-site), we may be required to use MnRAM for the sequencing assessment. Using MnRAM to show that the replacement mitigation is of equal or higher quality than the impacted wetland.
3.Who **uses** your wetland assessment product?
State Agencies, local governments, private consultants. As far as I know, MnRAM has not been used by academics in the area.
4.Do you know how they use it? For what purpose? (Compare wetlands to each other? Compare "value" of wetlands to "value" of uplands? Help compare project alternatives? Just be able to check a box that says wetland assessment was done? Help with Corps of Engineers public interest review? Define compensatory mitigation needs?)
State agencies and local governments use MnRAM to create wetland management plans and assess overall wetland quality. MnRAM is often used to compare wetlands to each other through the sequencing process used for wetland mitigation/replacement. This can also be applied to a comparison of project alternatives. MnRam has no way to assess upland areas, so it cannot be used to compare wetlands to uplands.
5. Do you think the methods you use meet the project proponents' and reviewing agencies' needs?
MnRAM has been upgraded three times (hence 3.0) to adapt to agency needs. Most of the agencies and private consultants I have talked to think the system has significant flaws but is a basically workable assessment. The "significant flaws", I think, are inherent to any qualitative assessment method that can be done quickly and probably not specific to MnRAM.
6. Can you estimate the amount of time you spend assessing each wetland? (apart from delineation, permitting, etc.)
A MnRAM takes 2-4 hours per wetland. It is a qualitative and relatively simple method of wetland assessment. Once the user is familar with the process, it probably takes closer to 2 hours.
7. Are there other methods you think are used in your area (but you don't use them)?
Not that I know of. MnRAM is the only method accepted by Minnesota regulators for permitting. Wisconsin regulators use the Wisconsin Method and South Dakota uses HGM for prairie potholes.
8. Can you recommend other professionals who could describe the state-of-the-practice in their geographic areas? Contact info?
MnRam 3.0 Developed by Barr Engineering (Mark Johnson) and BWSR (Minnesota Board of Soil and Water Resources).
After we review the method you use, may we call you again?
Sure.

Bruce Moreira
Environmental Scientist

From: Johnson, David C.
Sent: Thursday, April 07, 2005 9:06 AM
To: Emery, Sarah L; Moreira Bruce B.
Subject: FW: wetland assessment methods

I know that you are really busy but if one of you could take a few minutes to call Anne it would be great. Helping another office has almost always led to more opportunity. Thank you.

Dave

From: Leggett, Anne [mailto:Anne.Leggett@hdrinc.com]
Sent: Wednesday, April 06, 2005 11:11 PM
To: ESPUG - Wetlands
Subject: wetland assessment methods

Hello, fellow HDR wetland people!

We (at HDR Alaska) are helping the Alaska Department of Transportation and Public Facilities define a method to be used statewide(!) to assess wetlands within the vicinity of their routine construction projects (roads and airports). We are to develop and present a synthesis of rapid wetland assessment practices potentially applicable to Alaska projects; then recommend an approach for DOT&PF. Our aim is not to “re-invent the wheel”, but to build on the work and experience of others. We may end up recommending that DOT&PF customize an existing method for use in Alaska, or perhaps picking and choosing pieces of different methods and customizing them, or…..?

We are looking for folks to interview about the state-of-the-practice—HDR wetland professionals, your counterparts at state transportation departments, other agency folks, potentially academics.

My immediate questions for you:
1. Are you (or someone in your office potentially not on the wetlands mailing list) involved in wetland assessment, enough to be able to describe the state-of-the-practice in your area?
2. If so, may we interview you by phone? Would sometime yet this week be convenient? Or do you prefer next week? (A list of draft questions is presented below, in case you'd prefer to just jot down and email your answers.)
3. Can you recommend other professionals who could describe the state-of-the-practice in their areas? Contact info?

Draft interview questions for non-Alaskan wetland practitioners:
1. What wetland assessment method or methods do you typically employ? (If we are not familiar with the method, can you give us enough of a citation or a contact so we can find the document?)
2. Are you **required** to use any particular method? Different methods for different clients/types of projects/reviewing agencies?
3. Who **uses** your wetland assessment product?
4. Do you know how they use it? For what purpose? (Compare wetlands to each other? Compare “value” of wetlands to “value” of uplands? Help compare project alternatives? Just be able to check a box that says wetland assessment was done? Help with Corps of Engineers public interest review? Define compensatory mitigation needs?)
5. Do you think the methods you use meet the project proponents' and reviewing agencies' needs?
6. Can you estimate the amount of time you spend assessing each wetland? (apart from delineation, permitting, etc.)
7. Are there other methods you think are used in your area (but you don't use them)?
8. Can you recommend other professionals who could describe the state-of-the-practice in their geographic areas? Contact info?

After we review the method you use, may we call you again?

THANK YOU!!

Anne Leggett, Senior Biologist
HDR | ONE COMPANY - *Many Solutions*
2525 C Street, Suite 305
Anchorage, Alaska 99503
907.644.2038 Direct phone
907.644.2022 Fax
Anne.Leggett@hdrinc.com

Telephone Record

Project:	DOT&PF Rapid Wetland Assessment	Project No:	07072/23460 code: 234
Date:	4/8/2005	Subject:	
Call to:	Dave Erikson	Phone No:	261-9750
Call from:	Becky Shaftel	Phone No:	644-2118

Discussion, Agreement and/or Action:

Dave provided a summary of the wetland functional assessment methods that he has used in Alaska:
Dave has used the Adamus 1983 method, or a modified version of it, for most projects that required some form of a wetland functional assessment.
Adamus was modified by selecting which criteria to use.
It was specifically adapted to the Juneau access project and developed by an agency team.
His personal opinion of Adamus is that it does not fit very well; if a scientist is familiar with an area, it could be modified to be fit better.
It was used to compare alternatives on a particular project and determine their impact on wetland functions.
For TAPS, before Adamus, he created a list of functions and values.
He has not used HGM.

I asked Dave's opinion on various types of methods used for functional assessment:
He thinks that numerical ratings are ok if they are used to rank wetlands within a project.
When used to assign a functional score and then compared, he thinks it becomes less useful.
Social values are an important aspect that is difficult to address. On the Juneau access project, they were ignored. Social values are very difficult to apply to wilderness areas, whereas in urban settings like Anchorage, they are more easily understood.
He thinks that a user needs a broad base of experience in order to be able to use a functional assessment method. Training cannot be used in place of a background in the specific criteria that are being evaluated such as wildlife and fish habitat, hydrology, etc.

Dave thinks that ultimately, it depends on what kind of information the agencies are interested in. For the Shepard Point EIS, the COE wanted a lot of detail on functions.
Dave has a memory that the state has looked into a rapid assessment method before and will check into it.

He suggested contacting Kristin Marsh with URS also.

HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503-2632
Phone (907) 644-2000
Fax (907) 644-2022
www.hdrinc.com

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Telephone Record

Project: DOT&PF Rapid Wetland Assessment	Project No: 07072/23460 code: 234
Date: April 7, 2005	Subject: Discussion of wetland assessment methods
Call to: Mike Gracz, Kenai Watershed Forum	Phone No: (907) 235-2218
Call from: Jeff Schively, HDR Alaska, Inc.	Phone No: (907) 644-2016

Discussion, Agreement and/or Action:

I called Mike to discuss his past and current work with assessing wetland functions in Alaska and see if he had any insight or experience with any existing assessment methods. He stated that a lot of the methods he is familiar with are generally not sufficient in developing a clear understanding of undeveloped wetlands and tend to be more applicable in the lower-48 where users can apply the method to degraded or disturbed wetlands. Mike is currently working on two large projects on the Kenai Peninsula where he will map wetlands and attribute functional characteristics to them. In doing this work, he has researched many of the different methods available for assessing wetland functions and hasn't found a clear, straightforward existing method in which he intends to use.

City of Homer Project

Mike discussed his project he is doing for the City of Homer, including his approach to the mapping which will result in identifying wetland functions for 414 individual wetland polygons within the city limits. The goal of the project is to steer the City away from using their past wetland ranking system of "high" and "low" value wetlands and instead develop a database of descriptions of each individual wetland polygon. He stated that the previous mapping and management plan for Homer generally based a wetlands value solely on its type and not on features such as its location in the watershed, functions it may perform, or its interspersion with other wetlands (which he emphasized were much more important than wetland type alone).

Mike mentioned that in the near future he was going to facilitate a workshop in Homer where many wetland experts would attend and review the mapped wetland polygons. His goal with the workshop was to have the attendees choose priority polygons among the 414 mapped wetlands and list the functions or significant characteristics of each of those wetlands. He would then collate all of the suggestions from the experts as to what functions the wetland may be performing or what value they may have and attach that compiled list to the description of each wetland. To encourage creative and useful responses from the meetings attendees, he is handing out a list of questions to each person before the meeting to review. The questions were modified from a set of questions developed by Lois Wolfson of Michigan State University in a 2002 publication. Mike e-mailed me the list of questions (which are attached to this telephone record) and gave me the necessary information to track down the Wolfson 2002 publication (also attached to this record). The questions were based on concepts/practice associated with the WET assessment method.

His overall goals with the project include: (1) Avoid ranking wetlands and instead develop an information database which instead would be focused on preserving wetland functions; (2) Protect key wetlands by taking approaches from the field of Conservation Biology and preserving certain key wetlands forever; and (3) Develop a team-derived judgment on how certain wetlands are functioning (reduces subjectivity involved with a single person describing functions).

Kenai Peninsula Borough Project

Mike also briefly discussed his work he is currently doing with the Kenai Borough. He stated that this project, in regards to the wetland function attributing phase, is still in its early stage. His goal is to develop a GIS database of western Kenai Peninsula wetlands accessible to anyone with an internet connection, which has a set of attributes describing the vegetation community, soils, and wetland functions that a wetland may be performing. He has recently published much of the wetland mapping and its attributable information (minus wetland function information) on the boroughs internet mapping server. This webpage allows a viewer to select an individual wetland polygon and gain detailed information (photos, detailed descriptions) about it by linking to an online database. He is unsure as to how he will identify wetland functions for the project at this time, or how they will be attributed to the GIS database in the future but he is hoping that the Homer project (and its workshop approach of a team of wetland experts identifying wetland functions) will serve as a worthwhile pilot project which will help him develop a usable method for the boroughs wetland mapping.

Miscellaneous
Mike mentioned that he has been formally trained in using HGM in Alaska. His overall impression of the method is that it isn't a good method for the State of Alaska. He believes that it is more applicable to the lower-48 where it can measure disturbed/degraded wetlands. He remembered when he applied the method on the Kenai that he had some doubts about is usability because the sites he assessed (which were entirely different sites, and obviously functioning very differently) came out to have nearly the same functional capacity index.

Attachments

1. List of wetland function-related questions he is using for the workshop in Homer.
2. Wolfson et al. 2002 publication where the questions were based from.

Wetland Functional Assessment Guiding Questions:

1. What is the percent of the watershed that is wetland?
2. What percent of the watershed upslope of the wetland is wetland?
3. What is the average slope of the sediment contribution area?
4. What is the K factor of immediately adjacent soils?
5. What is the infiltration rate of immediately adjacent soils?
6. What is the ratio of Organic : Mineral soils in the wetland and surrounding area?
7. What is the primary vegetation class?
8. How many vegetation classes are present?
9. What is the vertical and what is the horizontal heterogeneity of the habitat?
10. What is the ratio of percent open water : percent vegetated area of the wetland?
11. What is the evapotranspiration likely to be:
    a. How much open peatland?
    b. How much surrounding wind protection
    c. How much higher vascular plant cover (vs. sphagnum moss)
12. How much groundwater recharge is taking place?
13. How much groundwater discharge is taking place?
14. What is the flow, into, through and out of the wetland?
15. How much surface water storage potential (and when) is available?
16. How much groundwater storage potential (and when) is available?
17. Descriptions of the Inlet or Outlet (stream, groundwater)
18. Human disturbance:
    a. Drianage contol present?
    b. Fill present?
    c. Impoundments?
    d. Dredged?
19. What is 10cm soil temperature curve like?
20. What is the distance to the Bay?
21. Connection to anadromous streams?
22. Recreation:
    a. Travel corridor?
    b. Berries?
    c. Moose hunting?
    d. Bird watching?
23. Local topography?
24. Where in the watershed is the wetland?
25. How common is this type of wetland?
26. How close are other wetlands?
27. What is the surrounding surfacial geology?
28. What is the surrounding habitat like? Heterogeneity?
29. Organic matter exported from the wetland?
30. What is the water table depth?
31. How does water table vary throughout the season?
32. Is the wetland connected to:
    a. Stream?
    b. Lake?
    c. Upland?
33. Bird habitat?
34. Fish habitat?
35. Ownership?

36. Peat depth?
37. Current uses:
    a. Scientific
    b. Educational?
    c. Water supply?

Lakes & Reservoirs: Research and Management 2002 **7**: 207–216

Development and use of a wetlands information system for assessing wetland functions

Lois Wolfson,[1]* Del Mokma,[2] Ger Schultink[3] and Eckhart Dersch[3]
Departments of [1]Fisheries and Wildlife and Institute of Water Research, [2]Crop and Soil Sciences and [3]Resource Development, Michigan State University, East Lansing, Michigan, USA

Abstract

A wetlands information management system was developed to assess various wetland functions and values in two townships in Michigan, USA. The goals of the study were to determine the effectiveness of a wetland-assessment method integrated with a geographical information system (GIS) to assess appropriate environmental criteria, potential effects of wetland size and type on function, and to develop a user–friendly interface that local officials might use in decision-making related to wetland preservation and land-use planning. In order to assess seven wetland functions and two values, quantitative measures were incorporated using GIS techniques to derive some of the needed information from existing spatial databases. However, on-site investigation was required for all assessments. Of 65 wetlands evaluated through the system, no significant difference ($P > 0.05$) was found between wetland size and its ability to perform a given function. No single wetland type (e.g. forested, shrub/scrub, emergent, open water) had a higher probability of performing all wetland functions or values significantly more than another type. However, the combined application of on-site evaluation and GIS technology might offer a more efficient method to assess wetland functions and values, with the latter providing an educational tool for local wetland planning and management.

Key words

geographic information system, information systems, land-use planning, Michigan, resource management, wetland assessment, wetland functions, wetland preservation.

INTRODUCTION

Wetlands, including marshes, swamps, fens and bogs, are among the most biologically productive natural ecosystems in the world. They are typically identified by the presence of water at or near the land surface at a frequency and duration sufficient to support a predominance of aquatic life by the presence of saturated soil conditions (hydric soils) and by the presence of plants typically adapted for living in saturated soil conditions (hydrophytes). Although the exact definition of wetlands has undergone considerable debate, government agencies and the scientific community generally accept these characteristics as the primary indicators of wetland conditions. Wetlands perform important functions by providing food and habitat to numerous threatened and endangered species, improving water quality by intercepting surface run-off, removing or trapping sediment and nutrients, stabilizing sediments, and offering protection by storing flood waters and replenishing groundwater. Values provided by wetlands are those deemed beneficial by society, such as recreation, aesthetics, uniqueness and biodiversity.

Despite this critical role in providing environmental, social and economic benefits, wetlands are continually threatened. During the past two centuries, conversion and drainage of wetlands have resulted in dramatic losses of wetland acreage in the US. Since the 1980s, only an estimated 104 million acres of wetlands remain in 48 conterminous states, a 53% reduction from the original 215 million wetland acres (Dahl 1990). Within Michigan, it is estimated that only 5.6 million acres of the original 11 million acres remain, encompassing 15% of the state's surface area (Dahl 1990). Further, wetland losses have not been uniformly distributed throughout the state. Great Lakes coastal marshes have been reduced by over 70% while forested wetlands have sustained losses of approximately 25–35%.

To address this threat and help preserve remaining wetlands, several assessment methods were developed and

*Corresponding author. Email: wolfson@msue.msu.edu
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employed to compare the relative importance of various wetland functions and values (Adamus *et al.* 1987, 1991; Ammann & Stone 1991), although newer assessment methods have since been developed for regulatory purposes (Brinson 1993). These assessments can help to target land areas best qualified for protection or land acquisition, in designing and determining mitigation activities to ensure that wetland functions and not just acreage are replaced, and in identifying important functions or values that should not be disrupted.

In order to provide a tool in this assessment process and to determine if the size or type of a wetland affects functions or values, a wetlands information management system (WIMS II) was developed that combined the on-site wetland evaluation required for these assessments with geographic information system (GIS)-based spatial analysis. Although GIS has been increasingly used in environmental planning and management, its application in wetland assessment has been minimal and has generally concentrated on only a single wetland function or value (Ji *et al.* 1992; Garcia *et al.* 1993).

The interface and multifunctions of WIMS II were redesigned and enhanced from an earlier prototype (WIMS) that was developed on a UNIX platform (Kang *et al.* 1994; Wolfson *et al.* 1995). The new Windows-based system was developed to characterize a wetland and evaluate its functional capabilities. The principal research goals were to determine the effectiveness of using an established wetland-assessment method coupled with a GIS-based system to assess relevant environmental criteria and potential effects of wetland size and type, and to develop a user–friendly interface for wetland conservation and planning by local governments.

EXPERIMENTAL SITE AND METHODS

Two adjacent townships in Ingham County, Michigan, were selected for the study. Meridian and Williamstown townships are located in the lower central portion of the state in the north-west corner of Ingham county. While the geomorphology and wetlands of the two townships are very similar, their land use and development characteristics are not. Meridian Township, with a population of 39 116 in 2000, is largely a residential and commercial community with virtually no land remaining in active agriculture. Williamstown Township, with a population of 4834 in 2000, is predominantly an agricultural community experiencing the beginning of expanded residential subdivision, commercial and industrial development.

For both townships, the base wetland map used for the assessment method was a digital copy of the US Fish and Wildlife Services' National Wetlands Inventory (NWI) map, which was originally mapped in 1982 using aerial photography and classified using the Cowardin system (Cowardin *et al.* 1979). Wetlands were reclassified from the original NWI map into five categories including forested, emergent, scrub-shrub, aquatic bed and open water. The reclassification was done to correspond with the classifications used by the Michigan Resource Information System (MIRIS) in their land use/land cover database, which was also used in the WIMS II program.

Seven wetland functions and two wetland values were selected for assessment. The wetland functions, defined as attributes vital to the integrity of the wetlands (Adamus *et al.* 1991), consisted of flood-control potential, groundwater recharge, sediment/toxicant retention, sediment stabilization (shoreline anchoring/consolidation), nutrient removal/transformation, fish habitat/aquatic diversity, and wildlife diversity/abundance. Wetland values, which are not necessarily important to the wetland system itself but are perceived as being valuable or enjoyed by the public, consisted of noteworthiness (rare or unique) and recreation. Several wetland functions were assessed for both opportunity and effectiveness. Opportunity is the chance a wetland has to perform a specific function, whereas effectiveness is the capability of a wetland to perform the function because of its physical, chemical or biological characteristics (Adamus *et al.* 1991).

The methodology selected was based predominantly on features of the Wet II method and to a lesser extent on the New Hampshire method (Adamus *et al.* 1987, 1991;

Table 1. Databases and map layers utilized in Wetlands Information Management System II

National wetlands inventory	MIRIS Land use/cover	Pre-settlement land cover
MIRIS wetlands	Wetlands (≤ 5 acres)	Soils
Hydric soils	Watershed boundary	Rivers/streams
Lakes	Drains	Highways
County roads	Railroads	Basins
Digital elevation	Aerial photos	Topographic USGS quad map
Contours	Flow direction	Census roads and blocks

MIRIS, Michigan Resource Information System.

Ammann & Stone 1991), and previously incorporated into the earlier WIMS prototype. A wetland function/value index (WFI/WVI), adapted from the New Hampshire method (Ammann & Stone 1991), was used to compare the functions and values of each wetland assessed. This analysis could be performed for an individual function or value or for all functions and values simultaneously. However, each function or value received its own numerical and descriptive rating. Ratings were not combined to obtain any overall index value. For each function or value, a set of criteria was developed and multiple questions were developed to address the criteria. Those criteria that had a higher 'potential importance to function ratings' (Adamus *et al.* 1991; Marble 1992) were considered more important in determining whether or not the wetland performed that function/value and were designated as high, moderate or low in importance. A weighting factor was associated with each of these importance levels. The weighted scores for each question were then averaged to give an overall score for the individual function or value being assessed. The score was also converted to a rating of high (0.7–1.0), moderate (0.4–0.69) or low (0–0.39), representing the probability of the wetland to perform the given function/value.

The WIMS II program (Michigan State University 1999), completely redesigned from the original WIMS, was developed for the two townships using MS Visual Basic 5.0 and Environmental Systems Research Institute (ESRI) MapObjects Professional 2.0 (a product of ESRI). Microsoft Access was used for the database. The program was designed to maximize use of GIS-based data, supplemented with information collected during site visits. Capabilities within the customized system included map overlay, query functions, analysis, graphics, data display, reporting and images. Data layers added to the WIMS II are listed in Table 1. All base digital data obtained at a 1:24 000 scale, excluding the NWI inventory, contour and pre-European settlement cover layers, were derived from MIRIS. All were converted from their native microstation (DGN) format to ArcInfo (ESRI GIS software) coverages. Soil and land-use/cover data were built as polygons and their codes were assigned text descriptions. Once entered into the WIMS II, additional tabular data for soils was joined to each soil polygon. All GIS layers were converted to ArcView shapefiles and clipped to the two township boundaries where necessary.

Pre-European settlement cover data that included wetlands and major land-cover types were provided by the Michigan Natural Features Inventory. Actual acreage was not provided. After conversion to Arc/Info coverages, cover-type codes for each polygon were given text descriptions and cover data were cropped in ArcView to the two township boundaries. Three meter contour data were digitized from 7.5 min quadrangles and put in ArcView shapefile format. A digital elevation model was generated using the TOPOGRID command of ArcInfo. Once generated, a flow direction surface was developed which was then used to calculate hydrological basins.

The wetlands data for the WIMS II were derived from three primary sources: (i) the digital NWI maps, which was also provided by MIRIS; (ii) pre-European settlement cover data; and (iii) digital soils data. Text descriptions were assigned to NWI codes after entry into the system software as shapefiles. Aerial photographs from 1938, 1981 and 1992 were obtained by the Center for Remote Sensing and Geographic Information Science image archive at Michigan State University, rectified using the 1:24 000 base data previously generated and saved in georectified

Table 2. Number of wetland types and sizes within each township

	Meridian Township	Williamstown Township
Wetland types		
Forested	220	164
Emergent	388	238
Scrub/shrub	96	74
Open water	180	157
Aquatic bed	5	5
Unclassified	37	8
Wetland size		
Greater than 20 ha	7	6
Between 2 and 20 ha	188	110
≤ 2 ha	731	530
Total number of wetlands	926	646

Table 3. Questions posed in Wetlands Information Management System II

1. *The area of the evaluation area (EA) is:
2. *The area of the EA's watershed is:
3. *Area of other wetlands upslope of EA as a percentage of watershed area:
4. *According to the Cowardin *et al.* (1979) classification scheme, which wetland system is this EA classified as:
5. *Which condition best describes the shape of the wetland/upland edge?
6. *Is the EA on or associated with islands?
7. *Which best describes the drop in elevation between a point two miles downslope and a point two miles upslope from the EA?
8. *What is the average slope of the EA's watershed (sediment contribution area)?
9. *What is the major land cover type in the watershed?
10. *What is the average soil erodibility ('K-factor') for lands immediately surrounding the EA?
11. *Which of the following best characterizes the infiltration rate of soils in the EA's watershed (up to one mile from EA)?
12. *Which of the following best characterizes the infiltration rate of soils in the EA?
13. *What combination best characterizes the EA soils infiltration rate and underlying strata?
14. *Which condition best describes the spatially dominant substrate of the EA?
15. *Are the soils of the EA predominately alluvial, alfisol, ferric, clay, or other fine material, or do they have elevated concentrations of aluminium or iron?
16. *What is the dominant vegetation class of the EA?
17. What is the average width of emergent, shrub-scrub, or forest vegetation in the EA?
18. How many vegetation classes are represented in the EA?
19. Which condition best describes the degree of vegetation and water interspersion in the EA?
20. The proportion of vegetation to water in the EA is:
21. How much shade is provided to the EA at midday?
22. Does vegetation or topographic relief sufficiently shelter the EA and associated open water body from the effects of the wind?
23. What percent of the dominant vegetation in the EA is aquatic bed?
24. What is the average width of stands of emergent, shrub, or forest vegetation in the EA? (for sediment stabilization)
25. Which of the following best characterizes the spatially dominant hydroperiod of the EA?
26. Which of the following best describes the EA's outlet?
27. How does water primarily move in the EA?
28. The primary source of water for the EA is:
29. Are artificial drainage features (ditches, canals, levees) present that increase the rate at which water leaves the EA?
30. Are there any dams, dikes, or other impoundments immediately upslope of the EA (within 2 miles) that influence the amount of water and sediment received by the EA?
31. Are there any dams, dikes, or impoundments immediately downslope of the EA that influence (even seasonally) the water level of the EA?
32. What is the water depth covering the greatest portion of the EA?
33. How would you best characterize the extent and duration of seasonal flooding in the EA?
34. Which of the following best describes the EA's inlet/outlet?
35. The pH of the EA is:
36. The salinity of the wetland is:
37. The concentration of suspended solids in the EA is:
38. The concentration of dissolved oxygen in the EA is:
39. The bottom water temperatures are:
40. *The distance of the EA to one of the Great Lakes or a major river is:
41. *Is the EA hydrologically connected to a state or federally designated river (i.e. a natural or wild and scenic river)?
42. Which of the following best describes the flow conditions of water in the EA?
43. How would you best characterize the potential sources of sediments/contaminants in the EA's watershed?
44. How would you best characterize the potential sources of nutrients in the EA's watershed?
45. Which human disturbance condition best describes the EA?

Table 3. (continued)

46. Is the EA or adjacent water body fished?
47. Is hunting permitted in the EA?
48. Are opportunities for non-consumptive non-water-based uses such as photography, hiking, wildlife observation, or bird-watching available in the EA?
49. Is there public access to the EA and/or off-road public parking available?
50. Is access to the open water available for boating/canoeing?
51. Are boat wakes a significant source of waves in the open waters of the EA and associated water-bodies?
52. Which special habitat feature best describes the EA?
53. Does the EA have local significance (research site, historical landmark, archaeological site, rare biological or geological features)?
54. Is the EA one of the last of its type remaining in the watershed?
55. Does the EA contain critical habitat for a state or federally listed threatened or endangered species (animal or plant) of special concern?

Questions adapted from Adamus *et al.* (1987, 1991). *Data provided in the programme and existing data were used in selecting answers. Unmarked questions required an on-site visit.

TIFF format. Township level mosaics were assembled for the aerial photographs by using ArcInfo GRID software, which allowed the overlay of other GIS layers onto the image in the WIMS II system. A mosaic of scanned and rectified colour images of the 7.5 min quadrangles comprising the two townships was also rectified and saved in georectified TIFF format.

For the function and value assessments, where possible, GIS spatial analytical capabilities were used to derive information with which the user could then select the most appropriate answers. To assist users in viewing their wetland of interest prior to onsite visitation, ground-level photographs of the wetland sites were stored in the system and could easily be retrieved.

RESULTS

The customized system provided users with the ability to overlay layers of data and georectified aerial photos. It also provided a window for displaying any layers selected, such as base data, on a topographic quadrangle map. Separate layers for NWI wetlands, hydric soils, presettlement land cover and aerial photographs provided a visual comparison between historic, recent past and present-day wetlands. Actual acreage was only available from the NWI data set. The query function was used to determine the size and types of wetlands within each township. Meridian Township consisted of 926 wetlands totaling 1841 has (4549 acres) while Williamstown Township had 646 wetlands totaling 983 ha (2429 acres). Overall emergent wetlands were the dominant wetland type followed by forested. The majority of the wetlands in both townships were ≤ 2 ha (5 acres) in size (Table 2).

The evaluation of wetland functions and values could be performed on a function-by-function basis or evaluated for all functions simultaneously. In total, 55 different questions were necessary to assess all functions and values for an individual wetland (Table 3). Many of the questions that dealt with wetland size, wetlands upslope, soil erodibility and infiltration, and major land-cover types were repeated for several functions. Once the answer was selected for one function, it was automatically entered for all the other functions. When a wetland was hydrologically connected to another nearby wetland, the user could combine the two into one evaluation area (EA). A unique identification number was assigned to each EA evaluated and added to the list of wetlands already evaluated. As questions were answered, they were stored in a report file that was automatically saved and linked to the identification number assigned to the wetland being assessed.

Of the 55 questions, 18 could be answered using the GIS interface, associated data and aerial photographs (Table 3), and did not require an on-site visit. These questions addressed information on wetland size, type, watershed area, soils, infiltration rate of soils, soil erodibility, slope, proximity to other wetlands and land cover/use. Some answers were immediately generated through calculations performed within the WIMS II system, such as wetland coverage or type of wetland. The associated drainage basin for the wetland could be highlighted with its size provided; however, as the basin was generated based on 3-m contour data, it did not always reflect the local drainage area for the wetland in question. In most instances, the number generated was much greater than the actual size of the wetland's drainage basin. When this occurred, an option was available to change the number to more accurately reflect the wetland's true drainage-basin size, based on either map visualization or on-site visits.

Attributes related to soils could be viewed in the relational Soil Survey Geographic Database (SSURGO, Natural

Resources Conservation Service) used in WIMS II. As soil-map units did not always correspond directly to the wetland EA, it was necessary to determine the best answer based on the area of each map unit and composite soils. A summary sheet containing the soils attributes required by the assessment method was embedded in the system, including data on the soil's K-factor and permeability (Fig. 1).

All other questions, such as water depth, outlet characteristics, hydrology, vegetation classes, water-quality data such as pH, salinity and alkalinity, canopy and vegetation to water interspersions and proportions, required field visits to the wetlands. For the field investigations, some variables were difficult to measure or assess while others were highly subjective (Table 3).

Sixty-five wetlands in the two townships were selected for the evaluation. All but four were visited over a single summer period. The remaining four were evaluated the previous summer. Only those that were not hydrologically connected to a river or stream were considered for evaluation, and a random selection was made from those remaining. Once all the selected answers were entered into the program, analyses were performed on each wetland sampled and comparisons were made for functions, values, wetland type and size.

Of the wetlands assessed through the WIMS II, no significant difference ($P > 0.05$) was found between the size of the wetland and its ability to perform a given function using a one-way analysis of variance. For wetlands up to 10 ha in size, the highest wetland function index (WFI) values for hydrology and water quality functions were for effectiveness in sediment stabilization, nutrient removal and transformation, and sediment/toxicant retention, respectively (Fig. 2a). For wetlands greater than 10 ha in size, the WFI for flood control effectiveness was higher than the WFI for effectiveness in nutrient removal and transformation and sediment/toxicant retention. The two major factors that determine a wetland's ability to control flooding are the amount of storage potential in the wetland and how slowly the wetland releases the stored waters (Ammann & Stone 1991). The larger wetland size was likely a contributing factor for the WFI being greater than in the smaller wetlands. However, only three of the evaluated wetlands were greater than 10 ha so the sample size might not have been representative of this size wetland in the township.

The lowest WFI function was for the opportunity for stabilizing sediments. For a wetland to function in stabilizing shoreline sediment, potentially erosive conditions must be present. In the evaluation, the criteria used to assess this included fetch/exposure to wind, flow characteristics and boat wakes. In the majority of the wetlands assessed, flow was rated low and boat wakes did not exist. Thus, although the majority of wetlands were found to be effective in sediment stabilization, most did not have the opportunity to do so (Fig. 2b). With respect to biological functions, no significant difference was found between any single function and wetland size, although wildlife diversity and abundance had higher WFIs for all wetland sizes compared with fish habitat and aquatic diversity. For wetland values, on average, the wetlands assessed had a low probability of providing either recreation or being noteworthy (Fig. 2c).

Additionally, no single wetland type (e.g. forested, shrub/scrub, emergent, open water) performed all assessed wetland functions significantly better than another type (Fig. 3a–c). No significant difference ($P > 0.05$) was found among emergent, forested or scrub/

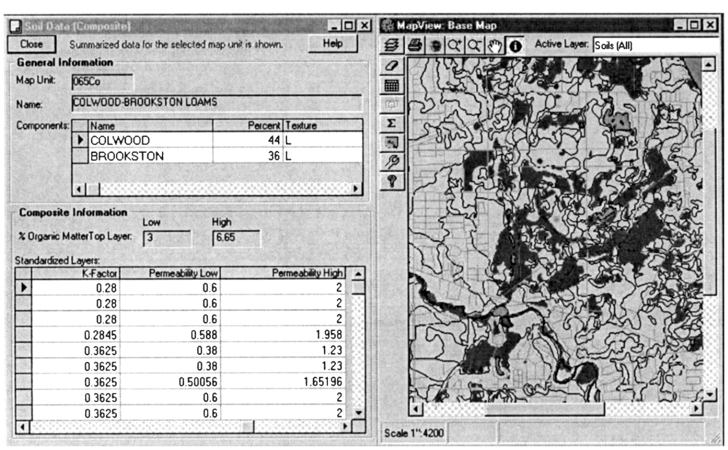

Fig. 1. Interface of soils map and summary data for a specific soil type.

shrub wetlands within any single function. Open water was significantly lower ($P < 0.01$) than the other wetland types for the two functions of sediment-stabilization effectiveness and flood-control effectiveness (Fig. 3a,b). For a wetland to be effective in controlling flooding, it must have unrestricted space for absorbing floodwaters and/or have physical obstructions such as dense stands of vegetation that can slow the velocity of floodwaters (Adamus *et al.* 1987). The small size of these wetlands might have limited their effectiveness. Conversely, open water was significantly higher ($P < 0.05$) for the wetland value of recreation compared with the other wetland types (Fig. 3c). However, the overall probability index for recreation was still in the low range. All but one of the open-water wetlands assessed

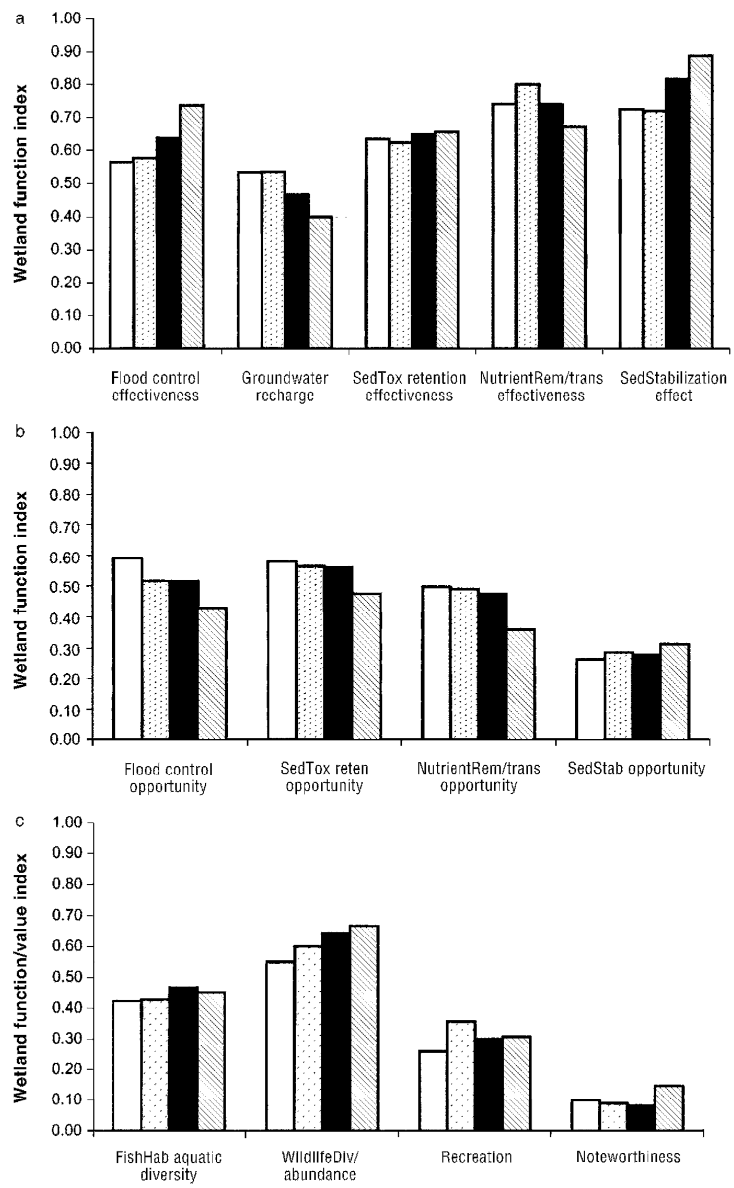

Fig. 2. Wetland function and value index as a function of wetland size. (a) Hydrological and water-quality effectiveness functions, (b) hydrological and water-quality opportunity functions, (c) biological functions and wetland values. (□) 0–2ha, (▨) 2.1–4.0 ha, (■) 4.1–10 ha, (▧) >10 ha.

were less than 2 ha in size. Recreational activities including hunting, fishing and non-consumptive uses, were also likely limiting due to size and location of the wetlands within the watershed.

DISCUSSION AND CONCLUSIONS

The development and use of the GIS-based interface for assessing wetland functions and values greatly augmented the on-site investigations by answering questions or pro-

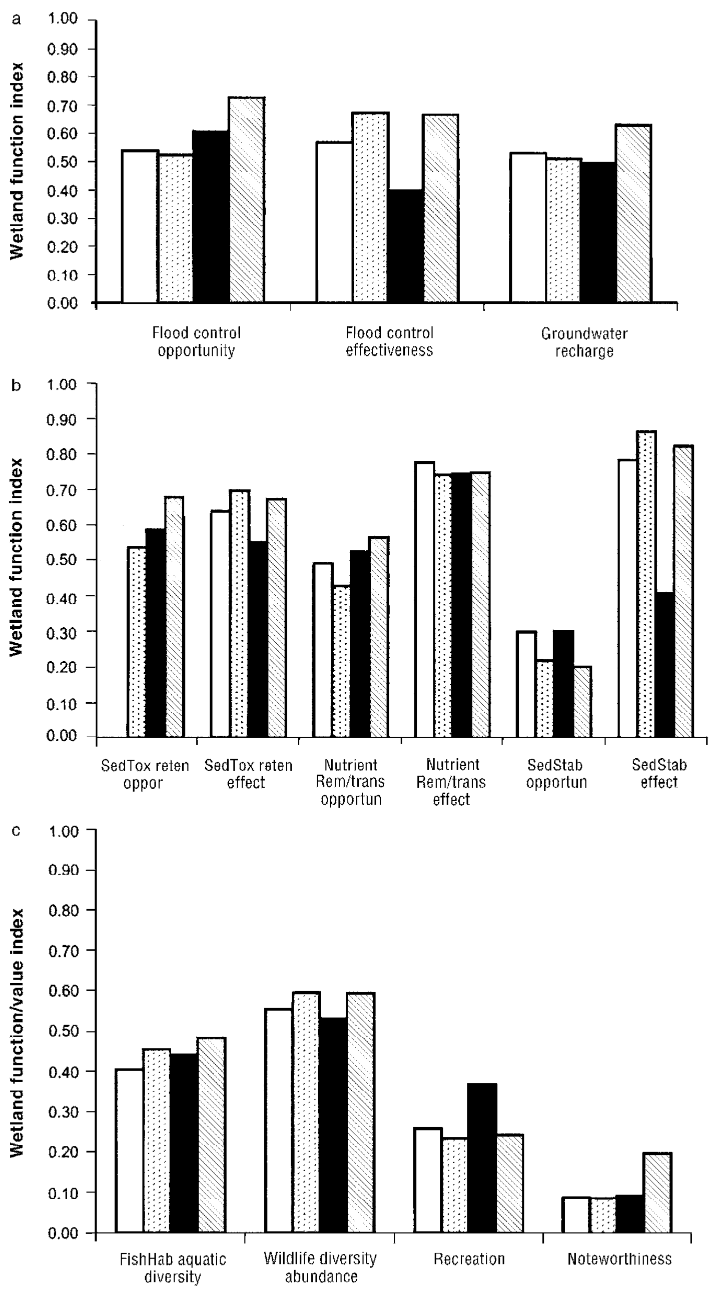

Fig. 3. Wetland function and value index as a function of wetland types. (a) Hydrological functions, (b) water-quality functions, (c) biological functions and wetland values. (□) emergent, (▨) forested, (■) open water, (▧) scrub/shrub.

viding data that resided in a single system. However, no single function or value could be solely assessed through GIS. Field visits were always necessary to complete the evaluation of a wetland. Although all evaluations were completed during summer season, several functions addressed the wetland's hydroperiod and extent and duration of seasonal flooding, which required knowledge of annual conditions. Where uncertainty existed, field evidence such as high water marks on trees was used to infer answers; however, this method introduced subjectivity into the system's output. Questions relating to the function of fish habitat and aquatic diversity required field sampling for several water-quality parameters. Analysis of this function might prove difficult for local decision-makers who might not have access to the equipment necessary to make these determinations.

The use of the GIS had several advantages. Because the entire wetland and its drainage basin could be viewed in a spatial context, questions that addressed wetlands upslope of the wetland being evaluated, shape of the wetland, and elevation changes within a particular radius could be readily answered using the databases available. The relational databases on soils provided needed information on soil erodibility (K-factor), infiltration rates and dominant substrate of both the wetland itself and its associated drainage basin. Much time and effort was saved in utilizing these data sources compared with determining these parameters on site. Although the GIS provided algorithms that could be used to derive wetland and drainage-basin size, the algorithm for drainage-basin boundaries often overestimated the size of the wetland in question. Thus, it was necessary to estimate the size of the drainage basin based on the elevation and flow direction to obtain a more accurate answer than the one generated by the algorithm. As this example demonstrated, it was important to document the limitations and potential inaccuracy of computer-generated data in the development of this information system so that users could make adjustments to answers generated by the program when necessary.

Overall, the system provided much more information than a person would likely obtain from a single on-site visit. However, even though the system was easy to maneuver and use, the evaluation itself was not simple. The field investigations proved particularly challenging for questions relating to hydrology. A non-wetlands expert would have difficulty correctly answering the questions posed.

Although the WIMS II is flexible in structure and can be used with any spatially referenced data that reside in a relational database, much of the data required to answer the questions posed in the assessment method are not available digitally. Databases and imagery that could enhance the system include floodplain boundaries, land ownership, wildlife habitats, water quality, and digital orthophoto quads. Many of the questions relating to vegetation, vegetation cover and the proportion of vegetation to water might be able to be answered as digital orthophoto quads become available and added to the system.

Although wetlands have been repeatedly shown to provide a variety of benefits, they are often lost, damaged or compromised by developmental pressures and alterations in hydrologic flow (Schultink *et al.* 2000). In Michigan, wetlands less than 2 ha (5 acres) that are not contiguous to the Great Lakes or a river, stream or lake, are under voluntary and limited local jurisdiction and, in most cases, not protected by a local wetland ordinance. However, based on the wetland-function index in the two townships studied, smaller wetlands, particularly those less than 2 ha, are just as likely to perform a particular function as larger wetlands, and might be of great value when cumulative impacts are considered. Thus, protection of these wetlands by local governments might be considered equally important as those currently protected by state regulations. In several instances, the wetland showed a high probability of being effective in performing a function, but had little opportunity to do so due to its size, type, or location within the watershed. This information could also prove valuable to local decision-makers in land-use planning and wetland preservation. Further, an assessment of cumulative impacts of many small wetlands could be as important or more so than a single large wetland in performing a function, and users of the program should be careful to consider cumulative impacts in management decisions.

While the assessment method used in WIMS II can assist local communities in assessing functions and values, it cannot be used for federal and state regulatory purposes. A newer method that satisfies the technical and programmatic requirements of Section 404 of the Clean Water Act is being used (Schultink *et al.* 2000). However, the mapping, querying and integration capabilities of the system can be instrumental in helping local communities learn more about the landscape. Local units of governments are continually faced with land-use decisions regarding development and protection of wetlands. Although the WIMS II was developed as a prototype model for two townships, its application can be modified for any area. While these models might be costly to develop initially, their use over many years could justify the associated development costs. It could be argued that the development of GIS-based evaluation models, such as WIMS II, provide an efficient means to improve the assessment of wetland functions and values, and facilitate informed decision-making regarding wetland preservation and planning.

ACKNOWLEDGEMENTS

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REFERENCES

Adamus P. R., Clairain E. J., Smith R. D., Jr & Young R. E. (1987) Wetland Evaluation Technique II: Methodology. Operational Draft Technical Report, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS; Y-87.

Adamus P. R., Stockwell L. T., Clairain E. J., Morrow M. E. Jr, Rozas L. P. & Smith R. D. (1991) Wetland evaluation technique I: Literature Review and Evaluation Rationale. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS; Technical Report WRP-DE-2.

Ammann A. P. & Stone A. L. (1991) Method for the comparative evaluation of nontidal wetlands in New Hampshire. New Hampshire Department of Environmental Services, Concord, NH; NHDES-WRD-1991–3.

Brinson M. M. (1993) 'A Hydrogeomorphic Classification for Wetlands'. US Army Engineer Waterways Experiment Station, Vicksburg, MS; Technical Report WRP-DE-4

Cowardin L. M., Carter V., Golet F. C. & Laroe E. T. (1979) Classification of Wetlands and Deepwater Habitats of the United States. US Department of the Interior, Washington, DC; GWS/OBS-79/31.

Dahl T. E. (1990) *Wetland Losses in the United States 1780s to 1980s*. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.

Garcia L. S., Meyer S. P., Vada R. G. & Crossman J. (1993) A Decision Support System for Wetland Development: Application of Advanced Information Technologies. In: *Effective Management of Natural Resources, Proceedings of the 1993 Conference, Spokane, WA*. American Society of Agricultural Engineers, St Joseph, MI. pp. 332–41.

Ji W., Johnston J. B., McNiff M. E. & Mitchell L. C. (1992) Knowledge-Based GIS: An Expert System Approach for Managing Wetlands. *Geo Info Systems* **10**, 60–4.

Kang Y. T., Zahniser T. E., Wolfson L. G. & Bartholic J. F. (1994) WIMS: A prototype wetlands information management system for facilitating wetland decision making. In: *American Society for Photogrammetry and Remote Sensing Annual Convention,* Reno, NV (ed LeLand D. Whitmill) pp. 290–300. American Society for Photogrammetry and Remote Sensing and the American Congress on Surveying and Mapping, Bethesda, MD.

Marble A. D. (1992) *A Guide to Wetland Functional Design*. Lewis Publishers, Ann Arbor, MI.

Michigan State University (1999) Wetlands Information Management System II (ver 1.0.0. CD ROM). Michigan Agricultural Experiment Station, East Lansing, MI.

Schultink G., Moore R., Wolfson L. & Dischinger-Smedes J. (2000) Guidelines for Wetland Identification and Evaluation: Needs and Opportunities for Local Protection. Michigan Agricultural Experiment Station, Michigan State University, East Lansing, MI; Research Report 572.

Wolfson L. G., Kang Y. T., Zahniser T. E. & Bartholic J. F. (1995) A Wetlands Information Management System (WIMS) for Facilitating Wetlands Evaluations. Institute of Water Research, Michigan State University, East Lansing, MI; X995791-02-0.

Leggett, Anne

From: Kunneke, Tom
Sent: Friday, April 08, 2005 7:49 AM
To: Leggett, Anne
Subject: FW: wetland assessment methods

Hi Anne,
I would be glad to give you some inputs from our wetlands assessment perspectives here in central/south florida. We've used the Wetlands Rapid Assessment Procedure (WRAP) and recently started being required to use the Florida Uniform Mitigation Assessment Method (UMAM). Info on both of those is attached.

Another assessment method employed by mitigation bank and accepted by agencies is called W.A.T.E.R. and is more in-depth but still scores close to WRAP (therefore accepted). I will be using that for the first time in a couple weeks down south, for a road project. That link is below.
http://www.fpl.com/environment/emb/pdf/wetland_assessment.pdf

I'd enjoy doing this via phone as well, if you'd like to call next Tuesday afternoon or Wednesday are good. I'll also be here today until 16:00.

Regards.
Tom Kunneke, PWS

From: Leggett, Anne [mailto:Anne.Leggett@hdrinc.com]
Sent: Thursday, April 07, 2005 12:11 AM
To: ESPUG - Wetlands
Subject: wetland assessment methods

Hello, fellow HDR wetland people!

We (at HDR Alaska) are helping the Alaska Department of Transportation and Public Facilities define a method to be used statewide(!) to assess wetlands within the vicinity of their routine construction projects (roads and airports). We are to develop and present a synthesis of rapid wetland assessment practices potentially applicable to Alaska projects; then recommend an approach for DOT&PF. Our aim is not to "re-invent the wheel", but to build on the work and experience of others. We may end up recommending that DOT&PF customize an existing method for use in Alaska, or perhaps picking and choosing pieces of different methods and customizing them, or…..?

We are looking for folks to interview about the state-of-the-practice—HDR wetland professionals, your counterparts at state transportation departments, other agency folks, potentially academics.

My immediate questions for you:
1. Are you (or someone in your office potentially not on the wetlands mailing list) involved in wetland assessment, enough to be able to describe the state-of-the-practice in your area?
2. If so, may we interview you by phone? Would sometime yet this week be convenient? Or do you prefer next week? (A list of draft questions is presented below, in case you'd prefer to just jot down and email your answers.)
3. Can you recommend other professionals who could describe the state-of-the-practice in their areas? Contact info?

Draft interview questions for non-Alaskan wetland practitioners:

1. What wetland assessment method or methods do you typically employ? (If we are not familiar with the method, can you give us enough of a citation or a contact so we can find the document?)
2. Are you **required** to use any particular method? Different methods for different clients/types of projects/reviewing agencies?
3. Who **uses** your wetland assessment product?
4. Do you know how they use it? For what purpose? (Compare wetlands to each other? Compare "value" of wetlands to "value" of uplands? Help compare project alternatives? Just be able to check a box that says wetland assessment was done? Help with Corps of Engineers public interest review? Define compensatory mitigation needs?)
5. Do you think the methods you use meet the project proponents' and reviewing agencies' needs?
6. Can you estimate the amount of time you spend assessing each wetland? (apart from delineation, permitting, etc.)
7. Are there other methods you think are used in your area (but you don't use them)?
8. Can you recommend other professionals who could describe the state-of-the-practice in their geographic areas? Contact info?

After we review the method you use, may we call you again?

THANK YOU!!

Anne Leggett, Senior Biologist
HDR | ONE COMPANY - *Many Solutions*
2525 C Street, Suite 305
Anchorage, Alaska 99503
907.644.2038 Direct phone
907.644.2022 Fax
Anne.Leggett@hdrinc.com

Leggett, Anne

From: May, Philip

Sent: Thursday, April 07, 2005 4:46 AM

To: Leggett, Anne

Subject: FW: wetland assessment methods

Anne

See responses below from our work in North Carolina. Environmental Concern produced a review of about 40 different methods - it is available at http://www.wetland.org/ecpubs.htm.

Phil

Philip May
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207
Raleigh, NC 27612
(919) 232-6610
phil.may@hdrinc.com

From: Leggett, Anne [mailto:Anne.Leggett@hdrinc.com]
Sent: Thursday, April 07, 2005 12:11 AM
To: ESPUG - Wetlands
Subject: wetland assessment methods

Hello, fellow HDR wetland people!

We (at HDR Alaska) are helping the Alaska Department of Transportation and Public Facilities define a method to be used statewide(!) to assess wetlands within the vicinity of their routine construction projects (roads and airports). We are to develop and present a synthesis of rapid wetland assessment practices potentially applicable to Alaska projects; then recommend an approach for DOT&PF. Our aim is not to "re-invent the wheel", but to build on the work and experience of others. We may end up recommending that DOT&PF customize an existing method for use in Alaska, or perhaps picking and choosing pieces of different methods and customizing them, or…..?

We are looking for folks to interview about the state-of-the-practice—HDR wetland professionals, your counterparts at state transportation departments, other agency folks, potentially academics.

My immediate questions for you:
1. Are you (or someone in your office potentially not on the wetlands mailing list) involved in wetland assessment, enough to be able to describe the state-of-the-practice in your area? I manage most of our NCDOT projects that require wetland assessments.
2. If so, may we interview you by phone? Would sometime yet this week be convenient? Or do you prefer next week? (A list of draft questions is presented below, in case you'd prefer to just jot down and email your answers.) I am really busy the next few weeks, but if the answers below need qualifications, you can give me a call.
3. Can you recommend other professionals who could describe the state-of-the-practice in their areas? Contact info? See below.

Draft interview questions for non-Alaskan wetland practitioners:

1. What wetland assessment method or methods do you typically employ? (If we are not familiar with the method, can you give us enough of a citation or a contact so we can find the document?) Guidance for Rating the Value of Wetlands in North Carolina, Version 4 -

http://h2o.enr.state.nc.us/ncwetlands/regcert.html

2. Are you **required** to use any particular method? Different methods for different clients/types of projects/reviewing agencies? NCDOT requires this method in their natural resource investigation procedures. It is generally accepted in the state, but not officially adopted by the Corps.
3. Who **uses** your wetland assessment product? In our experience, it is used during the NCDOT permitting process by both our NCDOT PMs and reg agencies (Corps, DWQ, USFWS, USEPA, NC Wildlife Resources Commision) as a guide to the quality of wetlands being impacted. Especially useful when they do not visit the site in question.
4. Do you know how they use it? For what purpose? (Compare wetlands to each other? Compare "value" of wetlands to "value" of uplands? Help compare project alternatives? Just be able to check a box that says wetland assessment was done? Help with Corps of Engineers public interest review? Define compensatory mitigation needs?) Generally, I have seen it used when discussing alternative routes, need for the bridging of a wetland, etc.
5. Do you think the methods you use meet the project proponents' and reviewing agencies' needs? I think it is a decent rapid assessment of value, and less effective assessment of function. The agencies don't rely on it as the only factor in their decision making.
6. Can you estimate the amount of time you spend assessing each wetland? (apart from delineation, permitting, etc.) This method is relatively quick - 30 minutes.
7. Are there other methods you think are used in your area (but you don't use them)? The only other method in general use is best professional judgement. HGM is still being developed by the Corps but not in heavy use from my experience.
8. Can you recommend other professionals who could describe the state-of-the-practice in their geographic areas? Contact info? You may want to talk to Environmental Concern, Inc. in Maryland. Their Evaluation of Planned Wetlands is in use in the mid-Atlantic region. See reference above.

After we review the method you use, may we call you again? Yes

THANK YOU!!

Anne Leggett, Senior Biologist
HDR | ONE COMPANY - *Many Solutions*
2525 C Street, Suite 305
Anchorage, Alaska 99503
907.644.2038 Direct phone
907.644.2022 Fax
Anne.Leggett@hdrinc.com

Leggett, Anne

From: Whittaker, Christine L.
Sent: Thursday, April 07, 2005 7:01 AM
To: Leggett, Anne
Subject: RE: wetland assessment methods

I have provided brief answers to the questions in this e-mail. I will be available next week if you want to discuss further.

Regards
Christine

Christine L. Whittaker, RLA
HDR ONE COMPANY | *Many Solutions*
412 E. Parkcenter Blvd. Suite 100 | Boise, ID | 83706
Phone: 208-387-7067 | Fax: 208-387-7100 | Email: christine.whittaker@hdrinc.com

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From: Leggett, Anne [mailto:Anne.Leggett@hdrinc.com]
Sent: Wednesday, April 06, 2005 10:11 PM
To: ESPUG - Wetlands
Subject: wetland assessment methods

Hello, fellow HDR wetland people!

We (at HDR Alaska) are helping the Alaska Department of Transportation and Public Facilities define a method to be used statewide(!) to assess wetlands within the vicinity of their routine construction projects (roads and airports). We are to develop and present a synthesis of rapid wetland assessment practices potentially applicable to Alaska projects; then recommend an approach for DOT&PF. Our aim is not to "re-invent the wheel", but to build on the work and experience of others. We may end up recommending that DOT&PF customize an existing method for use in Alaska, or perhaps picking and choosing pieces of different methods and customizing them, or…..?

We are looking for folks to interview about the state-of-the-practice—HDR wetland professionals, your counterparts at state transportation departments, other agency folks, potentially academics.

My immediate questions for you:
1. Are you (or someone in your office potentially not on the wetlands mailing list) involved in wetland assessment, enough to be able to describe the state-of-the-practice in your area?
2. If so, may we interview you by phone? Would sometime yet this week be convenient? Or do you prefer next week? (A list of draft questions is presented below, in case you'd prefer to just jot down and email your answers.)
3. Can you recommend other professionals who could describe the state-of-the-practice in their areas? Contact info?

Draft interview questions for non-Alaskan wetland practitioners:

1. What wetland assessment method or methods do you typically employ? (If we are not familiar with the method, can you give us enough of a citation or a contact so we can find the document?) WET, Oregon Freshwater Methodology and Montana Freshwater Assessment Method.
2. Are you **required** to use any particular method? Different methods for different clients/types of projects/reviewing agencies? Different methods for different clients/states etc.
3. Who **uses** your wetland assessment product? USACE, Oregon Department of Lands, Montana Department of Transportation, Idaho Transportation Department.
4. Do you know how they use it? To define wetland functional values For what purpose? Defining mitigation (Compare wetlands to each other? Yes Compare "value" of wetlands to "value" of uplands? Help compare project alternatives? Just be able to check a box that says wetland assessment was done? Help with

Corps of Engineers public interest review? Define compensatory mitigation needs?)

5. Do you think the methods you use meet the project proponents' and reviewing agencies' needs? It is very hard to figure out what to do with the information that is derived from these assessments. Everyone likes to talk about it but they usually don't know exactly how to use it especially to define mitigation requirements.
6. Can you estimate the amount of time you spend assessing each wetland? (apart from delineation, permitting, etc.)
7. Are there other methods you think are used in your area (but you don't use them)? HGM
8. Can you recommend other professionals who could describe the state-of-the-practice in their geographic areas? Contact info?

After we review the method you use, may we call you again? Yes

THANK YOU!!

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HDR | ONE COMPANY - *Many Solutions*
2525 C Street, Suite 305
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907.644.2038 Direct phone
907.644.2022 Fax
Anne.Leggett@hdrinc.com

Leggett, Anne

From: Witter, Michael
Sent: Thursday, April 07, 2005 7:22 AM
To: Leggett, Anne
Subject: FW: wetland assessment methods

We have been doing a lot of wetland functional assessment lately. Washington State has just developed new rating systems for wetlands in eastern Washington and western Washington, and we have used them both. They have also devised a Wetland Functional Assessment Method (WAFAM) that we have also done. The WAFAM is the basis for the rating system and much more time consuming. So, you could look at the rating system as a model that approximates the detailed functional assessment method. We also have a quick and dirty high, medium low blues method that has gotten a lot of use at the DOT (attached). The Ecology WAFAM and the rating system is not necessarily intuitive, and requires an orientation. We can talk about this stuff whenever you want. Mike

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From: Leggett, Anne [mailto:Anne.Leggett@hdrinc.com]
Sent: Wednesday, April 06, 2005 9:11 PM
To: ESPUG - Wetlands
Subject: wetland assessment methods
Hello, fellow HDR wetland people!

We (at HDR Alaska) are helping the Alaska Department of Transportation and Public Facilities define a method to be used statewide(!) to assess wetlands within the vicinity of their routine construction projects (roads and airports). We are to develop and present a synthesis of rapid wetland assessment practices potentially applicable to Alaska projects; then recommend an approach for DOT&PF. Our aim is not to "re-invent the wheel", but to build on the work and experience of others. We may end up recommending that DOT&PF customize an existing method for use in Alaska, or perhaps picking and choosing pieces of different methods and customizing them, or…..?

We are looking for folks to interview about the state-of-the-practice—HDR wetland professionals, your counterparts at state transportation departments, other agency folks, potentially academics.

My immediate questions for you:
1. Are you (or someone in your office potentially not on the wetlands mailing list) involved in wetland assessment, enough to be able to describe the state-of-the-practice in your area?
2. If so, may we interview you by phone? Would sometime yet this week be convenient? Or do you prefer next week? (A list of draft questions is presented below, in case you'd prefer to just jot down and email your answers.)
3. Can you recommend other professionals who could describe the state-of-the-practice in their areas? Contact info?

Draft interview questions for non-Alaskan wetland practitioners:

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2. Are you **required** to use any particular method? Different methods for different clients/types of projects/reviewing agencies?
3. Who **uses** your wetland assessment product?
4. Do you know how they use it? For what purpose? (Compare wetlands to each other? Compare "value" of wetlands to "value" of uplands? Help compare project alternatives? Just be able to check a box that says wetland assessment was done? Help with Corps of Engineers public interest review? Define compensatory mitigation needs?)
5. Do you think the methods you use meet the project proponents' and reviewing agencies' needs?
6. Can you estimate the amount of time you spend assessing each wetland? (apart from delineation, permitting, etc.)
7. Are there other methods you think are used in your area (but you don't use them)?
8. Can you recommend other professionals who could describe the state-of-the-practice in their geographic areas? Contact info?

After we review the method you use, may we call you again?

THANK YOU!!

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Appendix D
Technical Advisory Group
Comments on Report Draft

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Meeting Notes

Subject: Technical Advisory Group review of draft report	
Client: AK Dept. of Transportation and Public Facilities	
Project: Rapid Wetland Assessment Method	Project No: 07072/23460
Meeting Date: September 19, 2005	Meeting Location: teleconference
Notes by: Anne Leggett	

Attendees:
Clint Adler (DOT&PF), Bill Ballard (DOT&PF), Anne Leggett (HDR), Bill Pearson (USFWS), Jim Powell (DEC), Jerry Tande (USFWS)

Topics Discussed:
This meeting was to discuss the draft report for the DOT&PF Rapid Wetland Assessment Method Project. The topics discussed ranged more widely

Action/Notes:

Comments on report

1. Bill Ballard states: There is a need to identify a systematic approach to rapid wetland assessment based upon a rapid progression of broad to finer screening elements/criteria. The rapid assessment techniques should quickly focus attention on important unique characteristics particular to a region (i.e., a "higher value" stream through a "low value" spruce bog.)

2. Bill Ballard wonders whether WRAP was reviewed. (Later response: It was eliminated in the second round of screening because it relies largely on Best Professional Judgment. The method is also quite specific to the southeast U.S.)

3. Jim Powell takes exception to two statements on page 5; specifically, the reference to HGM not being applicable to non-degraded wetlands, and the statement that the rationales behind the models and variables are not clearly described. (So noted. Those sentences will be modified for the final report.)

4. DOT&PF desires the report to identify and investigate potentially better approaches/tools for improving/streamlining wetland assessment, in addition to identifying specific functional assessment methods already available. Therefore, there is a need for the report to go beyond applicability of existing methods, and outline a potential framework for combining existing methods, technological tools, policy considerations, and best professional judgment.

5. The report needs a concise executive summary.

Other ideas discussed, grouped by topic

Consider a categorization of wetlands that identifies distinctly more important and less important wetlands

The DOT&PF approach should include some sort of method or tools for categorization (classification) of wetlands that we agree are more valuable or less valuable.
The classification could include a method for identifying wetlands that do not need further assessment and those that may need further assessment (i.e., "red flag" attributes).

The AK Wetlands Initiative identified important wetland types. These include: open water areas, emergent wetlands, migration and riparian corridors, etc. Report should reference back to this existing work. It was an interagency effort, which would provide a basis for agencies' acceptance of categorizing wetlands. (Later note: The Alaska Wetlands Initiative Summary Report did not identify important wetland types.)

Use of GIS to screen for important wetlands

Several seemed to be interested in DOT&PF using a GIS-based system for identifying important wetlands. This would be a planning tool and allow incorporation of wetland information early in design process. DOT&PF wants to identify those tools that have best promise of improving practice. This could be a statewide tool.
Anne thinks it would be more economical to focus development of such a system on locations where DOT&PF projects might be.
Use of GIS – data that could be considered includes water bodies, impaired water bodies, anadromous fish streams, NWI…
Use of NWI to identify HGM types – Jim Powell thinks it's possible. Advanced identification of valuable wetlands based on HGM types was discussed.
Perhaps we should compile GIS-based data and develop a screening tool for a pilot area.
Perhaps development of a GIS-based way of assessing wetlands is a long-term strategy.
Anne could look into availability of resources statewide that could be incorporated into GIS for wetland assessment.

Contents of, and recommendations to include in, final report

- Report needs a stand-alone, clear Executive Summary.
- Make recommendations regarding a Rapid Assessment Method.
- Discuss potential categorization of wetlands – red flags. DOT&PF should develop criteria for identifying when wetland assessments are necessary.
- Discuss benefits of/approach to transitioning to use of GIS – may use the AEDIS system.
- For each of the above topics: What are the research needs? What policy decisions must be made?

HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503-2632
Phone (907) 644-2000
Fax (907) 644-2022
www.hdrinc.com

Appendix E
Excerpts from Two Methods

From Montana Wetland Assessment Method:
Rating Form

From Wetland Rating System for Western Washington:
Rationales for Management Categories
Rating Summary Form
Form for Categorizing Wetlands Based on Special Characteristics

MDT
Montana Wetland Assessment Method

Prepared for:

Montana Department of Transportation
Environmental Services
2701 Prospect Avenue
P.O. Box 201001
Helena, Montana 59620-1001

and

Morrison-Maierle, Inc.
910 Helena Avenue
P.O. Box 6147
Helena, Montana 59604-6147

Prepared by:

Jeff Berglund
Western EcoTech
1280 Lariat Road
Helena, Montana 59602

May 25, 1999

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. Project Name:________________________ **2. Project #:** ________________ **Control #:**____________

3. Evaluation Date: Mo.____ Day____ Yr.____ **4. Evaluator(s):**______________ **5 . Wetlands/Site #(s)**______________

6. Wetland Location(s): i. Legal: T ____ N or S; R ____ E or W; S ____________; T ____ N or S; R ____ E or W; S ____________;
ii. Approx. Stationing or Mileposts: ______________________________

iii. Watershed: _ _ _ _ _ _ _ _ **GPS Reference No. (if applies):** ______________________
Other Location Information:

7. a. Evaluating Agency: ______________;
b. Purpose of Evaluation:
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4.____ Other

8. Wetland size: (total acres) __________ (visually estimated)
__________ (measured, e.g. by GPS [if applies])

9. Assessment area: (AA, tot., ac., see instructions on determining AA) __________ (visually estimated)
__________ (measured, e.g. by GPS [if applies])

10. Classification of Wetland and Aquatic Habitats in AA (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA

(Abbreviations: **System:** Palustrine(P)/ **Subsyst**.: none/ **Classes:** Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ **System:** Lacustrine (L)/, **Subsyst.:** Limnetic (2)/ **Classes:** RB, UB, AB/ **Subsystem:** Littoral (4)/ **Classes:** RB, UB, AB, US, EM/ **System:** Riverine (R)/ **Subsyst.:** Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ **Subsystem:** Upper Perennial (3)/ Classes: RB, UB, AB, US/ **Water Regimes:** Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) **Modifiers:** Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) **HGM Classes:** Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown Rare Common Abundant
Comments:

12. General condition of AA:
i. Regarding disturbance: (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings.	moderate disturbance	moderate disturbance	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.):______________________
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list) ____________

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:

13. Structural Diversity: (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	High	Moderate	Low

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ____________________

Secondary habitat (**list species**) D S ____________________

Incidental habitat (**list species**) D S ____________________

No usable habitat D S ____________________

II. Rating (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	.3 (L)	0 (L)

Sources for documented use (e.g. observations, records, etc):

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ____________________

Secondary habitat (**list species**) D S ____________________

Incidental habitat (**list species**) D S ____________________

No usable habitat D S ____________________

II. Rating (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	0 (L)

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. Evidence of overall wildlife use in the AA (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):

__ observations of abundant wildlife #'s or high species diversity (during any period)
__ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ presence of extremely limiting habitat features not available in the surrounding area
__ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):

__ few or no wildlife observations during peak use periods
__ little to no wildlife sign
__ sparse adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):

__ observations of scattered wildlife groups or individuals or relatively few species during peak periods
__ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ adequate adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

ii. Wildlife habitat features (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	H	M	M	H	M	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

iii. Rating (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	.9 (H)	.7 (M)	.5 (M)	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle **NA** here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted ih the comments.)

i. Habitat Quality (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - **>75%** of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – **50 to 75%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading - **< 50%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. Modified Habitat Quality (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity* **or** *is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y N Modified habitat quality rating = (circle) E H M L

iii. Rating (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	.7 (M)	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	.6 (M)	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle **NA** here and proceed to next function.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains **unrestricted outlet**	.9(H)	.8(H)	.5(M)	.7(H)	.6(M)	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? Y N

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle **NA** here and proceed with the evaluation.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond **≥ 5 out of 10 years**	1(H)	.9(H)	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond **< 5 out of 10 years**	.9(H)	.8(H)	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments:

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle **NA** here and proceed with the evaluation.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains **no or restricted outlet**	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains **unrestricted outlet**	.9 (H)	.7 (M)	.6 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle **NA** here and proceed to next function)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	.6 (M)	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments:

14I. Production Export/Food Chain Support:
i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	.8H	.7M	.7M	.6M	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators
___Springs are known or observed
___Vegetation growing during dormant season/drought
___Wetland occurs at the toe of a natural slope
___Seeps are present at the wetland edge
___AA permanently flooded during drought periods
___Wetland contains an outlet, but no inlet
___Other

ii. Recharge Indicators
___Permeable substrate present without underlying impeding layer
___Wetland contains inlet but no outlet
___Other

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	N/A (Unknown)

Comments:

14K. Uniqueness:
i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types **and** structural diversity (#13) is high **or** contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	.5 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) Y N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)
ii. Check categories that apply to the AA: ___ Educational/scientific study; ___ Consumptive rec.; ___ Non-consumptive rec.; ___Other
iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? Y N
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])
iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	1 (H)	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	.1 (L)

Comments:

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat			1	
B. MT Natural Heritage Program Species Habitat			1	
C. General Wildlife Habitat			1	
D. General Fish/Aquatic Habitat				
E. Flood Attenuation				
F. Short and Long Term Surface Water Storage				
G. Sediment/Nutrient/Toxicant Removal				
H. Sediment/Shoreline Stabilization				
I. Production Export/Food Chain Support			1	
J. Groundwater Discharge/Recharge			1	
K. Uniqueness			1	
L. Recreation/Education Potential			1	
Totals:				

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) **I II III IV**

Category I Wetland: (Must satisfy **one** of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
___ Score of 1 functional point for Uniqueness; **or**
___ Score of 1 functional point for Flood Attenuation **and** answer to Question 14E.ii is "yes"; **or**
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied **and** meets any **one** of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; **or**
___ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; **or**
___ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish/Aquatic Habitat; **or**
___ Score of .9 functional point for Uniqueness; **or**
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; **and**
___ "Low" rating for Production Export/Food Chain Support; **and**
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

WASHINGTON STATE WETLAND RATING SYSTEM

for

WESTERN WASHINGTON

Revised

Ecology Publication # 04-06-025

Thomas Hruby, PhD
Washington State Department of Ecology
August 2004

3. RATIONALE FOR THE CATEGORIES

This rating system is designed to differentiate between wetlands based on their sensitivity to disturbance, rarity, the functions they provide, and whether we can replace them or not. The emphasis is on identifying those wetlands:

- where our ability to replace them is low,
- that are sensitive to adjacent disturbance,
- that are rare in the landscape,
- that perform many functions well,
- that are important in maintaining biodiversity.

The following description summarizes the rationale for including different wetland types in each category. As a general principle, it is important to note that wetlands of all categories have valuable functions in the landscape, and all are worthy of inclusion in programs for wetland protection.

3.1 CATEGORY I

Category I wetlands are those that 1) represent a unique or rare wetland type; or 2) are more sensitive to disturbance than most wetlands; or 3) are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime; or 4) provide a high level of functions. We cannot afford the risk of any degradation to these wetlands because their functions and values are too difficult to replace. Generally, these wetlands are not common and make up a small percentage of the wetlands in the region. Of the 122 wetlands used to field test the current rating system only 24 (20%) were rated as a Category I. In western Washington the following types of wetlands are Category I.

Estuarine Wetlands - Relatively undisturbed estuarine wetlands larger than 1 acre are Category I wetlands because they are relatively rare and provide unique natural resources that are considered to be valuable to society. These wetlands need a high level of protection to maintain their functions and the values society derives from them. Furthermore, the questions used to characterize how well a freshwater wetland functions cannot be used for estuarine wetlands. No rapid methods have been developed to date to characterize how well estuarine wetlands function.

Estuaries, the areas where freshwater and salt water mix, are among the most highly productive and complex ecosystems where tremendous quantities of sediments, nutrients and organic matter are exchanged between terrestrial, freshwater and marine communities. This availability of resources benefits an enormous variety of plants and animals. Fish, shellfish and birds and plants are the most visible. However, there is also a huge variety of other life forms in an estuarine wetland: for example, many kinds of diatoms, algae and invertebrates are found there.

Estuarine systems have substantial economic value as well as environmental value. All

Washington State estuaries have been modified to some degree, bearing the brunt of development pressures through filling, drainage, port development and disposal of urban and industrial wastes. The over-harvest of certain selected economic species has also modified the natural functioning of estuarine systems. Many Puget Sound estuaries such as the Duwamish, Puyallup, Snohomish and Skagit have been extensively modified. Up to 99% of some estuarine wetland areas in the state have been lost.

Estuaries, of which estuarine wetlands are a part, are a "priority habitat" as defined by the state department of Fish and Wildlife. Estuaries have a high fish and wildlife density and species richness, important breeding habitat, important fish and wildlife seasonal ranges and movement corridors, limited availability, and high vulnerability to alteration of their habitat (Washington State Department of Fish and Wildlife (WDFW), http://www.wa.gov/wdfw/hab/phslist.htm, accessed October 15, 2003).

Natural Heritage Wetlands – Wetlands that are identified by scientists of the Washington Natural Heritage Program/DNR as high quality, relatively undisturbed wetlands, or wetlands that support State listed threatened or endangered plants are Category I wetlands.

High quality, relatively undisturbed examples of wetlands are uncommon in western Washington. By categorizing these wetlands as Category I, we are trying to provide a high level of protection to the undisturbed character of these remaining high quality wetlands. Examples of undisturbed wetlands help us to understand natural wetland processes. Furthermore, the presence of rare plants in a wetland indicates unique habitats that might otherwise not be identified through the rating system. Rare plant populations are also sensitive to disturbance, particularly activities that result in the spread of invasive species.

The Washington Natural Heritage Program of the Department of Natural Resources (DNR) has identified important natural plant communities and species that are very sensitive to disturbance or threatened by human activities, and maintains a database of these sites.

"These natural systems and species will survive in Washington only if we give them special attention and protection. By focusing on species at risk and maintaining the diversity of natural ecosystems and native species, we can help assure our state's continued environmental and economic health." (DNR http://www.wa.gov/dnr/htdocs/fr/nhp/wanhp.html , accessed October 1, 2002)

Bogs - Bogs are Category I wetlands because they are sensitive to disturbance and impossible to re-create through compensatory mitigation.

Bogs are low nutrient, acidic wetlands that have organic soils. The chemistry of bogs is such that changes to the water regime or water quality of the wetland can easily alter its ecosystem. The plants and animals that grow in bogs are specifically adapted to such conditions and do not tolerate changes well. Immediate changes in the composition of the plant community often occur after the water regime changes. Minor changes in the water regime or nutrient levels in these systems can have major adverse impacts on the plant and animal communities (e.g. Grigal and Brooks, 1997).

In addition to being sensitive to disturbance, bogs are not easy to re-create through compensatory mitigation. Researchers in northern Europe and Canada have found that restoring bogs is difficult, specifically in regard to plant communities (Bolscher 1995, Grosvermier et al. 1995, Schouwenaars 1995, Schrautzer et al. 1996), water regime (Grootjans and van Diggelen 1995, Schouwenaars 1995) and/or water chemistry (Wind-Mulder and Vitt 2000). In fact, restoration may be impossible because of changes to the biotic and abiotic properties preclude the re-establishment of bogs (Shouwenaars 1995, Schrautzer et al. 1996). Furthermore, bogs form extremely slowly, with organic soils forming at a rate of about one inch per 40 years in western Washington (Rigg 1958).

Nutrient poor wetlands, such as bogs, have a higher species richness, many more rare species, and a greater range of plant communities than nutrient rich wetlands (review in Adamus and Brandt 1990). They are, therefore, more important than would be accounted for using a simple assessment of wetland functions (Moore et al. 1989).

Mature and Old-growth Forested Wetlands – Mature and old-growth forested wetlands over 1 acre in size are "rated" as Category I because these wetlands cannot be easily replaced through compensatory mitigation. A mature forest may require a century or more to develop, and the full range of functions performed by these wetlands may take even longer (see review in Sheldon et al. 2004, in press).

These forested wetlands are also important because they represent a second "priority habitat" as defined by the state department of Fish and Wildlife. "*Priority habitats* are those habitat types or elements with unique or significant value to a diverse assemblage of species." (Washington State Department of Fish and Wildlife (WDFW), http://www.wa.gov/wdfw/hab/phslist.htm, accessed October 15, 2002). NOTE: All wetlands are categorized as a priority habitat by the WDFW. Mature and forested wetlands, therefore, represent two priority habitats that coincide.

Wetlands in Coastal Lagoons – Coastal lagoons are shallow bodies of water, like a pond, partly or completely separated from the sea by a barrier beach. They may, or may not, be connected to the sea by an inlet, but they all receive periodic influxes of salt water. This can be either through storm surges overtopping the barrier beach, or by flow through the porous sediments of the beach.

Wetlands in coastal lagoons are placed into Category I because they probably cannot be reproduced through compensatory mitigation, and because they are relatively rare in the landscape. No information was found on any attempts to create or restore coastal lagoons in Washington that would suggest this type of compensatory mitigation is possible. Any impacts to lagoons will, therefore, probably result in a net loss of their functions and values.

In addition, coastal lagoons and their associated wetlands are proving to be very important habitat for salmonids. Unpublished reports of ongoing research in the Puget Sound (Hirschi et al. 2003, Beamer et al. 2003) suggests coastal lagoons are heavily used by juvenile salmonids.

Wetlands That Perform Many Functions Very Well - Wetlands scoring 70 points or more (out of 100) on the questions related to functions are Category I wetlands.

Not all wetlands function equally well, especially across the suite of functions performed. The field questionnaire was developed to provide a method by which wetlands can be categorized based on their relative performance of different functions. Wetlands scoring 70 points or more were judged to have the highest levels of function. Wetlands that provide high levels of all three types of functions (improving water quality, hydrologic functions, and habitat) are also relatively rare. Of the 122 wetlands used to calibrate the rating system in western Washington, only 18 (15%) scored 70 points or higher based on their functions.

The questionnaire on wetland functions is based on the six-year effort to develop detailed methods for assessing wetland functions both in eastern and western Washington. These methods currently represent the "best available science" in rapid assessments of wetland functions.

3.2 CATEGORY II

Category II wetlands are difficult, though not impossible, to replace, and provide high levels of some functions. These wetlands occur more commonly than Category I wetlands, but still need a relatively high level of protection. Category II wetlands in western Washington include:

Estuarine Wetlands - Any estuarine wetland smaller than an acre, or those that are disturbed and larger than 1 acre are category II wetlands. Although disturbed, these wetlands still provide unique natural resources that are considered to be valuable to society. Furthermore, the questions used to characterize how well a wetland functions cannot be used for estuarine wetlands.

Interdunal Wetlands - Interdunal wetlands greater than 1 acre are Category II because they provide critical habitat in this ecosystem (Wiedemann 1984). This resource is important but constitutes only a small part of the total dune system (Wiedemann 1984). No methods have been developed to characterize how well interdunal wetlands function, so these wetlands cannot be rated by a score.

Interdunal wetlands form in the "deflation plains" and "swales" that are geomorphic features in areas of coastal dunes. These dune forms are the result of the interaction between sand, wind, water and plants. The dune system immediately behind the ocean beach (the primary dune system) is very dynamic and can change from storm to storm (Wiedemann 1984). For the purpose of rating, any wetlands that are located to the west of the 1889 line (western boundary of upland ownership) are considered to be interdunal.

Wetlands That Perform Functions Well - Wetlands scoring between 51-69 points (out of 100) on the questions related to the functions present are Category II wetlands. Wetlands scoring 51-69 points were judged to perform most functions relatively well, or performed one group of functions very well and the other two moderately well.

3.3 CATEGORY III

Category III wetlands are 1) wetlands with a moderate level of functions (scores between 30 -50 points) and 2) interdunal wetlands between 0.1 and 1 acre in size. Wetlands scoring between 30 -50 points generally have been disturbed in some ways, and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands.

3.4 CATEGORY IV

Category IV wetlands have the lowest levels of functions (scores less than 30 points) and are often heavily disturbed. These are wetlands that we should be able to replace, and in some cases be able to improve. However, experience has shown that replacement cannot be guaranteed in any specific case. These wetlands may provide some important functions, and also need to be protected.

DRAFT WETLAND RATING FORM – WESTERN WASHINGTON

Name of wetland (if known): ____

Location: SEC: ___ TWNSHP: __ RNGE: ___ (attach map with outline of wetland to rating form)

Person(s) Rating Wetland: ______________ Affiliation: ___________ Date of site visit: ___

DRAFT SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III___ IV___

Category I = Score >70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	
Score for Hydrologic Functions	
Score for Habitat Functions	
TOTAL score for functions	

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply___

Final Category (choose the "highest" category from above)

Check the appropriate type and class of wetland being rated.

Wetland Type		Wetland Class	
Estuarine		**Depressional**	
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above			

Does the wetland being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That Need Special Protection, and That Are Not Included in the Rating	YES	NO
SP1. *Has the wetland been documented as a habitat for any Federally listed Threatened or Endangered plant or animal species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		
SP2. *Has the wetland been documented as habitat for any State listed Threatened or Endangered plant or animal species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database.		
SP3. *Does the wetland contain individuals of Priority species listed by the WDFW for the state?*		
SP4. *Does the wetland have a local significance in addition to its functions*? For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the appropriate Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands ***(see p. 86)*** Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ___	
SC 1.1 Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating** **I/II**

SC 2.0 Natural Heritage Wetlands *(see p. 87)* Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species. SC 2.1 Is the wetland being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)* S/T/R information from Appendix D ___ or accessed from WNHP/DNR web site ___ YES____ – contact WNHP/DNR (see p. 79) and go to SC 3.2 NO ___ SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species? YES = Category I NO ____	**Cat. I**
SC 3.0 Bogs *(see p. 87)* Does the wetland (or part of the wetland) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.*** 1. Does the wetland have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 No - go to Q. 2 2. Does the wetland have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? Yes - go to Q. 3 No - Is not a bog for purpose of rating 3. Does the wetland have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)? Yes – Is a bog for purpose of rating No - go to Q. 4 NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog. *3.* Is the wetland forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?* 4. YES = Category I No___ Is not a bog for purpose of rating	**Cat. I**

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SC 4.0 Forested Wetlands ***(see p. 90)***

Does the wetland have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

— **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

— **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I NO ___

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Cat. I

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SC 5.0 Wetlands in Coastal Lagoons ***(see p. 91)***

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

— The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

— The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1 NO___ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

— The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).

— At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

— The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I NO = Category II

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Cat. I

Cat. II

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SC 6.0 Interdunal Wetlands *(see p. 93)* Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? YES - go to SC 6.1 NO __ not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula- lands west of SR 103 • Grayland-Westport- lands west of SR 105 • Ocean Shores-Copalis- lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger? YES = Category II NO – go to SC 6.2 SC 6.2 Is the wetland between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? YES = Category III	**Cat. II** **Cat. III**
Category of wetland based on Special Characteristics *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p.1	