Idaho Interim Functional Assessment for Riverine Wetlands on the Floodplains of Low- to Moderate gradient, 2nd or 3rd Order Streams on Fine Textured Substrates

May 1999

Prepared By The
Idaho Wetland Functional Assessment Committee

Mabel Jankovsky-Jones, Committee Leader

DISCLAIMER

This interim functional assessment model is based upon expert opinion. The model has only limited field testing and has not been calibrated with real data. The model is meant to serve as an interim tool and may be revised based on field use and as other information becomes available.

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This functional assessment model has been developed to be used as an interim procedure to assess wetland functions pertaining to USDA producer requests for wetland manipulations as they relate to minimal effect and mitigation. Policy is described in the Third Edition, Amendment 2, November 1996 of USDA Natural Resources Conservation Service's National Food Security Act Manual.

This functional assessment model can also be used to assess wetland functions pertainent to applications for Department of the Army permits under Section 404 of the Clean Water Act as they relate to wetland impacts and mitigation.

Comments from the Committee

This committee was charged with development of an interim wetland function assessment procedure to implement the Wetland Provisions of the 1996 Federal Agricultural Improvement Reform Act of 1996 and Section 404 of the Clean Water Act. It was the desire of the committee to use Hydrogeomorphic (HGM) Evaluation Principles when developing the interim procedures. It should be understood by users of this model that the committee recognizes that some wetland functions are not adequately represented in this interim model, and thus, limitation on some projects and sites will occur. Furthermore, users should be aware that this is not an HGM model; rather, it is an interim assessment procedure to be utilized by Natural Resources Conservation Service (NRCS) and Army Corp of Engineers (ACOE) until HGM models are developed. However, for the vast majority of conversions within the defined wetland subclass, the committee is confident that this model will adequately assess wetland function losses and provide a basis for determining appropriate mitigation as well as assisting in quantifying threshold limits associated with NRCS minimal effect determinations.

This interim model was developed by an interagency committee consisting of:

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Subclass: Riverine wetlands on the floodplains of low- to moderate- gradient, 2nd or 3rd order streams on fine textured substrates.

Introduction:

This subclass includes montane, low- to moderate-gradient riverine wetlands. The wetlands occur in broad valleys and have fine textured sediments deposited by peak flows in the spring. Examples of this subclass are found along tributaries to Camas Creek in south-central Idaho, the broad valleys of southwest Idaho occupied by streams such as Diamond Creek, Thomas Fork, and Lanes Creek, and low gradient tributaries emptying into Cascade Reservoir in west central Idaho.

Functional Profile

Geomorphic setting:

The riverine subclass occurs in nearly level to gently sloping broad valleys on stream terraces, alluvial fans, bottom lands, and outwash plains. Surficial geology includes sand and gravelly sand of incised alluvial fans derived from local bedrock (Worl et al. 1991). Soils are deep, poorly drained and somewhat poorly drained loams, loamy coarse sands, sandy clay loams, and silty clay loams.

Ecological significance of geomorphic setting:
The water holding capacity of the soils is high within the deep rooting zone (60" or greater). The storage of water in the surface soil results in return of base flow to the stream during August and September providing continuous flows and corridors for aquatic species (fish).

Functions based on geomorphic setting:
The substrata of sands and gravels makes subsurface water storage and moderation of base (groundwater) flows important functions of this subclass.

Water Source and Climatic Setting:

Winter and spring weather patterns are influenced by westerly winds from the Pacific Ocean. This maritime influence weakens during summer months and continental climatic conditions prevail with air masses from the south producing thunderstorm activity. The area is considered semi-arid with average annual precipitation in the 12 to 22 inch range. Most of the precipitation is in the form of snow during the winter months. The frost-free period is 70 to 100 days (U.S. Department of Agriculture Soil Conservation Service, Ross and Savage 1967). Water enters riverine wetlands via run-off events and groundwater inputs. Run-off enters the

system via tributaries, and overbank flow. Not all wetlands in the subclass are flooded by overbank flows; however, most remain saturated for prolonged periods by groundwater. Groundwater enters primarily from stream recharge, but sideslope contributions may be significant during run-off periods.

Ecological significance of water source:
The seasonal saturation and subsequent drawdown in wetlands associated with the riverine subclass results in a diverse mosaic of plant communities. Sedges and rushes dominate moist swales (typically created by former channels) and may also occur along channels. Areas which drawdown earlier in the growing season are dominated by tufted hairgrass, tickle grass, and basin wildrye. Somewhat drier hummocks may have alkali sage, silver sage, and grass species which are often associatated with uplands. Stands of willow including yellow willow, whiplash willow, and coyote willow are of occasional occurrence and become established along channels on bars and banks. The arrangement of plant communities provides habitat for a number of bird species including bank swallows, redwing blackbirds, fickers, snipes, avocet, phalorope, and killdeer. Shrublands may provide habitat for yellow warblers and other neotropical migrants. Sandhill crane and long-billed curlew may use seasonally saturated grasslands. The meadows and low shrublands often provide foraging areas for falcons, northern harriers, and red tail hawks. The stream corridors and associated willow stands may provide migration corridors and hiding cover for mule deer and other mammal species (Idaho Conservation Data Center 1997, Groves et al. 1997).

Functions based on water source and climatic setting:
The presence of these wetlands in relatively arid landscapes make spatial structure of habitat, interspersion and connectivity, and maintenance of the characteristic plant community important habitat functions.

Hydrodynamics:

Peak flows in riverine wetlands occur in spring and early summer. Water moves from valley walls towards the channel, from the channel into the floodplain during overbank events, and downstream via channels or overbank flows. In the case of overbank events water may leave wetlands via surface flow to the channel. Water stored in the subsurface may leave via flows through the substrata zone to the channel, percolation into deeper groundwater aquifers through permeable layers, or by evapotranspiration. Not all wetlands of this subclass experience inundation by floodwater, but remain saturated for long periods due to groundwater.

Surface runoff is slow. Available water capacity of the soils is moderate to high. Permeability is moderately slow in the subsoil and rapid in the substratum. The water table ranges from 1 to 5 feet below the surface in the summer.

Channels of this subclass with an unaltered hydrograph are meandering due to low gradient and the fine textured substrates. Multiple channels may be present. Historically, beaver played a

role in channel evolution.

Ecological significance of hydrodynamics:
The natural hydrograph of most riverine wetlands in this subclass has been altered by diversions and small dams. Additionally, wells remove subsurface water from the system. Channelization, placement of fill, and removal of vegetation have altered how water moves across the floodplain. Channel reaches isolated from the natural floodplain are subject to increased velocities and tend to incise due to the fine textured soils. Incision may result in permanent loss of shallow water tables, and streamside and wetland vegetation may be replaced with upland species.

Functions based on hydrodynamics:
The ability of the wetlands in this subclass to receive and store water make long- and short-term surface water storage, dissipation of energy, nutrient cycling, and retention of particulates important functions.

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Table of Functions and Variables for riverine subclass.								
	Dynamic syrface h20 storage	Long-term surface H20 storage	Dissipation of energy	Sediment and nutrient retention and removal	Maintain characteristic plant community	Maintain detrital biomass	Maintain habitat interspersion and connectivity	Maintain characteristic bird populations
Vfreq	X		X	X			X	
Vinund	X							
Vmacro	X	X						
Vxsec	X	X					X	
Vrough	X		X					
Vmicro	X		X	X			X	
Vredvel			X					
Vlitter				X		X		
Vcwd						X		
Vtotcov				X			X	
Vwetuse				X	X		X	X
Vbuff					X			X
Vpdom					X			
Vsnags						X		
Vstrata								X
Vmosaic								X
Vbirduse								X
Vsurwat		X						
Vregen					X			
Vratio					X			

Variables for assessment of wetland functions in riverine wetlands on the floodplains of low- to moderate gradient, 2nd or 3rd order streams on fine textured substrates.

Assessment Area_____ Date_____

Surveyor(s) _____ Purpose: 9 Conversion 9 Mitigation

_____

Model Variables	Indicators	Pre-	Post-	Comments and notes
V_{FREQ}: frequency of overbank flooding	Soil survey indicates flooding or ponding frequency is frequent or common (occurs, on the average, more than once in 2 years).	1.0	1.0	
	Soil survey indicates flooding or ponding frequency is occasional (occurs, on the average, once or less in 2 years).	0.5	0.5	
	Soil survey indicates flooding or ponding frequency is rare (unlikely but possible under unusual weather conditions).	0.1	0.1	
	Soil survey indicates flooding or ponding frequency is none (flooding is not probable).	0.0	0.0	
V_{INUND}: average depth of inundation	Inundation > 6 inches.	1.0	1.0	
	Inundation between surface and 6 inches.	0.5	0.5	
	No indication of surface inundation.	0.0	0.0	
V_{MACRO}: macro-topographic relief	Average number of macrotopographic features (large-scale relief in the form of oxbows, meander scrolls, abandoned channels, and backswamps) per cross-section transect across the floodplain is $2.	1.0	1.0	
	Average number of macrotopographic features per cross-section transect across the floodplain is $ 1 and < 2.	0.5	0.5	
	Average number of macrotopographic features per cross-section transect across the floodplain is > 0 and < 1.	0.1	0.1	
	There are no macrotopographic features.	0.0	0.0	
V_{XSEC}: ratio of floodplain width (including stream) to bankfull width	Ratio is $ 7.	1.0	1.0	
	Ratio is $ 3 and <7.	0.5	0.5	
	Ratio is > 1 and < 3.	0.1	0.1	
	Ratio is 1.	0.0	0.0	

V_{VROUGH}: vegetation roughness	Woody vegetation (including coarse woody debris) comprises greater than 75% of total canopy cover.	1.0	1.0	
	Woody vegetation (including coarse woody debris) comprises between 25 and 75% of total canopy cover.	0.5	0.5	
	Woody vegetation (including coarse woody debris) comprises less than 25% of total canopy cover or dense herbaceous vegetation present.	0.1	0.1	
	No woody vegetation (including coarse woody debris) present.	0.0	0.0	
V_{MICRO}:structural roughness provided by microtopographic relief (microtopographic features may be present within macrotopographic features)	Greater than 50% of Wetland with micro-topography or small depressions (10 ft or less in diameter) which store surface water. Swales or other areas with low topographic relief which allow water to be stored or shrub or ant hummocks which allow water to be stored in vegetated water tracks are present and capable of holding ponded water.	1.0	1.0	
	Wetland with lesser amounts (25-50%) of surface topography which stores surface water. Hummocking accelerated by trampling, water tracks unvegetated, and/or soils compacted.	0.5	0.5	
	Wetland is flat and water essentially flows as a sheet.	0.0	0.0	
V_{REDVEL}: reduction in velocity	Sediment deposits, silt deposits on vegetation, buried root collars, stacked wracks of debris, directionally bent vegetation present. Site well vegetated and erosion of soils not evident. Shrubs and trees with significant cover (>25%).	1.0	1.0	
	Sediment deposits, silt deposits on vegetation, buried root collars, stacked wracks of debris, directionally bent vegetation present. Site well vegetated primarily by herbaceous species and erosion of soils not evident. Herbaceous species dominant.	0.5	0.5	
	Sediments scoured from site, coarse woody debris moved about (but not stacked), some erosion of soil surface indicating less velocity reduction than above. Site well vegetated but a herbaceous layer may be absent due to shading and scouring.	0.1	0.1	

	Strong evidence of site degradation by channel scouring, exposed root masses, or exposure of bare soil. Site may be sparsely vegetated	0.0	0.0	
V_{SURWAT}: Presence of surface water	Frequent flooding or ponding (once or more every two years) as indicated on soil survey, drift lines, direct observation of flooding or ponding, gage data, annual understory absent and Hydrologic soil group C or D (low permeability).	1.0	1.0	
	Flooding or ponding occurs less than once in two years as indicated by gage date, soil survey (occasional/common) and Hydrologic soil group C or D.	0.5	0.5	
	Flooding or ponding rare (not possible except under unusual weather conditions). Hydrologic soil group C or D.	0.1	0.1	
	No evidence or indicators of flooding or ponding or hydrologic soil group not C or D.	0.0	0.0	
V_{LITTER}: Herbaceous plant detritus	Litter with 50% to continuous cover. (H&C have microbial and include humus stratum, fine woody debris, and floating, submerged, and herbaceous emergents).	1.0	1.0	
	Litter with 10-50% cover.	0.5	0.5	
	Litter cover present, but sparse (<10% cover).	0.1	0.1	
	No litter present.	0.0	0.0	
V_{TOTCOV}: total cover of herb, shrub, and tree strata	The combination of herbaceous and shrub cover greater than 60%.	1.0	1.0	
	The combination of herbaceous and shrub cover 20-60%.	0.5	0.5	
	The combination of herbaceous and shrub cover < than 20%.	0.1	0.1	
	Plants absent or very sparse (<5% cover).	0.0	0.0	
V_{WETUSE}:Landuse within the wetland	Wetland is part of an acre or larger block of land which is non-fragmented and has few non-natural breaks. No evidence of agricultural or physical impacts.	1.0	1.0	
	No tillage in saturated wetlands. Outermost zone minimally impacted by light grazing.If some agricultural uses (e.g. haying, grazing) occur in the wetland and surrounding landscape, no compaction from equipment or evidence of trampling.	0.5	0.5	

	Wetland receives conventional tillage; outermost zone tilled or grazed.	0.1	0.1	
	Wetland severely disturbed by tillage, grazing, and/or water development. Restoration potential questionable and will require replanting and hydrologic restoration.	0.0	0.0	
V_{PDOMIN}:number of dominant (>5% cover) wetland plant species	Number of dominant wetland plant species is greater than 8.	1.0	1.0	
	Number of dominant wetland plant species is 5 to 7.	0.75	0.75	
	Number of dominant wetland is 3 to 4.	0.5	0.5	
	Number of dominant wetland plant species is 1 to 2.	0.25	0.25	
	Site devoid of vegetation.	0.0	0.0	
V_{REGEN}: herb and shrub species present as clonal shoots, seedlings, or saplings	Seedlings, saplings, and/or clonal shoots present; reproduction dominated by native wetland plant species. Active channel bar formation suitable to the establishment of willow species.	1.0	1.0	
	Seedlings, saplings, and/or clonal shoots of both native and non-native species. Active channel bar formation, but bars being pioneered by weedy and/or non-native annuals.	0.5	0.5	
	Significant regeneration by non-native (and/or increaser) species due to ground disturbing activities or isolation of floodplain due to channel entrenchment. Minimal channel bar development, channel entrenched with steep cut banks.	0.1	0.1	
	No seedling/sapling and/or clonal shoots present.	0.0	0.0	
V_{BUFF}:zone surrounding wetland that protects its structural and functional integrity	Upland buffer (of at least 50 feet) is in native vegetaion with almost no disturbance.	1.0	1.0	
	Upland buffer (of at least 50 feet) is in native vegetation with light to moderate grazing.	0.5	0.5	
	Upland buffer (of at least 50 feet) receives conventional tillage or heavy grazing or is in non-native monoculture.	0.1	0.1	
	Urban, semi-pervious, or impervious surfaces immediately adjacent to the site.	0.0	0.0	

V_{RATIO}:ratio of native to non-native plant species	3 of the 4 most abundant plant species in the wetland are native species and/or 74-100% of the species surveyed are native species.	1.0	1.0	
	2 of the 4 most abundant plant species in the wetland are native species and/or 50-73% of the species surveyed are native species.	0.75	0.75	
	1 of the 4 most abundant plant species in the wetland are native species and/or 25-50% of the species surveyed are native species.	0.5	0.5	
	None of the 4 most abundant plant species in the wetland are native species; however, at least 1-25% of the species surveyed are native species.	0.1	0.1	
	Riparian corridor and floodplain unvegetated or dominated by planted or escaped cultivars.	0.0	0.0	
V_{SNAGS}: number of standing dead trees	Standing dead trees 5 per acre or more.	1.0	1.0	
	Standing dead trees 3 to 5 per acre.	0.5	0.5	
	Standing dead trees 1 to 3 per acre.	0.1	0.1	
	No standing dead trees.	0.0	0.0	
V_{CWD}: coarse woody debris	10 or more logs per acre greater than 6" diameter and longer than 4'.	1.0	1.0	
	5-9 logs per acre greater than 6" diameter and longer than 4'.	0.5	0.5	
	1-4 logs per acre greater than 6" diameter and longer than 4'.	0.1	0.1	
	No coarse woody debris.	0.0	0.0	
V_{MOSAIC}: number and proportion of cover types within the wetland	Wetland includes 3 or more vegetation classes based on Cowardin's classification or 3 or more cover types within a single vegetation class.	1.0	1.0	
	Wetland with 2 or more vegetation classes based on Cowardin's classification or 2 or more cover types within a single vegetation class.	0.5	0.5	
	Vegetation absent, a monoculture, or essentially a single plant community with little diversity.	0.1	0.1	

	Vegetation as above with little possibility of restoration or consisting of planted cultivars.	0.0	0.0	
V_{STRATA} : Number and attributes of vertical strata of vegetation	3 or more vertical strata evenly spaced throughout the wetland.	1.0	1.0	
	2 vertical strata evenly spaced throughout the wetland.	0.5	0.5	
	1 vertical strata dominating wetland area.	0.1	0.1	
	No vertical strata.	0.0	0.0	
$V_{BIRDUSE}$: number of species using the area within the wetland	Wetland used by 10 or more species of birds. Use nests, calls, tracks, feathers, skeletons, and field sightings.	1.0	1.0	
	Wetland used by 5 to 9 species of birds.	0.5	0.5	
	Wetland used by less than 5 species of birds.	0.1	0.1	
	No bird use evident.	0.0	0.0	

DEFINITION OF FUNCTIONS AND FUNCTIONAL INDEX WORKSHEETS

HYDROLOGIC FUNCTIONS

Function: DYNAMIC SURFACE WATER STORAGE

Definition: Capacity of a wetland to detain moving water from overbank flow for a short duration when the stream flow is outside its channel; associated with moving water from overbank flow and/or upland surface water inputs by overland flow or tributaries.

Effects On-Site: Replenishes soil moisture; import/export of materials (*i.e.*, sediments, nutrients, contaminants); import/export of plant propagules; provides conduit for aquatic organisms to access wetland for feeding, recruitment, etc.

Effects Off-Site: Reduces downstream peak discharge; delays downstream delivery of peak discharges; improves water quality through storage and retention of particles and solutes

Condition	INDICES OF VARIABLES						Index of Function = [Vfreq x Vinund x Vxsec x (Vmacro + Vmicro + Vrough)/3]$^{1/4}$
	Vfreq	Vinund	Vmicro	Vmacro	Vxsec	Vvrough	
Pre-project							
Post-project							
Comments:							

Function: DISSIPATION OF ENERGY

Definition: Allocation of the energy of water to other forms as it moves through, into, and out of the wetland as a result of roughness associated with large woody debris, vegetation structure, micro- and macro-topography, and other obstructions.

Effects on-site: Increase deposition of suspended material; increases chemical transformations and processing due to longer residence time.

Effects off-site: Reduction in downstream peak discharge, delays delivery of peak discharges, improves water quality, and reduces erosion to river banks and floodplains.

Condition	Indices of variables				Index of Function = (Vmicro x Vredvel x Vfreq x Vrough) $^{1/4}$
	Vmicro	Vredvel	Vfreq	Vrough	
Pre-project					
Post-project					
Comments:					

Function: LONG-TERM SURFACE WATER STORAGE

Definition: Capacity of a wetland to temporarily store surface water for long durations. Source of water may be overbank flow, direct precipitation, or upland sources such as overland flow, channel flow, and subsurface flow. Storage is associated with standing water.

Effects on-site: Maintains hydric soils and wetland plant species. Supports utilization of wetland by aquatic species.

Effects off-site: Capture of ground and surface water to maintain delivery of water to downstream sources throughout the growing season. Stores and retains particulates to maintain water quality.

Condition	INDICES OF VARIABLES			Index of Function = [Vsurwat * (Vxsec + Vmacro)/2]1/2
	Vsurwat	Vxsec	Vmacro	
Pre-project				
Post-project				
Comments:				

BIOGEOCHEMICAL FUNCTIONS

Function: SEDIMENT AND NUTRIENT RETENTION AND REMOVAL

Definition: The ability of the wetland to contribute to local or regional water quality by the removal of imported nutrients, contaminents, and other elements or compounds.

Effects on-site: Nutrients and contaminents in surface and/or ground water that come into contact with sediments and vegetation are either removed over the long term by sedimentation or are transformed into biogeochemically benign compounds. Sediment accumulation contributes to the nutrient capital of an ecosystem. Deposition increases surface elevation and changes topographic complexity. Organic matter may also be retained for decomposition, nutrient recycling, and detrital food web support.

Effects off-site: Constituents that undergo removal and concentration in the wetland, regardless of source, reduce downstream loading. Reduces stream sediment load and entrained woody debris that would otherwise be transported downstream.

Condition	Indices of Variables					Index of function = (Vfreq +Vmicro + Vlitter + Vtotcover+vwetuse)/5
	Vfreq	Vmicro	Vlitter	Vtotcover	Vwetuse	
Pre-project						
Post-project						
Comments:						

HABITAT FUNCTIONS

Function: MAINTAIN CHARACTERISTIC NATIVE PLANT COMMUNITY

Definition: Species composition and physical characteristics of living plant biomass. The emphasis is on the location dynamics and structure of the plant community within the wetland complex. This is evidenced by the dominant species of shrubs, seedlings, saplings and ground cover, and by the physical characteristics and successional status of vegetation.

Effects on-site: Converts solar radiation and carbon dioxide into complex organic compounds that provide energy to drive food webs. Provides seeds and propagules for regeneration.

Provides habitat diversity for nesting, resting, refuge, and escape cover for animals. Creates microclimatic conditions that support completion of life histories of plants and animals. Creates roughness that reduces velocity of flood waters. Provides organic matter for soil development and soil related nutrient cycling processes.Creates both long-term and short-term habitat for resident or migratory animals.

Effects off-site: Provides a source of seeds and propagules to maintain species composition and/or structure of adjacent wetlands and supplies propagules for colonization of near-by degraded systems. Provides food and cover for animals from adjacent ecosystems. Provides corridors (migratory pathways) between habitats, enhances species diversity and ecosystem stability, and provides habitat and food for migratory and resident animals. Supports primary and secondary production in associated aquatic habitats. Contributes leaf litter and coarse woody debris habitat for animals in associated aquatic habitats.

Condition	Indices of Variables					Index of Function = $[(Vpdomin + Vregen + Vbuff + Vwetuse)/4 \times (Vratio)]^{1/2}$
	Vpdomin	Vregen	Vbuff	Vwetuse	Vratio	
Pre-project						
Post-project						
Comments:						

Function: MAINTAIN DETRITAL BIOMASS

Definition: The production, accumulation, and dispersal of dead plant biomass of all sizes. Sources may be on-site or upslope and upgradient. Emphasis is on the amount and distribution of standing and fallen woody debris.

Effects on-site: Provides the primary resources for supporting detrital based food chains, which support the major nutrient-related processes (cycling, export, import) within wetlands. Provides important resting, feeding, hiding, and nesting sites for animals of higher trophic levels. Provides surface roughness that decreases velocity of floodwaters. Retains, detains, and provides opportunities for *in situ* processing of particulates. Primarily responsible for organic composition of soil.

Effects off-site: Provides sources of dissolved and particulate organic matter and nutrients for downstream ecosystems. Contributes to reduction in downstream water quality through

particulate retention and detention.

Condition	Indices of Variables			INDEX OF FUNCTION = (Vsnag + Vcwd + Vlitter)/3
	Vsnag	Vcwd	Vlitter	
Pre-project				
Post-project				
Comments:				

Function: MAINTAIN HABITAT INTERSPERSION AND CONNECTIVITY

Definition: The capacity of a wetland to permit aquatic organisms to enter and leave the wetland via permanent or ephemeral surface channels, overbank flow, or unconfined hyporheic gravel aquifers. The capacity of a wetland to permit access of terrestrial or aerial organisms to contiguous areas of food and cover.

Effects on-site: Provides habitat diversity. Contributes to secondary production and complex trophic interactions. Provides access to and from wetland for reproduction, feeding, rearing, and cover. Contributes to completion of life cycles and dispersal between habitats.

Effects off-site: Provides corridors for wide-ranging or migratory species. Provides refugia for plants and animals. Provides conduits for dispersal of plants and animals to other areas.

Condition	Indices of Variables					Index of Function = (Vfreq + Vxsec +Vmicro +Vtotcov+ Vwetuse)/5
	Vfreq	Vxsec	Vmicro	Vtotcov	Vwetuse	
Pre-project						
Post-project						
Comments:						

Function: MAINTAIN CHARACTERISTIC BIRD POPULATIONS

Definition: The abundance and species richness of birds is related to habitat complexity because birds have evolved to fill most available terrestrial niches. They partition habitats temporally (day versus night feeders), spatially (ground feeders, mid- and top-canopy feeders), and trophically (frugivores, insectivores, piscivores). Birds are sensitive to alterations in the structure and function of wetland ecosystems. Species richness and relative abundance can be measured. Bird richness increases with: vegetation/open water interspersion, increased layers of vegetation, and complexes of small and diverse wetlands.

Effects on-site: Maintain habitat for birds that has characteristic species composition, abundance, and structure containing diversity, nesting, resting, refuge, and escape cover.

Effects off-site: Maintain corridors between habitat islands and landscape biodiversity.

Condition	INDICES OF VARIABLES					Index of Function= (Vstrata + Vmosaic + Vbirduse + Vbuff+Vwetuse)/5
	Vstrata	Vmosaic	Vbirduse	Vbuff	Vwetuse	
Pre-project						
Post-project						
Comments:						

Worksheet for Calculating Mitigation Acres Required

Assessment Area_____Date_____Surveyor(s) _____

Comparison of Conversion site to Mitigation Site													
Function	Loss due to conversion			Mitigation site: **before** construction/restoration/manipulation				Mitigation site: **after** construction/restoration/ manipulation				(12) Uncertainty Factor (must be$1)	(13) Final acreage
	(1) FCI	(2) Area	(3) FCU	(4) Initial FCI	(5) Area	(6) FCU	(7) Target FCU = (col. 3 + col. 6)	(8) Planned FCI	(9) Area	(10) FCU	(11) FCU gained = (col. 10 - col. 7)		
Dynamic surface water storage													
Long term surface water storage													
Dissipation of energy													
Sediment and nutrient retention and removal													
Maintain characteristic plant community													
Maintain detrital biomass													
Maintain habitat interspersion and connectivity													
Maintain characteristic bird populations													

Chart Notes

FCI=Functional Capacity Index; FCU=Functional Capacity Units

Column 1:FCI after conversion=(Pre-project FCI-Post-project FCI).

Columns 4,8: FCI for mitigation site for pre- and post- mitigation. For column 4, FCI = 0 if creation site.

Columns 2,5,9: Area of the wetland or mitigation site being assessed.

Column 7: Target FCU=Column 3 + Column 6; this is your project goal to create or restore a wetland equal to this FCU.

Column 11: Column 10-Column 7; if this = 0 then functions are replaced; if > 0 then functions are exceeded; if < 0 then functions are not replaced and mitigation site is not adequate. If mitigation is inadequate choose another site (or additional acres) and begin calculations in column 4.

Column 12: Option to include Uncertainty Factor ($1) to account for lag time and scientific uncertainty.

Column 13: Final mitigation acreage=Mitigation Area X Uncertainty Factor (Column 9 X Column 12).