Washington State
Department of Transportation

WETLAND

FUNCTIONS CHARACTERIZATION TOOL

FOR

LINEAR PROJECTS

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WETLAND STRATEGIC PLAN IMPLEMENTATION PROJECT

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Preface

In 1995, the Washington State Department of Transportation (WSDOT) was directed by State Senate Bill 5894 to develop a long-term wetland management plan, which became known as the Wetlands Strategic Plan. Selected recommendations from the strategic plan were funded in 1997 from the transportation budget (ESSB 6061) and were referred to as the Wetland Strategic Plan Implementation project (WSPI).

One element of WSPI was to develop a method to characterize wetland functions in a consistent, yet rapid manner. The Washington Department of Ecology had already begun development of its quantitative, HGM-based *Washington State Wetland Function Assessment Project* methodology in 1997. WSDOT recognized the value of this complex Ecology methodology, but also realized that it would be neither feasible nor necessary for routine application on linear highway projects that make up the majority of its wetland evaluations.

A WSPI committee was formed to address development of a rapid assessment tool for wetland functions based on Best Professional Judgment (BPJ). The committee included representatives from regulatory and resource agencies as well as one Indian tribe. After several meetings and numerous discussions this tool, including guidance text and a field form, was developed. The BPJ tool does not quantify wetland functions, nor does it provide a comprehensive study of an entire wetland system, and it should not be used when a more intensive study is needed. This tool does provide a mechanism for wetland professionals to characterize and report wetland functions information in a consistent manner.

This document consists of a Guidance section, followed by a blank Field Data Form which is intended to be used in the field. When filling out the Field Data Form, the evaluator considers whether a suite of qualifiers is present or absent and then, using best professional judgment, determines whether or not a particular function is likely to be provided. The tool also permits the user to characterize the relative importance of each function. A blank Wetland Functions & Values Form is also included for use in summarizing the information from completed field forms for inclusion as an appendix to a report.

WSDOT encourages your use of this tool, and welcomes your comments, suggestions, and feedback. Comments should be sent to William Null (nullbil@wsdot.wa.gov). Written comments can be sent to the address below.

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WETLAND FUNCTIONS CHARACTERIZATION TOOL FOR LINEAR PROJECTS

GUIDANCE

INTRODUCTION

This tool is to be used in evaluating all wetlands and identifying the functions they provide. It is a qualitative tool designed for rapid documentation of linear projects using best professional judgment (BPJ) to characterize the functions provided by a given wetland. The tool may also be used to assess the potential effects of proposed projects.

The tool uses an organization similar to the New England Corps of Engineers' highway methodology for wetland functions (COE, 1995). Other methods utilizing qualitative approaches include the Oregon Freshwater Assessment Methodology (ODSL, 1993) and the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MBWSR, 1998). Quantitative approaches such as the Semi-Quantitative Assessment Methodology (Cooke, 2000) and The Washington State Wetland Functions Assessment Project (Hruby et al., 1999 and Hruby et al., 2000) are excellent tools but were considered too labor intensive for routine linear highway projects. The latter, however, proved to be an invaluable source of information, and was heavily drawn from in selecting the "qualifiers" and "attributes" used in the BPJ tool's functional characterizations.

The purpose of this tool is to provide a consistent format for the rapid characterization of wetland functions. It uses a trained wetland biologist's best professional judgment based on the guidance below. Being a qualitative tool rather than a quantitative tool, it is intended for use where a general characterization of wetland functions is needed but extensive field investigation is not practical or necessary.

The following guidance is to assist the biologist when observing site conditions to determine whether or not a particular function or value is likely being provided. Positive answers to a suite of qualifiers generally indicate the presence of factors important for a function or value. These qualifiers are furnished to guide the characterization. After completing each section, the biologist should use best professional judgment in determining the likelihood of that function being provided along with the function's relative importance. This characterization, along with the supporting rationale should be documented on the field data form.

FUNCTIONS EVALUATED

I. Hydrologic Functions
(Water Quantity)

A. Flood Flow Alteration

Reducing the flow of flood waters is defined as the wetland processes or characteristics by which the peak flow in a watershed can be attenuated during major storm events. Water storage is also considered a part of flood flow alteration especially when surface water, that may otherwise cause flooding, is temporarily stored in a wetland.

Potential: This function is dependent on the wetland's size, the amount of water it can hold, and its location in the watershed. (Wetlands higher in the watershed have more effect on reducing flooding to downstream areas, while wetlands lower in the watershed may provide greater benefits to a specific area.) Furthermore, if the wetland is

situated within a riparian zone in the floodplain of a stream and has dense woody vegetation, it has the potential to attenuate the severity of peak flows by dissipating their energy during flood events. Other contributing factors can be the lack of a discernible outlet or a constricted outlet, i.e., the size of the outlet compared to the size of its basin; an undersized culvert, topography of the wetland relative to its outlet, and the ability to receive floodwater in the form of sheet flow rather than channel flow.

Qualifiers/Indicators: The presence of high water marks, fluctuating water levels, debris lodged in branches, and algal mats shows that water was stored, and high energy (peak flow) events were reduced.

II. Hydrologic Functions
(Water Quality/Biofiltration)

B. Sediment Removal

Removal of sediment is defined as the wetland processes which remove sediments from the water column, and keep them from migrating downgradient in the watershed. Wetlands accomplish this retention through the natural processes of sedimentation and entrapment. Decreased water velocity causes increased sedimentation while standing vegetation acts both to filter and impede the downstream movement of sediments.

Potential: This function is dependent on sediment load being delivered by runoff and input from the upslope watershed. Important qualifiers include the wetland's configuration; bowl shaped so that water is detained for long durations, dense herbaceous vegetation, and slow-moving water to filter out sediments.

Qualifiers/Indicators: This function is being provided if the incoming water has greater turbidity than that of the outgoing water. Although difficult to evaluate during a brief one-time visit, if dense vegetation, standing water or newly deposited sediments are present in the wetland, this function has the potential of being provided.

C. Nutrient and Toxicant Removal

Removing nutrients and toxicants is defined as the wetland processes which remove nutrients (fertilizers) and toxicants (pesticides and heavy metals) from incoming water, and prevent them from going to downstream waters in the watershed. The major processes by which wetlands remove nutrients and toxicants are as follows: 1) by trapping sediments rich in nutrients and toxicants, 2) by adsorption to soils high in clay content or organic matter (Heavy metals, if any, are usually bound to the particulate sediments of incoming waters.), and 3) through nitrification and denitrification in alternating oxic and anoxic conditions. Removal of nutrients and toxicants is closely tied to the processes which provide for sediment removal. The difference in this instance, however, is to have the nutrients and toxicants sequestered in the soil.

Potential: This function is dependent on the wetland having similar physical properties as mentioned in item "B" above, and for nutrients and toxicants to be present in the up-gradient runoff and incoming waters to the wetland.

Qualifiers/Indicators: If there is a net annual decrease of nutrients to the surface waters below the wetland, this function is being provided. Like that for sediment and heavy metals retention, it is difficult to evaluate during a brief one-time visit, but if

dense vegetation, standing water or newly deposited sediments are present in the wetland, this function has the potential of being provided.

D. Erosion Control and Shoreline Stabilization

Erosion control and shoreline stabilization is defined as the wetland processes which reduce erosion of stream channels down-gradient of the wetland, along shorelines if associated with a lake or a tidally influenced water body, and within the wetland itself.

Potential: This function is dependent on the wetland being part of a water course or other body of water that either regularly or intermittently may experience high flow velocities or wave action. Between the open water and the non-wetland areas, the wetland should also have vegetation composed of either a dense energy-absorbing, resilient herbaceous layer or a mixture of trees and large multi-stemmed shrubs that can withstand high flow velocities and/or wave action.

Qualifiers/Indicators: This function is likely being provided if the wetland is so situated in the landscape, has the mentioned vegetation, and no evidence of such erosional signs as gullies, rills, exposed soil, scour marks, and slumping in the downgradient watercourse.

III. Biological Functions

E. Production of Organic Matter and its Export

Production of organic matter and its export is defined as the wetland processes which result in the production of plant material and also its subsequent transport to other downstream surface water locations. Herbaceous and deciduous plant material decompose at faster rates than do woody and evergreen material and, therefore, become available more quickly for export as decomposed and/or suspended organic matter.

Potential: This function is dependent on the wetland producing organic material, and being so situated that a portion of this biomass is transported outside the wetland. Generally, wetlands with greater areas of vegetation have potential for more production of organic matter than do wetlands having smaller areas of vegetation. Similarly, wetlands with more structural complexity (plant layers) tend to increase plant matter by providing additional strata. Wetlands with surface water outlets can more readily export this material to downgradient habitats than can wetlands without outlets.

Qualifiers/Indicators: If the above conditions occur, this function is likely being performed.

F. General Habitat Suitability

General habitat suitability is defined as the characteristics or processes present in a wetland that provide habitat for a broad range of wildlife species. Suitability is based on the number of different habitats a wetland provides. Vegetation is an important component of wildlife habitat and, as plant community diversity increases, so does the potential for animal diversity. The existence of two Cowardin classes adjacent to each other often improves the wildlife habitat value because some wetland wildlife species use the edge between two different plant communities. Open water along with the presence of both intermittent and perennial ponding plus structural complexity to include interspersion and strata, are also important habitat elements in a wetland.

Many of the qualifiers used to assess general wildlife habitat are also used in the characterizations of habitat for individual species groups. In addition to characterizing general habitat suitability in broad terms, this tool also permits the user to characterize habitat suitability for invertebrates, amphibians, aquatic birds, and aquatic mammals.

Potential: This function is dependent on the wetland possessing two or more Cowardin Classes with some interspersion, having connectivity with other habitats, containing plant forage species, and signs of animal use.

Indicators: If the above conditions occur, this function is likely being performed.

G. Habitat for Aquatic Invertebrates is defined as the wetland processes and characteristics that help maintain a high number of invertebrate species in the wetland. Emphasis here is on "macro-invertebrates," i.e., those readily seen with the naked eye, and species richness. Nearly every wetland, unless severely polluted, will provide habitat for some aquatic invertebrates which are important components of the food web. Species richness is assumed to be directly correlated with complexity of habitat structure. (High densities of a few aquatic invertebrates that are preferred prey for amphibians and other wetland-associated birds and mammals indicates a high degree of functioning.)

Potential: The wetland should have a high number of preferred prey or a complexity of habitat structure, i.e., different types of substrates that will support moist and wet soils, categories of woody debris, snags and stumps, number of plant strata, number of Cowardin classes, interspersion of them; and an assortment of water regimes (e.g., intermittent and perennial ponding). The presence of aquatic bed vegetation adds to the overall invertebrate richness of the wetland.

Qualifiers/Indicators: If the above mentioned attributes are present, habitat for aquatic invertebrates is most likely being provided. Also, if surface water features are very limited or absent and structural elements are few in number, the aquatic invertebrate habitat function, in most instances, would be considered insignificant. If, however, there are several to many different types of surface water features along with structural elements, the function may be quite significant.

H. Habitat for Amphibians is defined as the wetland processes and characteristics that contribute to the feeding, breeding, and refuge needs of wetland-dependent amphibian species. Emphasis is on species richness and conditions that would support an array of species and thus provide greater biodiversity. Permanent ponding, however, suits bullfrogs and resident fish which may compete with and prey upon the native amphibians (Adams 1999).

Potential: Downed logs and thin-stemmed vegetation in standing water are attributes which enhance amphibian habitat by supporting the development of eggs and larvae (Nussbaum et al 1983, Leonard et al 1993, Olson et al 1997). They also provide cover for amphibians moving in and out of the wetland. Long-duration seasonal ponding provides optimal habitat for diverse assemblages.

Qualifiers/Indicators: If the above mentioned attributes are present, habitat for wetland-dependent amphibians is most likely being provided. If egg masses, larvae or

transformed amphibians are also observed, then it can be concluded that the function is being provided.

I. Habitat for Wetland-Associated Mammals is defined as wetland features and processes that support one or more life requirements for such semi-aquatic mammals. The target mammals being considered are beaver, muskrat, river otter, and mink. If wetlands are available, many terrestrial mammals will use them to meet some of their life requirements, but they are not dependent on wetlands as are the four above.

Considerations include condition of the wetland buffer, permanence of inundation, water depth, condition of a travel corridor, and human-caused disturbance. It is assumed that wetlands which provide habitat for all of these four mammals function more effectively than those which meet the habitat needs of less than the four.

Potential: This function requires permanent inundation. Other attributes of importance include the presence of reliable food sources, den sites, persistent emergent vegetation, edge structure, interspersion of vegetation with open water, and the condition of travel corridors including the wetland buffer.

Qualifiers/Indicators: If the above-mentioned attributes are present, habitat for these wetland-associated mammals is most likely being provided. If dens, lodges, tracks, and/or feeding indicators are also observed, then it can be concluded that the function is being provided.

J. Habitat for Wetland-Associated Birds is defined as the processes and environmental characteristics in a wetland that provide habitats or conditions for species of such birds. Wetland-associated bird species are defined here as those which require a wetland ecosystem for some part of their life cycle, i.e., food, shelter, breeding, and/or resting. The guilds of wetland-associated birds on which this tool is focused include waterfowl, shorebirds, and herons. Birds of these guilds require perch and nesting sites near to or above bodies of water, and that the wetland contain or have the potential to contain a high population of aquatic vertebrates, invertebrates, and plants. Snags with diameters >10 cm (4 in) are also important habitat elements for some species. Priority Habitat and Species Maps may assist in identifying concentration areas for these birds.

- In addition to the above, some waterfowl prefer shallow open water, and good habitats can range anywhere between 30% open water with 70% emergent vegetation to 50% open water with 50% emergent vegetation (Hruby et al., 1999 and Ringelman, 1990).

Potential: This function is dependent on the wetland having a ratio of open water to emergent vegetation which falls within the ranges given above.

Qualifiers/Indicators: If the wetland has ratios of open water to emergent vegetation that fall within these ranges, it has the potential to provide habitat for waterfowl.

- Shorebirds prefer areas having exposed sandbars and mudflats where they may feed upon invertebrates, and water shallow enough to allow wading and foraging. Such areas can be near the edge of fresh or salt water bodies like the ocean, estuaries, rivers, lakes, ponds, or wet meadows (Larrison et al., 1968 and Paulson, 1993).

Potential: This function is dependent on the wetland having areas such as mudflats and sandbars where water pools to shallow

depths, and the substrate possesses an ample supply of invertebrates.

Qualifiers/Indicators: If the wetland has the above attributes, it is likely to provide habitat for shorebirds.

- Herons can use all of the above but prefer areas with water shallow enough for them to wade yet deep enough to forage for fish, amphibians, and invertebrates.

Potential: This function is enhanced when the wetland is near (4 to 5 km {2.5 to 3 mi}) a rookery, and has wading areas that support fish, amphibians, and invertebrates (Rodrick and Milner, 1991).

Indicators: If the conditions described above are present, the wetland has the potential to provide heron habitat.

In general, the potential for a wetland to provide aquatic bird habitat increases as the number of appropriate habitat conditions increase. Furthermore, wetlands that provide habitat for a greater number of aquatic bird species or guilds are assumed to be more effective than those with fewer numbers. The focus is on species richness rather than on the importance of a wetland to a threatened or endangered species or a regionally important guild.

K. General Fish Habitat

Habitat for fish requires that the wetland be associated with a fish-bearing water, and is defined as the environmental characteristics that contribute to the spawning, rearing, or refuge needs for native fish species that use wetlands. Salmonid vs. non-salmonid requires the need to determine if and what species use that particular reach of the stream. It is also important to know if the wetland provides more than simply a migratory reach.

Check the following sources and in the order given:

a) A catalog of Washington streams and salmon utilization (Williams, et. al., 1975)
b) Washington State salmon and steelhead stock inventory (SASSI, 1993)
c) PHS maps from WDFW
d) Stream Net from WDFW
e) The local WDFW fisheries habitat biologist and Tribal biologists.

All salmonid species can be expected to utilize wetlands that are connected to salmonid bearing waters given acceptable water quality and habitat conditions. However, salmonid use in wetlands is variable and depends upon the species and life stage of the fish.

The relative importance/value of a wetland is considered to be more significant if it supports salmonids and, if so, becomes even more meaningful in mitigation sequencing.

- Rearing requires that the wetland/stream complex have suitable aquatic habitats containing an ample supply of food in the form of aquatic invertebrates and detrital matter from overhanging vegetation. In streams, pool-and-riffle complexes are fundamental to this function. In wetlands, however, rearing may be provided in "wall-base channels" (Cederholm and Scarlett 1982; and Peterson and Reid 1984). A wall-base channel is a vegetated or unvegetated "pond" within a wetland complex that has an egress channel to a fish-bearing water (most often a stream). If these conditions are present, rearing has the potential to be provided.

- Refugia are oftentimes places where fish are not typically found throughout the year. However, off-channel areas that are frequently inundated can provide limited

seasonal forage/rearing opportunities for fish in addition to providing high water refuge. These areas are usually adjacent to a fish bearing water body and are connected through seasonal changes in water levels from tides, precipitation, and flood events. If these conditions are present, this function has the potential to be provided.

- Spawning requires that the wetland/stream complex have reaches with submerged vegetation or clean gravel of the size range for the particular species. If so, this function is likely to be provided for some native fish such as mudminnows (Wydoski and Whitney 1979; and Mongillo and Hallock 1999). Salmonids, however, are not known to spawn in wetlands.

L. Native Plant Richness

Native plant richness is defined as the wetland processes and features that help maintain a high number of native plant assemblages as well as providing specialized habitats for less common (unusual, rare, sensitive, threatened and endangered) plant species. Wetland habitat for species richness is assumed to improve with an increase in the number of strata, the number of plant assemblages, the number of plant species, and the presence of large trees.

- Vegetation Structure deals with the various classes or strata of vegetation, i.e., tall trees (> 15 m {> 50 ft}), trees (< 15 m {< 50 ft}), shrubs (< 6 m {< 20 ft}), herbaceous ground cover, and aquatic beds. The characterization is based on the number of strata, the number of plant assemblages, the presence or absence of mature trees, and the number of plant species. The greater the number of these attributes, the greater the potential for a wetland to maintain and support plant richness. Dominant non-native plants, however, reduce this quality.

Potential: This function is dependent on the wetland having minimal disturbance and sufficient attributes to preclude non-native plants from competing successfully or becoming dominant components of the community.

Qualifiers/Indicator: If these attributes and conditions are present, along with native plants being dominant, the wetland is likely to support native plant communities and thus richness.

IV. Social Values

M. Educational or Scientific Value

Depending on ownership, accessibility, and vegetation diversity, wetlands may have value for educational or scientific research purposes. Educational factors can be considered if the wetland is currently used for such purposes, is easily accessible, and can tolerate minor disturbance to the biota. Scientific factors should be considered if the wetland has features or characteristics suitable for basic or applied research.

N. Uniqueness and Heritage

These values become factors when the wetland contains documented occurrence of a state- or federally listed species; critical habitat, special plant communities, or priority species designated respectively by the U.S. Fish and Wildlife Service, the Washington Department of Natural Resources' Natural Heritage Program, or the Washington Department of Fish and Wildlife's Priority Habitats and Species Program; or is in or part of a National Natural Landmark or a Natural Heritage Site designated by the National Park Service and WDNR respectively. Also important is if the wetland has been identified by a local jurisdiction as having local/regional significance.

V. Other Wetland Attributes and Values

The following do not appear on the field assessment form but are included here for additional consideration when providing one's rationale on the field form.

O. Type

Use wetland classes of the appropriate subclasses of the Marine, Estuarine, Riverine, Lacustrine, and Palustrine Systems (Cowardin et al, 1979).

P. Quality

Quality is determined by the condition of the wetland. Extensive clearing of native vegetation followed by the placement of fill or conversion to non-native invasive plant species constitutes a "severely degraded" condition. A "disturbed" condition means the integrity of the wetland has been altered to some degree and is, therefore, less than pristine. The alteration could be human induced or have come from some natural event, and the degree could be reported as "slightly disturbed," "moderately disturbed," or "highly disturbed." A "pristine" condition constitutes a wetland with no readily discernible alterations caused by human activities. (Use the Washington State Department of Ecology's Rating Forms {WSDOE, 1991 & 1993}.)

Q. Species Richness

The number of different plant or animal species in the wetland. List the number of species observed on the data sheet.

R. Connectivity

Deals primarily with habitat connection both within and outside the wetland. Good or high connectivity allows organisms to move from community to community with greater safety.

Connectivity is considered high when the wetland is connected to, or part of, a riparian corridor at least 30 m (100 ft) wide and connecting two or more terrestrial/aquatic habitats. If the wetland is surrounded by undisturbed/underdeveloped habitats its value for wildlife increases.

S. Interspersion

Refers to Cowardin classes in the wetland, and how two or more are arranged with one another. High interspersion is equated with high habitat quality for edge dependent species. (Use that value taken from the Ecology Rating Form.)

T. Listed Species Habitat

If the wetland supports or is known to support federally listed (ESA) and/or state-listed species or critical habitat for a state or federally listed species, this function is being provided.

U. Streambed and Streambank Vegetation Structure

Deals with in-stream and out-of-stream features such as streambed composition (bedrock, cobble-gravel, rubble, boulders, mud, sand, organic, and vegetated) and vegetation along the streambank (herbaceous, shrubs, or trees and overhanging or not). The quality is assumed to be higher if the stream/wetland is able to support fish, especially salmonids.

V. Hydrologic Features

1. Hydroperiod (Use the water regimes from Cowardin et al, 1979).

2. Critical Recharge Area is not well defined or understood. However, if the wetland is known to occur in an aquifer recharge area and lacks a surface outlet, we can conclude that it has the potential to provide ground water recharge.

3. Outlets, their presence or absence, and relative size and elevation have a major role in wetland functionality. It is, therefore, important to determine if they exist or not.

4. Ground Water Discharge occurs as seeps, springs, and/or artesian wells. Depending on landform, such discharge can give rise to permanently flooded wetlands. Report this characteristic if it is observed.

W. Archeological/Cultural

Such investigations should be conducted by the state archeologist if the wetland possesses or has the potential to possess such attributes.

X. Recreation

Recreational use can be considered if the wetland is part of a park, public land, or even private land and provides or has the potential to provide active recreation (hunting, boating, fishing) or passive recreation (bird watching and/or photography).

Y. Agricultural/Commercial

Such use of wetlands requires documenting the current activity or looking for evidence of past activities and/or interviewing neighbors.

Z. Others (e.g. part of a viewshed)

VI. HGM CLASSIFICATION OF WETLANDS

A hydrogeomorphic classification for wetlands follows below. This classification has definitions for each class of wetlands, and lists the potential functions they provide. It is offered as an aid in determining the class of a particular wetland as well as the functions to be assessed, and was adapted from Hruby, et. al. (1999). A summary table on page 12 follows the text. A key to HGM Wetland Classification is included in the forms section of this document.

CLASS: Riverine

Definition: Riverine wetlands occur in floodplains and riparian corridors in association with stream or river channels. They lie in the active floodplain and have important hydrologic links to the water dynamics of the river or stream. The distinguishing characteristic of Riverine wetlands in Washington is that they are frequently flooded by overbank flow from the stream or river. Flood waters are a major factor that structure the ecosystem in these wetlands. Wetlands that lie in floodplains but are **not** frequently flooded are not classified as Riverine.

Potential Functions Provided:

- Sediment removal
- Nutrient removal
- Heavy metals and organics removal
- Peak flow reduction (flood flow alteration)
- Downstream erosion and shoreline stabilization
- Primary production and organic export
- Groundwater recharge

- General habitat suitability
- Habitat suitability for invertebrates
- Habitat suitability for amphibians
- Habitat suitability for anadromous fish
- Habitat suitability for resident fish
- Habitat suitability for wetland-associated birds
- Habitat suitability for wetland-associated mammals
- Native plant richness

CLASS: Depressional

Definition: Depressional wetlands occur in topographic depressions that exhibit closed contour interval(s) on three sides and elevations that are lower than the surrounding landscape. The shape of Depressional wetlands vary, but in all cases the movement of surface water and shallow subsurface water from at least three directions in the surrounding landscape is toward the point of lowest elevation in the depression. Depressional wetlands may be isolated with no surface inflow or outflow through a defined channel. Or, they may have perennial or intermittent surface water inflow or outflow in defined channels that connect them to other surface waters or wetlands. Streams draining into a Depressional wetland may modify the topographic contours of the depression where they enter or exit the wetland.

Depressional wetlands with channels or streams differ from Riverine wetlands in that their ecosystem is not significantly modified by overbank flooding events from a stream or river. Headwater wetlands should be classified as Depressional or Slope wetlands because overbank flooding is not a major ecological factor.

Potential Functions Provided

- Sediment removal
- Nutrient removal
- Heavy metals and organics removal
- Peak flow reduction (flood flow alteration)
- Downstream erosion and shoreline stabilization
- Primary production and organic export
- Groundwater recharge
- General habitat suitability
- Habitat suitability for invertebrates
- Habitat suitability for amphibians
- Habitat suitability for anadromous fish (**western Washington only**)
- Habitat suitability for resident fish (**western Washington only**)
- Habitat suitability for wetland-associated birds
- Habitat suitability for wetland-associated mammals
- Native plant richness

CLASS: Lacustrine Fringe

Definition: Lacustrine Fringe wetlands in western Washington occur at the margins of topographic depressions in which surface water is greater than 8 hectares (20 acres) in size and greater than 2 meters deep (3 meters in eastern Washington). They are found along the edges of bodies of water such as lakes. Surface water movement in Lacustrine Fringe wetlands can be bi-directional, i.e., having both a horizontal component due to winds or currents, and a corresponding vertical component resulting from seiches, wind or seasonal water fluctuations.

Potential Functions Provided

- Sediment removal
- Nutrient removal
- Heavy metals and organics removal
- Shoreline stabilization
- Primary production and organic export
- General habitat suitability
- Habitat suitability for invertebrates
- Habitat suitability for amphibians
- Habitat suitability for anadromous fish
- Habitat suitability for resident fish
- Habitat suitability for wetland-associated birds
- Habitat suitability for wetland-associated mammals
- Native plant richness

CLASS: Tidal Fringe

Definition: Tidal Fringe wetlands occur on continental margins where marine waters are greater than 2 meters deep and more than 8 hectares (20 acres) in size. In general, the deep water must represent at least 30% of the area of open water. Some wetlands may be adjacent to rivers that are more than 2 meters deep but these would be classified as Riverine because the flow tends to be in one direction and the wetland is subject to overbank flooding.

Potential Functions Provided

- Sediment removal
- Nutrient removal
- Heavy metals and organics removal
- Shoreline stabilization
- Primary production and organic export
- General habitat suitability
- Habitat suitability for invertebrates
- Habitat suitability for anadromous fish
- Habitat suitability for resident fish
- Habitat suitability for wetland-associated birds
- Habitat suitability for wetland-associated mammals
- Native plant richness

CLASS: Slope

Definition: Slope wetlands occur on hill or valley slopes. Elevation gradients may range from steep hillsides to slight slopes. Principal water sources are usually groundwater seepage and precipitation. Slope wetlands may occur in nearly flat landscapes if groundwater discharge is a dominant source of water and there is flow in one direction. The movement of surface and shallow subsurface water is perpendicular to topographic contour lines. Slope wetlands are distinguished from the Riverine wetland class by the lack of a defined topographic valley with observable features of bed and bank. Slope wetlands may develop channels but the channels serve only to convey water away from the slope wetland.

Potential Functions Provided

- Primary production and organic export
- General habitat suitability
- Habitat suitability for invertebrates
- Habitat suitability for amphibians
- Native plant richness

CLASS: Flats (Not commonly encountered in Washington State)

Definition: Flats wetlands occur in topographically flat areas that are hydrologically isolated from surrounding ground or surface water. The main source of water in these wetlands is precipitation. They receive virtually no groundwater discharge. This characteristic distinguishes them from Depressional and Slope wetlands.

Potential Functions Provided

- Primary production and organic export
- General habitat suitability
- Habitat suitability for invertebrates
- Habitat suitability for amphibians
- Habitat suitability for wetland-associated birds
- Native plant richness

TABLE 1

SUMMARY of POTENTIAL FUNCTIONS for HGM CLASS WETLANDS

HGM Class	Flood Flow Alteration	Sediment Removal	Nutrient & Toxicant Removal	Erosion-Shoreline Stabilization	Produc-tion Export	Wildlife Habitat	Fish Habitat
Riverine	Y	Y	Y	Y	Y	Y	Y
Depressional	Y	Y	Y	Y	Y	Y	Y [1]
Lacustrine Fringe	Y	Y	Y	Y	Y	Y	Y
Tidal Fringe	N	Y	Y	Y	Y	Y	Y
Slope	N	N	N	N	Y	Y	N
Flats	N	N	N	N	Y	Y	N

[1] Western Washington only

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APPENDIX 1

GLOSSARY

GLOSSARY

Adsorption: The attraction and adhesion of a layer of ions from an aqueous solution to the solid mineral surface with which it is in contact.

Anadromous: Pertaining to fish that spend most of their life in salt water but enter fresh water to spawn.

Baseflow Support: A wetland process in which incoming surface water is transported into subsurface water which helps maintain low flows during the dry season.

Class: A taxonomic unit in a classification scheme. In the Cowardin et al. (1979) classification of wetlands it refers to the highest taxonomic unit below the Subsystem level. In the HGM system it is the highest taxonomic unit.

Denitrification: The biological conversion of nitrate nitrogen to nitrogen gas by microbes in anaerobic conditions.

Depressional Wetland Class: Wetlands that occur in topographic depressions that exhibit closed contour interval(s) on three sides and elevations that are lower than the surrounding landscape.

DNR: Washington Department of Natural Resources.

Ecology Rating Form: A field form used to rate wetlands, by category, according to their size, ecological characteristics, and physiographic locations.

Edge: The boundary where habitats meet or where successional stages of plant communities come together.

Erosion Control and Shoreline Stabilization: The wetland processes which prevent erosion both inside and downslope of the wetland, and along shorelines if associated with a stream or lake.

ESA: Endangered Species Act

Flats Wetland Class: Wetlands that occur in topographically flat areas that are hydrologically isolated from surrounding ground or surface water (primarily precipitation driven).

Filtration: The blockage of sediment by standing vegetation.

Guild: A group of species that have similar ecological resource requirements and foraging strategies, and as a result, have similar roles in a community.

Hydrogeomorphic: Categorization of wetlands based upon geomorphic setting, water source and transport, and hydrodynamics.

Hydroperiod: The duration, and frequency of flooding or saturation of soils on a seasonal basis.

Interspersion: The degree of intermixing of different cover types, regardless of the number of types or their relative proportions.

Lacustrine Fringe Wetland Class: Wetlands that occur at the margins of topographic depressions in which surface water is greater than 8 hectares (20 acres) and greater than 2 meters deep in western Washington and 3 meters in eastern Washington.

Nitrification: The process of converting ammonia into nitrites or nitrates, i.e., inorganic forms of nitrogen that can be assimilated by plants.

Nutrient and Toxicant Removal: Wetland processes which remove nutrients and toxicants (including heavy metals) from incoming water by trapping sediments, adsorption to soils high

in clay or organic content, or nitrification/denitrification.

Peak Flow Reduction: A wetland process in which the peak flow in a watershed can be reduced during major storm events that cause flooding. Also referred to as water storage when surface water that may otherwise cause flooding is stored in a wetland

Production/Export: Wetland processes which result in the production of plant material and its subsequent transport to other locations, including downstream surface waters.

Riparian Corridor: An area containing a stream or river that connects the AU to other wetlands or areas of permanent or seasonal water. It is characterized by the presence of vegetation that tolerates moist conditions. It must contain an intermittent or permanent stream or river.

Riverine Wetland Class: Wetlands that occur in floodplains and riparian corridors in association with stream or river channels.

Salmonid: Those fishes in the family *Salmonidae*, including trout, salmon, char, and whitefish.

Sediment Removal: The wetland processes which remove sediments from the water column by decreased water velocity and filtration.

Sediment: Material suspended in flowing water which ultimately settles to the bottom after the water loses velocity.

Slope Wetland Class: Wetlands that occur on hill or valley slopes. Principal water sources are usually groundwater seepage and precipitation.
Species Richness: The total number of species in a community or assemblage.

Strata: A layer of vegetation covering at least 20% of the ground within the boundary of its plant assemblage, and that is rooted in the AU. There are six potential strata: mosses and other ground cover; herbs; shrub; sub-canopy; canopy; and vines.

Tidal Fringe Wetland Class: Wetlands that occur on continental margins where marine waters are greater than 2 meters deep and more than 8 hectares (20 acres) in size.

Values: Wetland processes, characteristics, or attributes that are considered to benefit society.

Wildlife Habitat Suitability (General): The characteristics or processes present in a wetland that provide habitat for a broad range of animal species, based on the number of different habitats present.

APPENDIX 2

Key to HGM Wetland Classification

Key to HGM Wetland Classification:

Washington Wetland Type

Wetland Name: _____

Date: _____

1) Water levels in wetland usually controlled by tides
   No – go to 2 Yes – **Tidal Fringe**

2) Topography is flat and precipitation is only source (>90%) of water to the wetland
   No – go to 3 Yes – **Flat**

3) Wetland is contiguous with > 8 ha (19.8 ac) open water, and water is deeper than 2 m (6.6 ft) over 30% of open water area
   No – go to 4 Yes – **Lacustrine Fringe**

4) Open water is < 8 ha (19.8 ac) and > 2 m (6.6 ft) deep, but wetland is a fringe narrower than ½ the radius of open water
   No – go to 5 Yes – **Lacustrine Fringe**

5) Water flow in wetland is unidirectional on a slope, water is not impounded in the wetland
   No – go to 6 Yes – **Slope**

6) Wetland is located in a topographic valley with stream or river in the middle
   No – go to 9 Yes – go to 7

7) Have data showing area flooded more than once every 2 yrs.; or indicators of flooding are present:
- ❒ Scour marks common
- ❒ Recent sediment deposition
- ❒ Vegetation that is damaged or bent in one direction
- ❒ Soils have alternating deposits
- ❒ Vegetation along bank edge has flood marks

   No for all indicators – go to 9 Yes for any indicator – go to 8

8) Flood waters retained
   No – **Riverine Flow-through**
   Yes – **Riverine Impounding**
- ❒ Depression in floodplain
- ❒ Constricted outlet
- ❒ Permanent water

9) Has surface water outflow – **Depressional Outflow**
   Has no surface outflow – **Depressional Closed**

Rationale for Choices (based on best available information - what can be seen or previously known information about the wetland system):

APPENDIX 3

Wetland Functions Field Data Form

Wetland Functions Field Data Form – WSDOT's BPJ Characterization *

Project: _____ Date: _____

Wetland Name: _____ Biologist: _____

A. Flood Flow Alteration (Storage and Desynchronization)	Likely or not likely to provide. (State your rationale.)
1. Wetland occurs in the upper portion of its watershed. 2. Wetland is in a relatively flat area and is capable of retaining higher volumes of water during storm events, than under normal rainfall conditions. 3. Wetland is a closed (depressional) system. 4. If flowthrough, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris. 5. Wetland has dense woody vegetation. 6. Wetland receives floodwater from an adjacent water course. 7. Floodwaters come as sheet flow rather than channel flow.	
B. Sediment Removal	Likely or not likely to provide. (State your rationale.)
1. Sources of excess sediment (from tillage or construction) are present upgradient of the wetland. 2. Slow-moving water and/or a deepwater habitat are present in the wetland. 3. Dense herbaceous vegetation is present. 4. Interspersion of vegetation and water is high in wetland. 5. Ponding of water occurs in the wetland. 6. Sediment deposits are present in wetland.	

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* Adapted from the Highway Methodology Workbook Supplement for Wetland Functions and Values (COE, 1995).

C. Nutrient and Toxicant Removal

1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present upgradient of the wetland.
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season.
3. Wetland provides long duration for water detention.
4. Wetland has at least 30% areal cover of live dense herbaceous vegetation.
5. Fine-grained mineral or organic soils are present in the wetland.

Likely or not likely to provide.
(State your rationale.)

D. Erosion Control and Shoreline Stabilization

If associated with water course or shoreline.

1. Wetland has dense, energy absorbing vegetation bordering the water course and no evidence of erosion.
2. A herbaceous layer is part of this dense vegetation.
3. Trees and shrubs able to withstand erosive flood events are also part of this dense vegetation.

Likely or not likely to provide.
(State your rationale.)

E. Production of Organic Matter and its Export

1. Wetland has at least 30% areal cover of dense herbaceous vegetation.
2. Woody plants in wetland are mostly deciduous.
3. High degree of plant community structure, vegetation density, and species richness present.
4. Interspersion of vegetation and water is high in wetland.
5. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season.
6. Wetland has outlet from which organic matter is flushed.

Likely or not likely to provide.
(State your rationale.)

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* Adapted from the Highway Methodology Workbook Supplement for Wetland Functions and Values (COE, 1995).

F. General Habitat Suitability 1. Wetland is not fragmented by development. 2. Upland surrounding wetland is undeveloped. 3. Wetland has connectivity with other habitat types. 4. Diversity of plant species is high. 5. Wetland has more than one Cowardin Class, i.e., (PFO, PSS, PEM, PAB, POW, etc.) 6. Has high degree of Cowardin Class interspersion. 7. Evidence of wildlife use, e.g., tracks, scat, gnawed stumps, etc., is present	Likely or not likely to provide. (State your rationale.)
G. Habitat for Aquatic Invertebrates 1. Wetland must have permanent or evidence of seasonal inundation for this function to be provided. 2. Various water depths present in wetland 3. Aquatic bed vegetation present. 4. Emergent vegetation present within ponded area. 5. Cover (i.e., woody debris, rocks, and leaf litter) present within in the standing water area. 6. A stream or another wetland within 2 km (1.2 mi) of wetland.	Likely or not likely to provide. (State your rationale.)
H. Habitat for Amphibians 1. Wetland contains areas of seasonal and/or permanent standing water in most years. (Must be present for this function to be provided) 2. Thin-stemmed emergent and/or floating aquatic vegetation present within areas of seasonal and/or perennial standing water. 3. Wetland buffer < 40% developed, i.e., by pavement and/or buildings.	Likely or not likely to provide. (State your rationale.)

* Adapted from the Highway Methodology Workbook Supplement for Wetland Functions and Values (COE, 1995).

4. Woody debris present within wetland. 5. Lands within 1 km (0.6 mi) of wetland are greater than or equal to 40% undeveloped (e.g., green belts, forest, grassland, agricultural). 6. Other wetlands and/or an intermittent or perennial stream within 1 km (0.6 mi) of wetland.	Likely or not likely to provide. (State your rationale.)
I. Habitat for Wetland-Associated Mammals 1. Permanent water present within the wetland. (Must be present for this function to be provided.) 2. Presence of emergent vegetation in areas of permanent water. 3. Areas containing dense shrubs and/or trees are present within wetland or its buffer. 4. Interspersion between different strata of vegetation. 5. Interspersion between permanent open water (without vegetation) and permanent water with vegetation. 6. Presence of banks suitable for denning. 7. Evidence of wildlife use, e.g., dens, tracks, scat, gnawed stumps, etc., is present.	Likely or not likely to provide. (State your rationale.)
J. Habitat for Wetland-Associated Birds 1. Wetland has 30 to 50% shallow open water and/or aquatic bed classes present within the wetland. 2. Emergent vegetation class present within the wetland. 3. Forested and scrub-shrub classes present within the wetland or its buffer. 4. Snags present in wetland or its buffer. 5. Sand bars and/or mud flats present within the wetland.	Likely or not likely to provide. (State your rationale.)

* Adapted from the Highway Methodology Workbook Supplement for Wetland Functions and Values (COE, 1995).

6. Wetland contains invertebrates, amphibians, and/or fish. 7, Buffer contains relatively undisturbed grassland shrub and/or forest habitats. 8. Lands within 1 km (0.6 mi) of the wetland are greater than or equal to 40% undeveloped (e.g., green belts, forest, grassland, agricultural).	Likely or not likely to provide. (State your rationale.)
K. General Fish Habitat (*Must be associated with a fish-bearing water.*) 1. Wetland has a perennial or intermittent surface-water connection to a fish-bearing water body 2. Wetland has sufficient size and depth of open water so as not to freeze completely during winter. 3. Observation of fish. 4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter. 5. Spawning areas are present (aquatic vegetation and/or gravel beds).	Likely or not likely to provide. (State your rationale.)
L. Native Plant Richness 1. Dominant and codominant plants are native. 2. Wetland contains two or more Cowardin Classes. 3. Wetland has three or more strata of vegetation. 4. Wetland has mature trees.	Likely or not likely to provide. (State your rationale.)
M. Educational or Scientific Value 1. Site has documented scientific or educational use. 2. Wetland is in public ownership. 3. Parking at site is suitable for a school bus.	Likely or not likely to provide. (State your rationale.)

* Adapted from the Highway Methodology Workbook Supplement for Wetland Functions and Values (COE, 1995).

N. Uniqueness and Heritage

	Likely or not likely to provide. (State your rationale.)
1. Wetland contains documented occurrence of a state– or federally listed threatened or endangered species.	
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service, the WDNR's Natural Heritage Program, or WDFW's Priority Habitats and Species Program.	
3. Wetland is part of a National Natural Landmark designated by the National Park Service or a Natural Heritage Site designated by WDNR.	
4. Wetland has biological, geological, or other features that are determined rare by the local jurisdiction.	
5. Wetland has been determined significant by the local jurisdiction because it provides functions scarce for the area.	
6. Wetland is part of … ➢ an estuary, ➢ a bog, ➢ a mature forest.	

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* Adapted from the Highway Methodology Workbook Supplement for Wetland Functions and Values (COE, 1995).

APPENDIX 4

Wetland Functions and Values Form

(Can be copied for use in the appendices of a report)

Wetland Functions & Values Form

Wetland I.D. _____ Project: _____ Assessed by: _____

Cowardin Class: _____ Ecology Category: _____ Local Rating: _____ Wetland size: _____ Date: _____

Function/Value	Occurrence Y	Occurrence N	Rationale	Principal Function(s)	Comments
Flood Flow Alteration					
Sediment Removal					
Nutrient & Toxicant Removal					
Erosion Control & Shoreline Stabilization					
Production of Organic Matter and its Export					
General Habitat Suitability					
Habitat for Aquatic Invertebrates					
Habitat for Amphibians					
Habitat for Wetland-Associated Mammals					
Habitat for Wetland-Associated Birds					
General Fish Habitat					
Native Plant Richness					
Educational or Scientific Value					
Uniqueness and Heritage					