WVWRAM Restoration Supplement *Version 1.0*

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Contents

Cover photo credits: Green heron by Dario Taraborelli; Tea Creek wetland/floodplain complex by Sindupa DeSilva; Swamp milkweed by Elizabeth Byers.

1. Introduction

This document is a supplement to the WVWRAM User Manual and WVWRAM Reference Manual. The information presented in this document is intended to assist restoration professionals with designing and scoring their wetland restoration projects. The WVWRAM Reference Manual contains significantly more detail on each metric, including all of the equations used to calculate the WVWRAM score. Please note that the WVWRAM Reference Manual equations are used to calculate regulatory function, wetland condition, and state land acquisition scores. The integer scores in the WVWRAM Reference Manual are divided by 85 to arrive at the decimal scores that make up the regulatory function score. In this document, the division has already been done, and the subscores shown are the regulatory function scores. Note also that while many of the subscores are simply added, some are combined with other metrics and the maximum or minimum is taken, or a cap is applied. The way subscores are summed up to arrive at the regulatory score is summarized in Section 9 of this document "Summary of point breakdowns" and described in detail in the WVWRAM Reference Manual.

1.1 Limitations and constraints of WVWRAM

WVWRAM, including both GIS and rapid field assessment of wetland functions, is not intended to answer all questions about wetlands. The following are important limitations:

- WVWRAM does not change any current procedures for determining wetland jurisdictional status or delineating wetland boundaries.

- WVWRAM does not assess all possible functions, values, and services that a wetland might support, but rather focuses on water quality, flood attenuation, and habitat/ecological integrity.

- WVWRAM is not intended to address the important question, "Is a wetland mitigation project in a *geomorphically appropriate* location?" That is, is the project sited in a location where key processes can be expected to adaptively sustain the wetland and wetland functions?

- WVWRAM is an additional tool for monitoring mitigation banks or other wetland restoration projects but does not replace more detailed performance criteria or standards required for release. WVWRAM scores may not be sufficiently sensitive to detect, in the short term, mild changes in some functions. Quantifying smaller changes will often require more intensive measurement protocols.

- The numeric estimates WVWRAM provides of wetland functions are not actual direct measures of those attributes. Rather, they are estimates of those attributes arrived at by using standardized scoring models that systematically combine well-accepted indicators that have been validated by other states or through peer-reviewed research.

2. How do WVWRAM restoration scores differ from impact scores?

2.1 The Project Area is the primary Assessment Area for restoration assessments.

a. Allows for better change/trajectory detection, with some loss in repeatability. A WVWRAM score for the Project Area wetlands should be submitted with each monitoring report.

b. If there is a surface water connection between the mitigation wetland and existing contiguous wetlands, then the hydrology metrics (floodplain, dominant water source, outlet, connection to stream continuum, hydrology stressors) should be filled out for the entire Wetland Unit rather than for just the project area.

c. If the Project Area is part of a larger Wetland Unit, i.e., if contiguous wetlands exist, then a baseline WVWRAM and final release WVWRAM should be conducted on contiguous wetlands to ensure they have not been drained, flooded, invaded, or otherwise degraded by the restoration project. Credits may be reduced if contiguous wetlands are damaged by the restoration project.

2.2 The GIS-derived Site Biodiversity Rank is not applied to restoration scores.

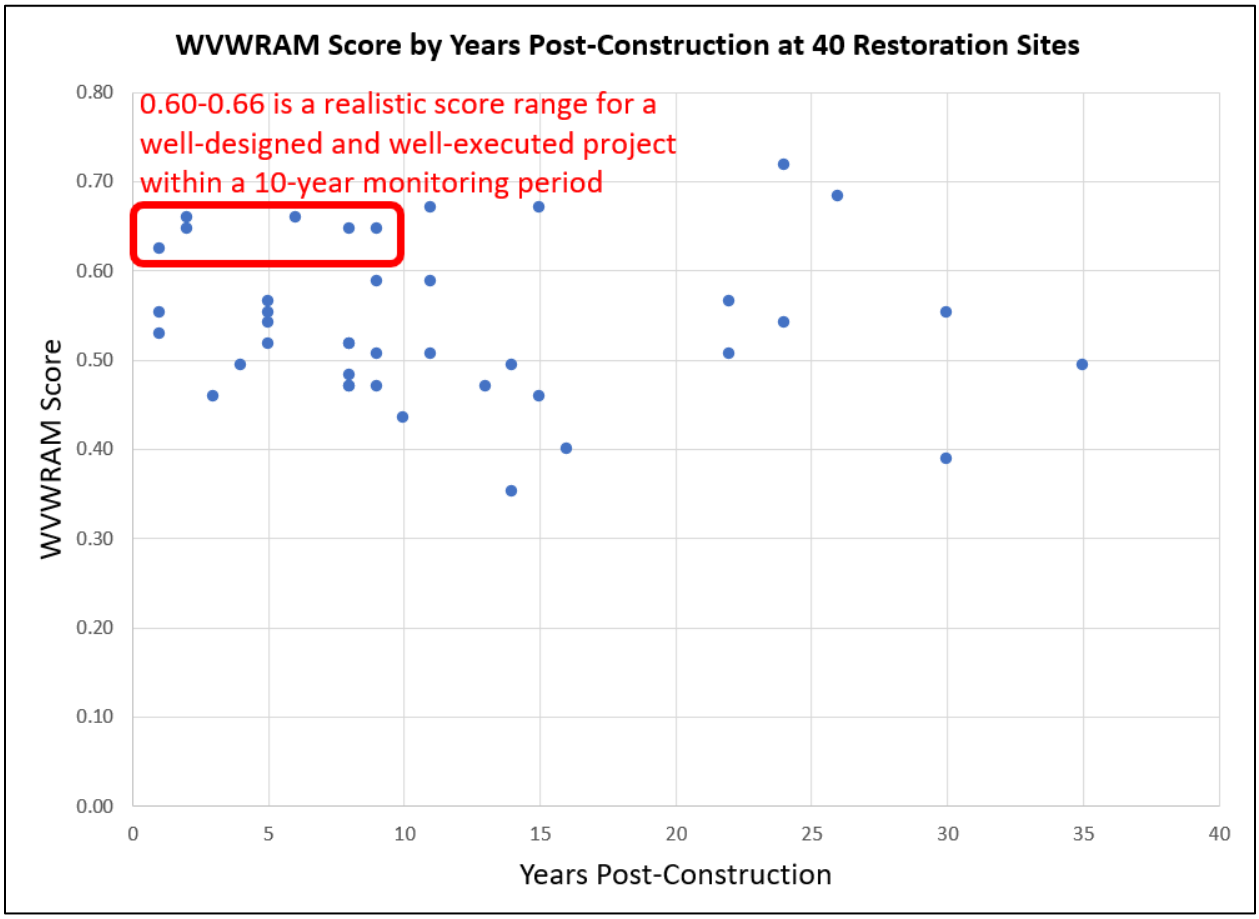
a. Pre-existing rare elements are not counted toward restoration scores.

b. If rare elements move in naturally (without assistance), and if they are documented and accepted into the Natural Heritage database, they may be counted toward the restoration score in the field-based Site Biodiversity Rank. This will not happen often.

3. Expected WVWRAM scores at mitigation sites

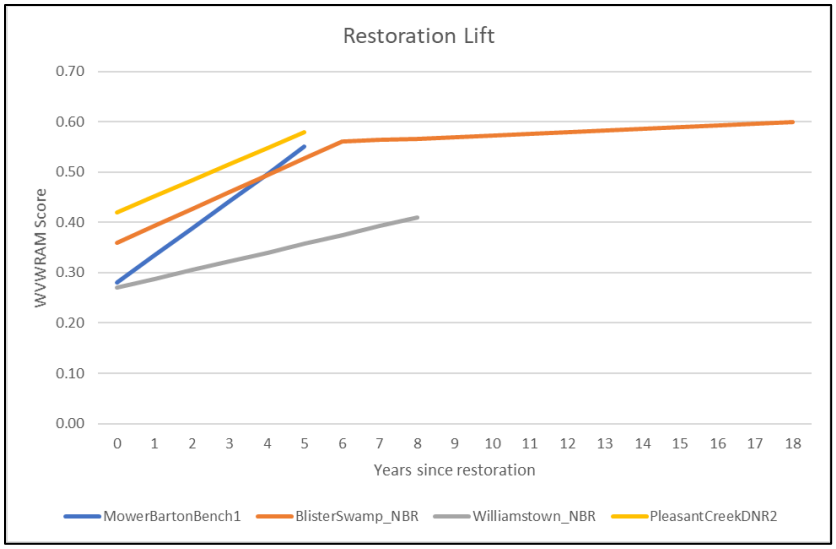
3.1 What is the expected range of re-establishment lift over time?

The range for 39 sites is 0.35 – 0.68. A realistic target for well-designed and constructed re-establishment sites within a 10-year monitoring period is 0.60-0.66.



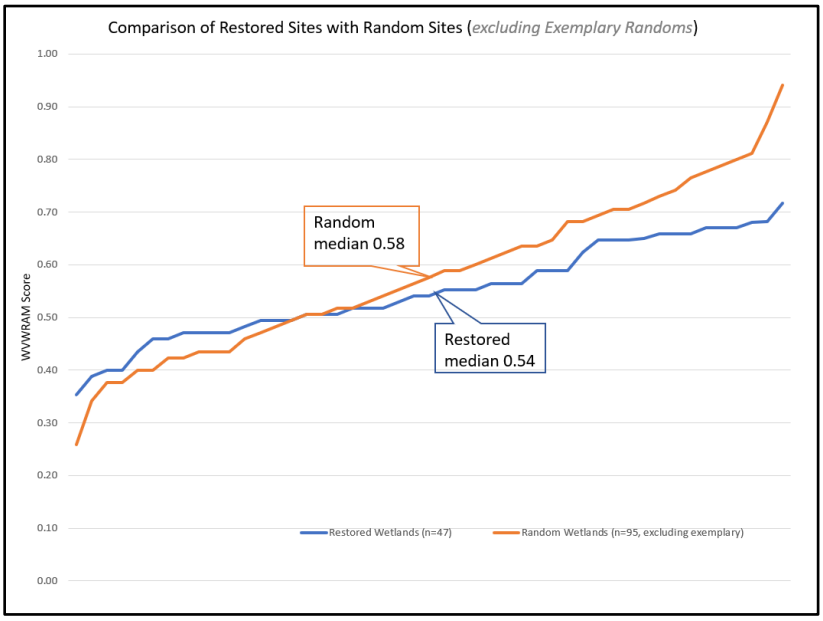
3.2 What is the expected range of enhancement lift over time?

We anticipate that a typical lift for enhancement will be about 0.2-0.3. The range for 4 known sites is lower, at 0.14 - 0.27. None of these are mitigation sites; they are all voluntary restorations. We anticipate that mitigation sites will score higher, since they will be tied to performance standards.



3.3 How do restored sites compare to randomly selected sites?

WVDEP has begun a statewide probabilistic monitoring program for wetlands. These randomly selected wetlands are representative of West Virginia wetlands as a whole, including a wide range of wetland conditions from natural to highly disturbed sites on both public and private land. Restored sites have lower median scores and a narrower range of scores as compared to randomly selected wetlands. As our state's wetland restoration expertise increases, we expect restored wetlands to eventually score higher than randomly selected wetlands.



4. Which metrics are a function of location rather than design?

Certain metrics are largely a function of location and do not generally depend on restoration design. In some cases, however, certain metrics such as location in a floodplain can be influenced by restoration design. Note that the scores below for individual metrics are not strictly additive – see the WVWRAM Reference Manual for how these scores are rolled up into a final score.

Soil and Structure

- Karst and Limestone-influenced Wetlands (0.035)

Hydrology

- Floodplain Location (changes metric roll-up strategy; floodplains can score 0.035 higher)
- Headwater Location (0.012)
- Impaired Waters Impacting Wetland (0.024)
- Wetland Discharges to Impaired Waters (0.012)
- Runoff from Contributing Watershed (0.024)
- Surface Water Outflow (0.047)

Buffer Condition and Extent

- Discharges to Wetland (0.024)
- Roads and Railroads (0.024)
- Landscape Integrity (0.035)

Landscape or Watershed Scale

- Aquatic Area Abundance (0.024)
- Biodiversity Rank of 12-digit HUC (0.012)
- Location in a DNR Conservation Focus Area (0.012)
- Land Use Disturbance in Contributing Watershed (0.012)
- Water Quality Issues in 12-digit HUC (0.012)
- Mean Slope of Contributing Watershed (0.024)
- Wetland Breeding Bird Occupancy (0.012)
- Watershed Position (0.012)
- Watershed Wetland Size and Uniqueness (0.012)

5. Which restoration actions result in a positive change to the WVWRAM score?

The WVWRAM regulatory score is built from 65 metrics that have both GIS and field components. Each metric relates to specific physical, chemical, or biological functions of the wetland. Changes or improvements to hydrology, vegetation, soils, buffer, and stressors will change the value of specific metrics. Some metrics, especially those related to siting (e.g., landscape context, geology, topographic position) will not improve based on restoration actions. The actions and metrics that can improve WVWRAM scores, and their location on the field forms, are presented below. The potential score increases are based on the low-to-high range of scores of actual sites currently in the WVWRAM database of 230 field-sampled sites. Although each metric is scored separately, many of the metrics are interconnected and as one goes up, others will also go up. For example, re-connecting a wetland to the adjacent stream will affect multiple metrics.

Vegetation improvement
0.4 (floodplain) or 0.29 (non-floodplain) maximum lift
Note that vegetation is also the most reliable indicator of successful improvements to hydrology/soil.

Vegetation metrics can be changed by rehabilitation or enhancement activities.

- Re-vegetate; vegetation changes from none to vegetated (0-0.012)
- Create PEM on marl (0-0.035)
- Create vegetated wetland 10m wide that fringes open water (0-0.012)
- Improve floristic quality (0-0.129)
- Create multiple natural vegetation types: horizontal interspersion (0-0.035)
- Remove livestock or stop mowing: persistent ungrazed veg (0-0.059)
- Create several strata in forested wetland (e.g., remove herbivory to restore shrub/herb layer); vertical structure (0-0.035)
- Plant woody veg (0-0.059)

Fix hydrology, expose hydric soil, add micro- and macro-topography
0.34 (floodplain) – 0.28 (non-floodplain) maximum lift

Abiotic metrics can be changed by rehabilitation or enhancement activities.

- Expose buried hydric soils containing clay or organic material near surface, or have them develop naturally after fixing hydrology (0-0.035)
- Create depressions that store water for several days after a storm (0-0.059)
- Create a diffuse and irregular upland-wetland boundary (0-0.012)
- Create microtopography (0-0.024)
- Remove soil stressors/compactors such as ATVs, livestock (0-0.024)
- Add structural patches such as coarse woody debris (0-0.035)
- Re-connect wetland to adjacent stream (0-0.024)

- Increase portion of wetland that is flooded by stream (0-0.024)
- Remove hydrologic stressors to restore intact hydrology (0-0.071)
- Create small (a few to tens of square yards) areas of surface water (0-0.012)
- Increase the proportion of wetland with seasonal ponding/saturation (0-0.035)
- Increase the complexity of the wetland-stream boundary (0-0.024)
- Proximity to other wetlands and aquatic resources (0-0.024)

Buffer rehabilitation
0.08 maximum lift (all wetlands)
Note that buffers are explicitly included in the SWVM, and only their direct impact on the wetland, e.g. sedimentation, discharges, etc. are included here.

Individual buffer metrics that can be changed by restoration, with raw points:

- Restore natural vegetation and remove stressors from 10m perimeter (0-0.024)
- Restore natural vegetation and remove stressors from 50m water quality buffer (0-0.035)
- Restore natural vegetation and remove stressors from 300m wildlife buffer (0-0.024)

6. Where do restoration actions appear on the WVWRAM datasheet?

6.1 Vegetation improvement

(Note that vegetation is also the most reliable indicator of successful improvements to hydrology/soil)
The maximum predicted increase in WVWRAM score for this group of actions is 0.40 for floodplain wetlands and 0.29 for non-floodplain wetlands.

Plant Native Species, Remove Invasive Plants

Improve floristic quality by planting appropriate native species, removing invasive plants, and removing hydrology or soil stressors that inhibit growth of native plant communities.
Metric: Floristic Quality
Potential WVWRAM regulatory score increase = 0.11
Pages 5 and 6 of field form:

West Virginia Wetland Rapid FQA Datasheet Page 5

WVWRAM Field Form

Site name _____ Date _____

NWI Wetland Type Code *(p.69)* *NWI codes must match codes on Soils sheet*	**Dominant species identified**	**% of AA** *field estimate or GIS (p.69)*	*Total veg cover if < 100%*	*Sum of identified cover*
1. _____	❑			
2. _____	❑			
3. _____	❑			

Dominant species identification (p.69). Sum cover values of identified vascular plant species across all strata within each wetland type. Stop when all dominant vascular plant species (≥ 10% total cover across all strata) AND highly invasive (bolded) plants have been identified AND the sum of species cover is ≥ 80%. For NWI wetland types with total vegetative cover of < 100% (e.g., aquatic bed, mudflats), the sum of species must be ≥ 80% of the total vegetative cover. Example: PAB has total cover of 40%. 80% of 40% = 32% is the required sum of species cover.

Species Checklist. Circle space when species has at least 10% cover in wetland type. At the end of each wetland type meander, record cover within circles. Highly invasive wetland species are ***underlined*** and must be recorded even if they have < 10% cover. Write in any dominant species not listed. Use absolute cover, not relative cover. Typical cover values are 0.1, 1, 3, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, or 100 percent.

Aquatic Plants (true aquatic plants that are submergent or have floating leaves)

NWI wetland type # 1 2 3		NWI wetland type # 1 2 3		NWI wetland type # 1 2 3	
___ ___ ___	*Brasenia schreberi*	___ ___ ___	*Lemna minor*	___ ___ ___	*Potamogeton sp.(not P. crispus)*
___ ___ ___	*Callitriche heterophylla*	___ ___ ___	***Myriophyllum aquaticum***	___ ___ ___	*Utricularia gibba*
___ ___ ___	*Ceratophyllum demersum*	___ ___ ___	*Nuphar lutea ssp. advena*	___ ___ ___	*Wolffia brasiliensis*
___ ___ ___	*Elodea canadensis*	___ ___ ___	*Nymphaea odorata*	___ ___ ___	_____
___ ___ ___	***Hydrilla verticillata***	___ ___ ___	*Potamogeton crispus*	___ ___ ___	_____

Increase the Diversity and Complexity of Natural Vegetation Types

Increase the number of natural vegetation types and the complexity of their boundaries. Create tall graminoid marsh habitat.
Metric: Horizontal Interspersion of Vegetation Types (VegHorInt)
Potential WVWRAM regulatory score increase = 0.035
Horizontal interspersion is calculated from field mapping by the GIS tool based on the number of NWI types present at the site and the complexity of their boundaries, combined with data from page 2 of the field form:

Skip if no PEM present. PEM canopy height(s). *Check all that apply*
Height stratum covers ≥ 5% of PEMs or occupies ≥ 0.1 acre: ❑ < 30 cm (1 ft) ❑ 30-100 cm (1-3.3 ft) ❑ > 100 cm (3.3 ft)
Tall (>100 cm) graminoid marsh *Check one*
Tall marsh with at least seasonal standing water and cattails, sedges, bluejoint grass, or bulrushes occupies ≥ 0.1 acre. ❑ Yes ❑ No

Improve Structure of Vegetation

Create several strata in forested wetland, for example reduce herbivory, replant shrub/herb layer and promote regeneration of canopy tree species.
Metric: Vertical Structure of Vegetation (VegVerStr)
Potential WVWRAM regulatory score increase = 0.035
Vertical structure of vegetation is calculated from field mapping by the GIS tool based on the percentage of forested wetland and the percentage of vegetated wetland, combined with data from page 2 of the field form:

VEGETATION STRUCTURE
Skip if no PFO present. Forest structure. *Check all that apply*
Stratum covers ≥ 5% of PFOs or occupies ≥ 0.1 acre: ❑ Canopy ❑ Understory ❑ Shrub ❑ Herb ❑ Moss
Skip if no PFO present. Forest regeneration. *Check one*
All native tree canopy species with >10% cover are present in the sapling layer. ❑ Yes ❑ No

Re-vegetate Unvegetated Areas

Re-vegetate; vegetation changes from none to vegetated.
Metric: All Vegetation Types (VegAll)
Potential WVWRAM regulatory score increase = 0.012
Percent of vegetated wetlands is calculated from field mapping by the GIS tool.

Plant Trees and Shrubs

Plant appropriate native trees and shrubs (use the WV Planting Tool).
Metric: Woody Vegetation (VegWoody)
Potential WVWRAM regulatory score increase = 0.059
Woody vegetation is calculated from field mapping by the GIS tool.

Reduce Mowing and Grazing

Remove livestock or stop mowing to allow vegetation to grow above 15 cm (6 inches) in height.
Metric: Persistent Ungrazed Vegetation (VegPerUng)
Potential WVWRAM regulatory score increase = 0.059
Page 2 of field form:

Mowed or grazed wetland *Check one*

Mowed < 15 cm (6") tall or livestock-grazed areas

❑ none ❑ trace - 33% ❑ 33-67% ❑ > 67%

Reduce Mowing, Grazing, Farming, Herbicide/Fertilizer Use

Remove stressors to vegetation, such as mowing, grazing, farming, herbicide use, or fertilizer application.
Metric: Vegetation Stressors (VegStress)
Potential WVWRAM regulatory score increase = 0.012
Page 3 of field form:

Vegetation Removal or Alteration. *Check one box that best describes the wetland.*

❑ Minimal or no signs of anthropogenic vegetation removal or alteration OR impacts occurred in the past (typically > 80 years ago) and the wetland appears to have recovered to near-natural conditions. Examples: mature forested swamps, undisturbed beaver systems, undisturbed peatlands.

❑ Moderate. Vegetation removal or alteration is on-going and has a moderate impact in terms of either severity or extent OR impacts occurred in the past and the wetland is still in the process of recovering. Examples: successional swamps (black willow, box elder), young/unstructured swamps, many shrub/emergent.

❑ Severe. More than half of wetland is impacted by regular mowing, clearing, grazing, timbering, farming, dredging of aquatic bed, herbicide/pesticide/fertilizer application, burning, excessive herbivory or other form of on-going vegetation removal or alteration. Comment_____

Increase Width of Vegetation Along Open Water

Increase vegetated area of wetland that fringes open water to at least 10 m (33 ft) width.
Metric: Vegetation Fringing Open Water (VegByLP)
Potential WVWRAM regulatory score increase = 0.012
Page 2 of field form:

Vegetation fringing open water *Check if applicable*

❑ At least 90% of open water boundaries (lake, pond ≥ 0.1 acre, perennial stream) with wetland are fringed by band of vegetation ≥ 10 m (33 ft) wide.

6.2 Soils, hydrology, topography, structural patches

The maximum predicted increase in WVWRAM score for this group of actions is 0.34 for floodplain wetlands and 0.28 for non-floodplain wetlands.

Expose Organic Soils or Accumulate Organic Material

Expose buried hydric soils containing organic material by scraping off surficial agricultural deposits, or have organic material develop naturally from vegetation growth after fixing hydrology.
Metric: Organic Soil Material (Organic)
Potential WVWRAM regulatory score increase = 0.035
Page 4 of field form:

2 cm (0.8") organic material near surface *Remove duff layer. Collect sample from top 8 cm (3") of soil profile. Refer to Organic Soils reference sheet. Peat, mucky peat, muck, or mucky modified mineral soil in top 8 cm (3") below the soil surface.*

Soil sampling site #									
1	2	3	4	5	6	7	8	9	
❑	❑	❑	❑	❑	❑	❑	❑	❑	Present: at least 2 cm (0.8") thick organic layer or mucky modified mineral layer
❑	❑	❑	❑	❑	❑	❑	❑	❑	Not present

Deep Organic Soil. *Excavate each soil hole to either 40 cm (16") depth of organic soil, or 80 cm (32") total soil depth, whichever comes first.*
Histosol: Peat, mucky peat, or muck soil with at least 12-18% organic matter by weight and >= 40 cm (16") deep within the upper 80 cm (32") of soil profile.
Histic epipedon: Peat, mucky peat, or muck soil with at least 12-18% organic matter by weight and >= 20 cm (8") thick, but < 40 cm (16") thick, as a surface horizon. Aquic conditions or artificial drainage is required.

Soil sampling site #										*Add Soil modifier to NWI code at top of page:*
1	2	3	4	5	6	7	8	9		*organic (g)*
❑	❑	❑	❑	❑	❑	❑	❑	❑	Histosol present; *NWI soil modifier = organic (g)*	*mineral (n)*
❑	❑	❑	❑	❑	❑	❑	❑	❑	Histic epipedon present, but no histosol; *NWI soil modifier = mineral (n)*	
❑	❑	❑	❑	❑	❑	❑	❑	❑	Neither histosol nor histic epipedon present; *NWI soil modifier = mineral (n)*	

Remove Livestock, ATVs, Soil Compaction

Remove soil stressors or compactors such as livestock, ATVs, or machinery.
Metric: Soil Stressors (SoilIntact)
Potential WVWRAM regulatory score increase = 0.024
Page 3 of field form:

Soil Stressors. *Check all that apply, then review total disturbance below.*

- ❍ Livestock (trampling, pugging, compaction, or heavy grazing that leads to erosion)
- ❍ Machinery (plowing, filling, grading, dredging, compaction)
- ❍ ATV or vehicles (ruts, compaction, other disturbance)
- ❍ Removal of soil (mining, excavation)
- ❍ Replacement of soil with waste or fill (mining spoil, landfill)
- ❍ Other trampling or soil compaction
- ❍ Other erosion, sedimentation, or stressor. Comment _____

Review the total soil disturbances above and rank severity of impact by checking one box below.

❑ Intact: no anthropogenic disturbance.
❑ Small to moderate stress to soil profile. On-going stressors affect < 10% of wetland OR impacts occurred in the past and the soil profile has largely recovered. Depth of disturbance typically < 10 cm (4"); ponding/channeling of water in disturbed areas has little or no impact on overall site hydrology.
❑ Substantial stress to soil profile with extensive and long-lasting impacts; depth of disturbance > 10 cm (4"), may cause significant ponding or channeling of water that alters hydrology and vegetation.

Re-connect Wetland to Adjacent Stream

Re-connect wetland to adjacent stream through stream or floodplain restoration.
Metric: Connectivity to the River Continuum (ConnectFL)
Potential WVWRAM regulatory score increase = 0.024
Page 2 of field form:

Overbank flooding and connection to river continuum *Check all that are observed within the wetland. Skip if no stream nearby/potentially connected.*

- ❑ active beaver dam
- ❑ flood deposits (sediment deposits, debris, drift deposits, flood wrack)
- ❑ vegetation flattened and aligned along flow lines
- ❑ tree trunks with flood lines (water marks, silt coatings, staining, moss or lichen trim lines) or flood impact scars
- ❑ absence of leaf litter under deciduous trees as a result of flooding (not livestock impacts)
- ❑ braided stream channels, backwater sloughs, backchannels, or other flood drainage patterns present
- ❑ flood-prone area (inundated at 2 x maximum bankfull depth) overlaps at least 10% of wetland

Disconnection from river continuum *Check all that are observed at the stream that controls the floodplain. Skip if no stream potentially connected.*

- ❑ physical barriers between wetland & stream (roads, railbeds, hardened levees)
- ❑ artificial drainage of floodplain between wetland and stream (ditches, drains, grading of land to improve drainage)
- ❑ stream channel hardened (riprap, gabions, concrete)
- ❑ stream channel straightened and/or moved to toeslope (meanders eliminated)
- ❑ dam upstream significantly reduces flooding
- ❑ land subsidence or significant streamflow reduction (sinking stream) in mined areas NOT on karst
- ❑ stream channel banks are steep, eroding, have abundant bank slides or slumps, have < 50% cover of roots, or are unvegetated
- ❑ stream is entrenched or moderately entrenched (Rosgen ER < 2.2 or Rosgen types A, F, G, B). Entrenchment is calculated as the flood-prone width divided by the bankfull width. Flood-prone width is measured at the elevation equal to twice the maximum bankfull depth. Maximum bankfull depth is the height of bankfull flow above the thalweg.
- ❑ stream is incised; bank height ratio (BHR) > 1.5. Bank height ratio is calculated as the height of lowest bank divided by maximum bankful depth.
- ❑ flood prone area (inundated at 2 x maximum bankfull depth) does not extend to more than 10% of wetland

Optional workspace for entrenchment, incisement, and flood-prone area measurements

See user manual for diagrams and definitions. Any units may be used as long as they are consistent.

maximum bankfull depth: _____
2 x maximum bankfull depth: _____
bankfull width: _____
flood-prone width: _____
lowest bank height: _____

_____ / _____ = _____
flood-prone width / bankfull width = entrenchment ratio (ER)

_____ / _____ = _____
lowest bank height / maximum bankfull depth = bank height ratio (BHR)

Remove Drains, Fill Ditches, Breach Berms, Reduce Hydrologic Stressors

Reduce hydrologic stressors, for example by removing underground drains, filling ditches, breaching berms, managing stormwater runoff, or making the upland/wetland boundary more diffuse.
Metric: Hydrology Stressors (HydIntact)
Potential WVWRAM regulatory score increase = 0.071
Page 3 of field form:

Hydrology Stressors. *Check all that apply, then review total disturbance below.*

- ❍ Ditch
- ❍ Tile or drain
- ❍ Weir, spillway, standing pipe or water control structure
- ❍ Impoundment impacting hydrology (excluding beaver dams)
- ❍ Berm
- ❍ Road or impervious surface (paved and/or not at grade)
- ❍ RR track
- ❍ Undersized or perched culvert
- ❍ Pump, spring box, water well
- ❍ Filling/excavating/grading the land surface
- ❍ Dredging of aquatic bed
- ❍ Point source discharge
- ❍ Stormwater input
- ❍ Agricultural runoff
- ❍ Invasive vegetation concentrated along watercourses, with at least twice as much invasive cover as areas away from watercourses
- ❍ Adjacent stream channel/riparian zone aggrading, with fresh splays of sediment, partially buried culverts, or bar formation
- ❍ More than 25% of the upland-wetland edge is abrupt and straight, not a gradual and complex transition zone > 3 meters (10 ft) wide
- ❍ Other_____

Review the total hydrologic disturbances above and rank severity of impact by checking one box below.

- ❑ Intact: Hydrologic regime is characterized by natural patterns, with no major hydrologic stressors present.
- ❑ Mild on-going disturbance and/or past disturbance but now essentially recovered. For example, small ditches or diversions; berms or roads at/near grade; or minor flow additions.
- ❑ Moderate on-going disturbance and/or in the process of recovering from more severe disturbance in the past. For example, dams upstream or downstream moderately affect hydroperiod; ditches or diversions < 1 m (3.3 ft) deep; two lane roads; culverts adequate for base stream flow but not flood flow; or moderate flow additions. Outlets may be moderately constricted, but flow is still possible.
- ❑ Severe on-going disturbance. For example, dams upstream or downstream moderately to substantially affect hydroperiod; a 4-lane highway; diversions upstream or > 1 m (3.3 ft) deep that withdraw a significant portion of flow; large amounts of fill or excavation; significant artificial groundwater pumping; or heavy flow additions. Outlets may be substantially constricted, blocking most flow.
- ❑ Hydrology is entirely artificial; no natural inflows. E.g., a water treatment wetland constructed below the outflow from a wastewater treatment plant.

Increase Area of Temporary or Seasonal Ponding/Saturation

Increase the proportion of wetland with temporary or seasonal ponding/saturation, i.e., NWI Water Regime = A, B, or C.
Metric: Seasonal Ponding (SeasonPond)
Potential WVWRAM regulatory score increase = 0.035
Page 4 of field form:

NWI Water Regime *Refer to NWI code diagram, NWI Water Regime Non-tidal Modifiers, and NWI Water Regime Restriction reference sheets.*

Soil sampling site #									Add Water Regime modifier to NWI code at top of page:		
1	**2**	**3**	4	5	6	7	8	9	*temporarily flooded (A)*	*continuously saturated (D)*	*intermittently exposed (G)*
									seasonally saturated (B)	*seasonally flooded-saturated (E)*	*permanently flooded (H)*
									seasonally flooded (C)	*semipermanently flooded (F)*	*intermittently flooded (J)*
											artificially flooded (K)

Create a More Complex Upland/Wetland Boundary

Create a more irregular and complex upland-wetland boundary.
Metric: Complex Upland/Wetland Boundary (IrrEdge)
Potential WVWRAM regulatory score increase = 0.012
Irregular upland/wetland boundary is calculated from field mapping (GIS tool).

Increase Cover of Small Surface Depressions

Increase the cover of small topographic or micro-topographic depressions that store water for several days after a storm (this action may be strongly limited by the topographic position).
Metric: Surface Depressions (Depressions)
Potential WVWRAM regulatory score increase = 0.059
Page 1 of field form:

TOPOGRAPHY AND STRUCTURE

Depressions *Check one*

❑ none ❑ trace-10% ❑ 10-33% ❑ >33%

Increase Microtopographic Complexity

Increase the complexity of the microtopographic surface of the wetland, e.g. drunken bulldozer method.
Metric: Microtopographic Complexity (Microtopo)
Potential WVWRAM regulatory score increase = 0.024
Page 1 of field form:

Microtopographic complexity *Check one*

❑ < 3% ❑ 3-40% ❑ > 40%

Add Coarse Woody Debris, Snags, and Structural Patches

Add structural patches such as coarse woody debris or snags. Adding patches of surface water can contribute to both Structural Patches and to Available Surface Water if other surface water is not available in the wetland.
Metric: Structural Patches
Potential WVWRAM regulatory score increase = 0.035
Page 1 of field form:

Structural Patch Type. ≥ 3 m^2 (32 ft^2) patch unless otherwise specified. *Check all that apply*

- ❑ Open water
- ❑ Oxbows, secondary channels, swales
- ❑ Pools inaccessible to fish
- ❑ Springs or upwelling groundwater
- ❑ Non-vegetated flats (mudflats, sandflats)
- ❑ Animal mounds or burrows
- ❑ Beaver dams or lodges
- ❑ Abundant deciduous leaf litter
- ❑ Plant hummocks or tussocks
- ❑ Plant hummocks or tussocks > 25% cover of wetland (abundant)
- ❑ Coarse woody debris at least 10 cm (4") diameter and 91 cm (36") long
- ❑ Coarse woody debris, abundant: > 3% cover of wetland
- ❑ Standing snags at least 7.6 cm (3") diameter and 137 cm (4.5') tall
- ❑ Standing snags, abundant: ≥ 3/acre with dbh > 25 cm (10")
- ❑ Upturned tree root wads (tip-up mounds) and pits

Comment _____

6.3 Buffer

Note that buffers are explicitly included in the SWVM, and only their direct impact on the wetland, e.g. sedimentation, discharges, etc. are included here.
The maximum predicted increase in WVWRAM score for this group of actions is 0.08 for all wetlands.

Restore Naturally Vegetated Perimeter

Restore natural vegetation and remove stressors from 10 m (33 ft) perimeter.
Metric: Natural Perimeter (BufferPerim)
Potential WVWRAM regulatory score increase = 0.024
Page 1 of field form:

PERIMETER AND NATURAL BUFFER		
Natural perimeter *Check one*		
❑ 100%	❑ 75-99%	❑ < 75%

Restore Natural Vegetation in Water Quality & Floristic Quality Buffer

Restore natural vegetation and remove stressors from 50 m (164 ft) water quality and floristic quality buffer.
Metrics: Water Quality Buffer, Floristic Quality Buffer (Disturb50m)
Potential WVWRAM regulatory score increase = 0.035
Page 1 of field form:

50m (164') natural buffer for water quality
Check one
❑ > 90%
❑ 75-90%
❑ 50-75%
❑ < 50%

Restore Natural Vegetation in Wildlife Buffer

Restore natural vegetation and remove stressors from 300 m (984 ft) wildlife buffer.
Metric: Wildlife Buffer (BufferContig)
Potential WVWRAM regulatory score increase = 0.024
Page 1 of field form:

Contiguous 300m (984') natural wildlife buffer *Check one*		
❑ > 90%	❑ 60-90%	❑ < 60%

7. Case studies

7.1 Re-establishment, Preston County

A small stream and tributary were disconnected during road construction. In 2007 mitigation was undertaken to re-connect the stream to wetlands and excavate a pond. In 2018, the wetland had become a shrub swamp with some open areas that receives regular overflow from the adjacent streams, in addition to stormwater. It is characterized by a high water table and mostly native vegetation.

Preston County site in 1997 & 2016.

Preston County site in 2018 (photo by Mark Haibach).

Which metrics changed immediately post-construction?

Most metrics went from zero to a positive score, since this was a re-establishment project. The metrics directly impacted by restoration action rather than by location in the (estimated) post-construction phase are shown below:

Preston County wetland	**Pre-construction**	**Post-construction**
Connection to the River Continuum	0	0.024
Depressions	0	0.035
Portion of Wetland in Floodplain	0	0.024
Lack of Hydrology Stressors	0	0.059
Available Surface Water	0	0.012
Seasonal Ponding/Saturation	0	0.035
Lack of Soil Stressors	0	0.012
Structural Patches	0	0.012
Vegetated Wetland	0	0.012
Vegetation Fringing Open Water	0	0.012
Regulatory Score	0	About 0.35

Which metrics changed most over time as part of restoration?

Metrics with significant changes over time (baseline, 2009, 2012, 2018) are shown below.

Preston County wetland	**Baseline 2007**	**2009**	**2012**	**2018**
Floristic Quality subscore	0	-0.012	0.012	0.047

Vegetation Fringing Open Water subscore	0	0	0.012	0.012
Horizontal Interspersion of Vegetation subscore	0	0.012	0.012	0.035
Woody Vegetation subscore	0	0	0	0.024
Regulatory Score	**0**	**0.49**	**0.53**	**0.67**

7.2 Enhancement, Pendleton County

Figure 1. Limestone-influenced swamp in 1997 and 2021.

In 1998, cattle were fenced out of a limestone-influenced swamp in Pendleton County. The 8-foot electric fence was designed to reduce deer crossing, and over the next 10 years trees were planted. The swamp had been a highly impacted emergent wetland and buried peatland at the beginning of the restoration, with 99% cover of non-native plants (mostly pasture grasses). Twenty years later it is a shrub swamp with emergent wetland with 99% native plants, a central beaver complex, and organic-rich peatland returning. Tree growth is healthy and the swamp is on a trajectory to become a complex forested swamp with natural beaver openings.

Figure 2. Limestone-influenced swamp in 2018.

Which metrics changed as a result of restoration success?

In the case of this limestone-influenced swamp, the metrics below changed as a result of restoration. Not included in the scores below is the fact that in this rare limestone-influenced swamp, several rare species returned and improved the Site Biodiversity Rank.

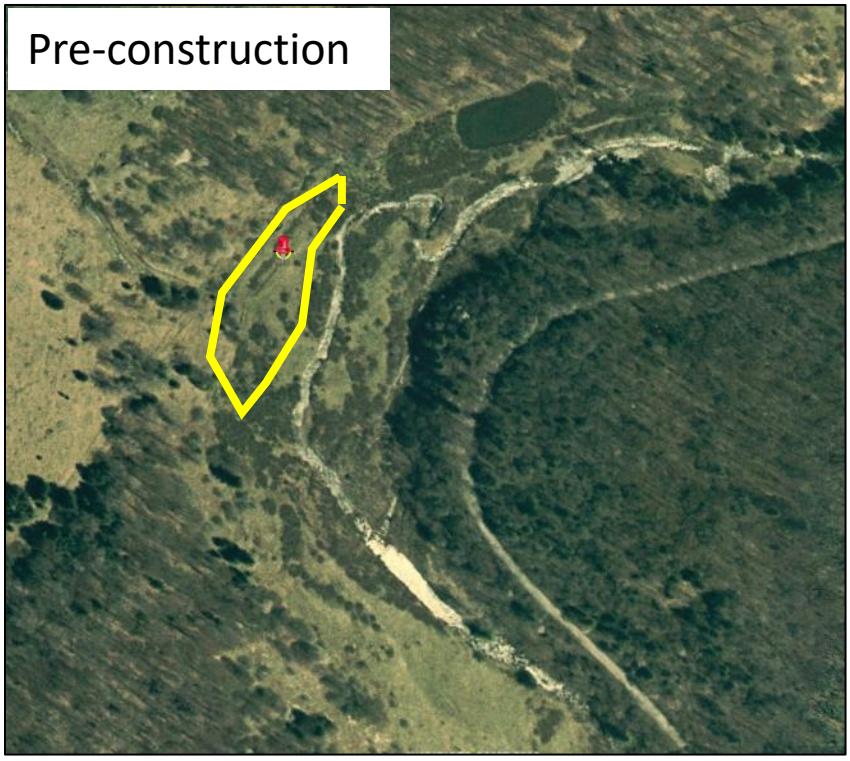
Limestone-influenced Swamp	**1998**	**2005**	**2018**
Regulatory Score	**0.36**	**0.56**	**0.60**
Deep Organic Soil	0.024	0.024	0.035
Available Surface Water	0	0.012	0.012
Microtopographic Complexity	0.012	0.012	0.024
Organic Material near Surface	0.024	0.035	0.035
Structural Patches	0.012	0.012	0.024
Floristic Quality	-0.012	0.047	0.047
Horizontal Interspersion of Vegetation	0.012	0.024	0.035
Persistent Ungrazed Vegetation	0	0.047	0.035
Woody Vegetation	0	0	0.024
Connection to Stream Continuum	0	0	0.012

7.3 Re-establishment, Randolph County headwater stream

The WVWRAM score at maturity can be estimated by exploring different site designs and restoration actions. Exploring 4 hypothetical WVWRAM scenarios results in the following scores:

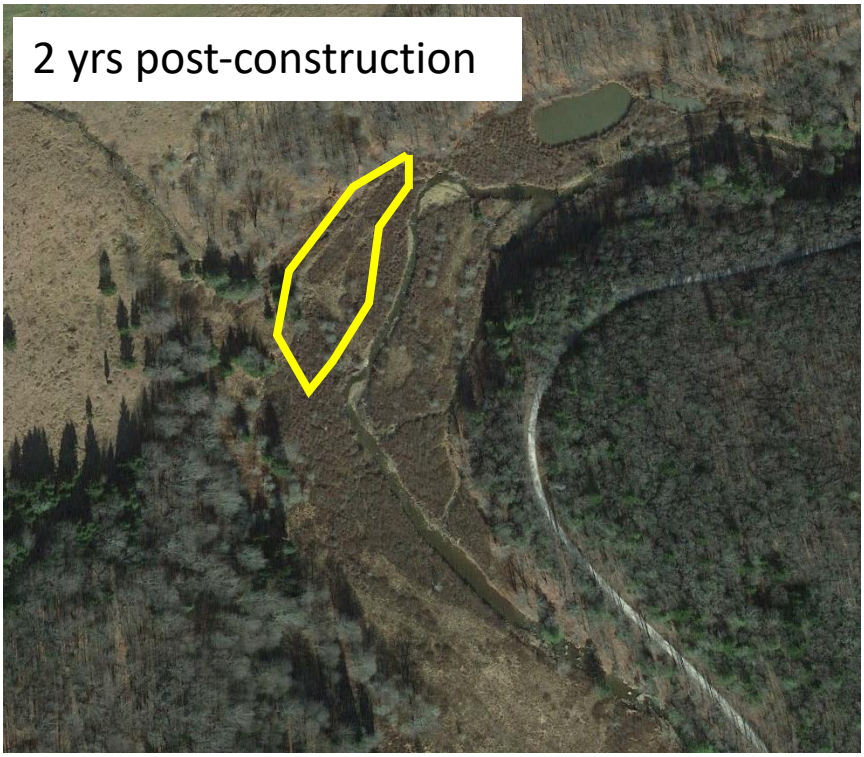
1. Connect to floodplain, add microtopography & depressions, plant native shrubs, treat invasives → 0.66
2. Connect to floodplain, plant native shrubs, treat invasives → 0.62
3. Connect to floodplain, add microtopography & depressions, plant native trees to attain 30% tree cover by maturity, treat invasives → 0.73
4. Add microtopography & depressions, plant native shrubs, treat invasives → 0.59

Preconstruction: Lacking in hydrology and hydrophytic vegetation. WVWRAM Score = 0.



Actual WVWRAM score 2 years post-construction = 0.66

Stream reconnected to floodplain. Depressions show development of hydric soils. PSS with meadowsweet and silky willow. 1% invasive reed canary grass – mostly native vegetation.



Which metrics changed immediately post-construction at this site?

WVWRAM metric	Pre-construction	Post-construction	Maximum Possible
Connection to the river continuum	0	0.024	0.024
Create depressions	0	0.059	0.059
Create microtopography	0	0.024	0.024
Add structural patches	0	0.012	0.035
Portion of wetland in floodplain	0	0.024	0.024
Remove hydrologic stressors	0	0.059	0.071
Available surface water	0	0.012	0.012
Seasonal ponding/saturation	0	0.035	0.035
Lack of soil stressors	0	0.012	0.024
Plant natives & treat invasives (part of floristic quality)	0	0.012	0.129
Plant woody vegetation (shrubs)	0	0.012	0.059

Which metrics may continue to change over time at this site if the trajectory is good?

WVWRAM metric	1 yr post-construction	2 yrs post-construction	Maximum possible
Floristic quality	0.012	0.059	0.129
Persistent ungrazed vegetation	0.012	0.047	0.059
Woody vegetation	0.012	0.035	0.059
Development of multiple vegetation types	0	0	0.035
Development of vertical veg strata	0	0	0.035
Development of structural patches	0.012	0.012	0.035
Development of organic soils	0	0	0.035

Which metrics at this site are a function of location rather than design?

Soil and Structure

- Karst and Limestone-influenced Wetlands = 0 at this site; maximum possible is 0.035

Hydrology

- Headwater Location = 0.012, which is the maximum possible

Buffer Condition and Extent

- Landscape Integrity = 0.035, which is the maximum possible

Landscape or Watershed Scale

- Biodiversity Rank of 12-digit HUC = 0.012, which is the maximum possible
- Location in a DNR Conservation Focus Area = 0.012, which is the maximum possible
- Wetland Breeding Bird Occupancy = 0.012, which is the maximum possible
- Watershed Position = 0.012, which is the maximum possible

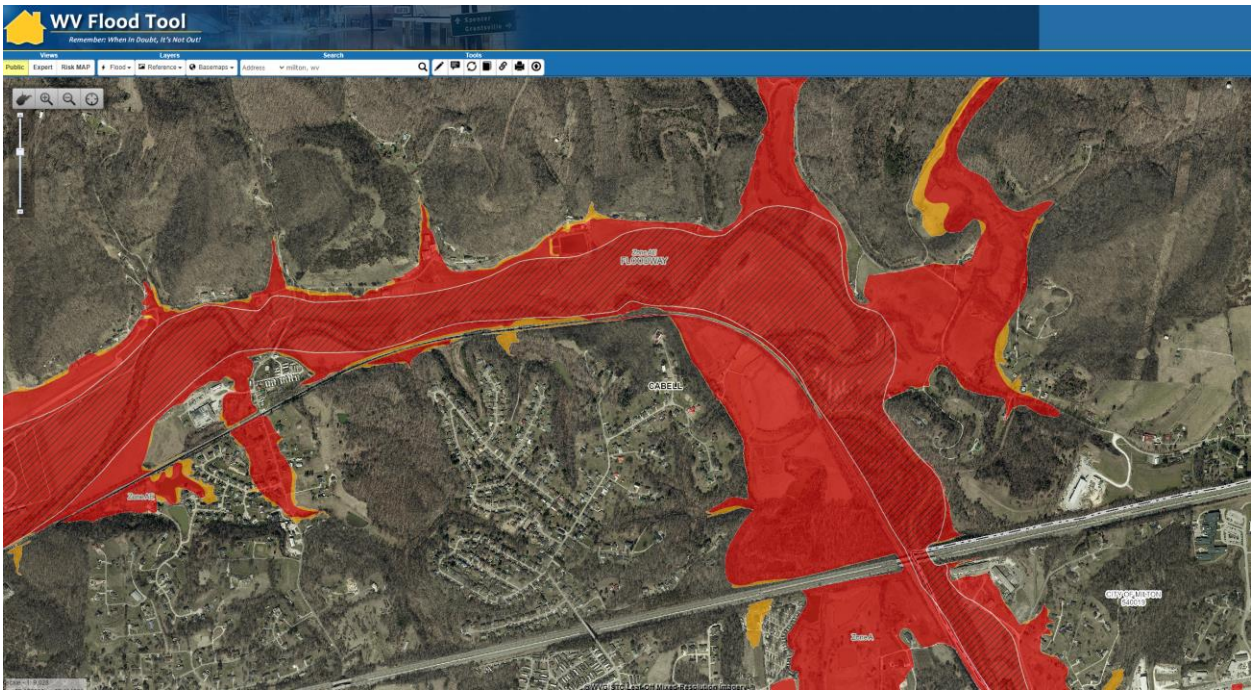
8. Restoration Design with WVWRAM

WVWRAM metrics reflect wetland functions and landscape position. An example of maximizing WVWRAM scores based on a hypothetical restoration design is shown in this section. The game plan is to:

1. Get familiar with your site
2. Calculate the baseline WVWRAM score
3. Design your restoration actions
4. For post-construction, 5 yrs, 10 yrs, maturity
    - Make maps & submit to GIS tool
    - Fill out database for expected conditions
    - Import GIS results and calculate WVWRAM scores

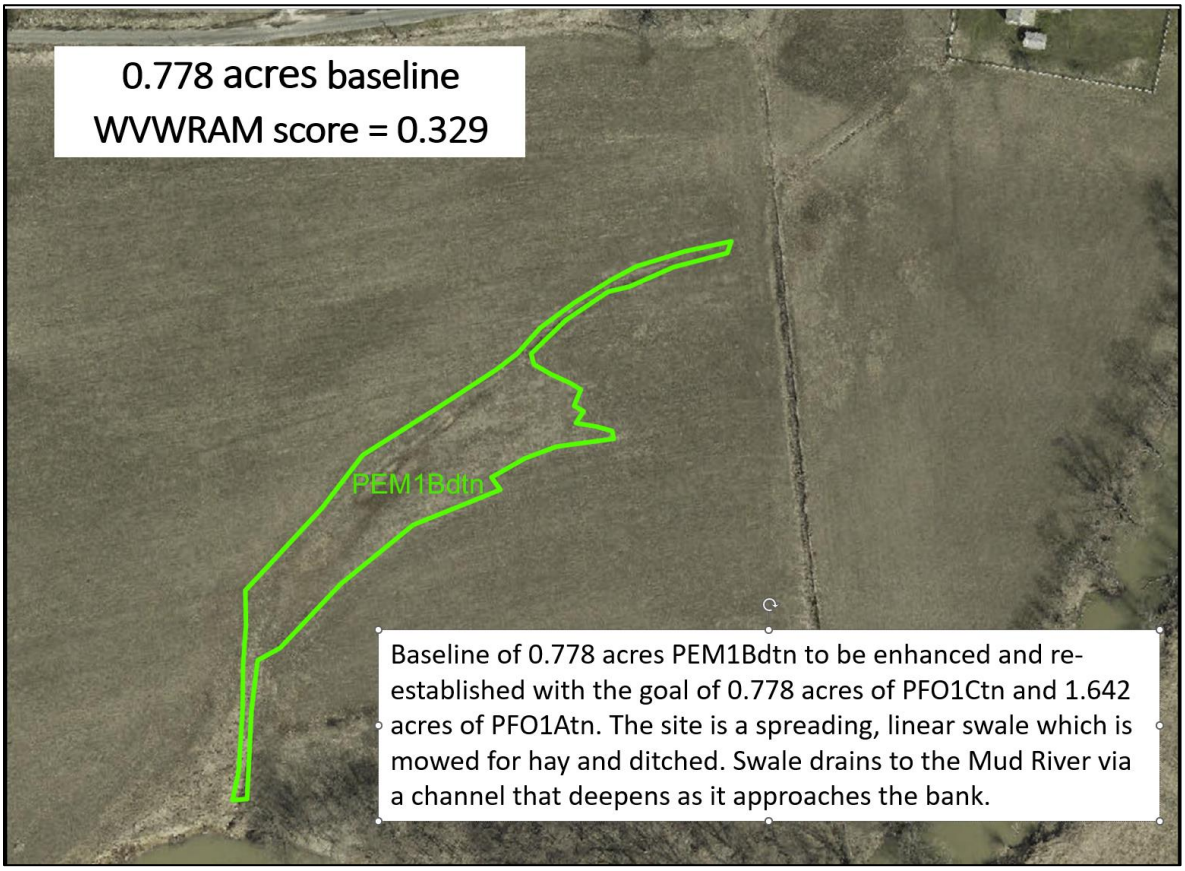
8.1 Get familiar with your site

- Maps, photos, and site visits, and site notes
- WV Flood Tool: floodplain, drainage patterns, leaf-off imagery, and hillshade
- SoilWeb
- WVDEP GIS Viewer
- USGS Historical Topographic Map Explorer
- WV Water Resources Registry
- WV Planting Tool



8.2 Calculate the baseline WVWRAM score

- Re-establishment baseline score is zero.
- Enhancement:
    - Map existing wetlands & submit to GIS tool
    - Conduct rapid assessment & fill out database
    - Import GIS results & calculate WVWRAM restoration score
- Review the landscape metrics on your baseline. These won't change with restoration. Better "neighborhoods" have higher scores. If there are no existing wetlands, create a dummy wetland to get the landscape metrics.



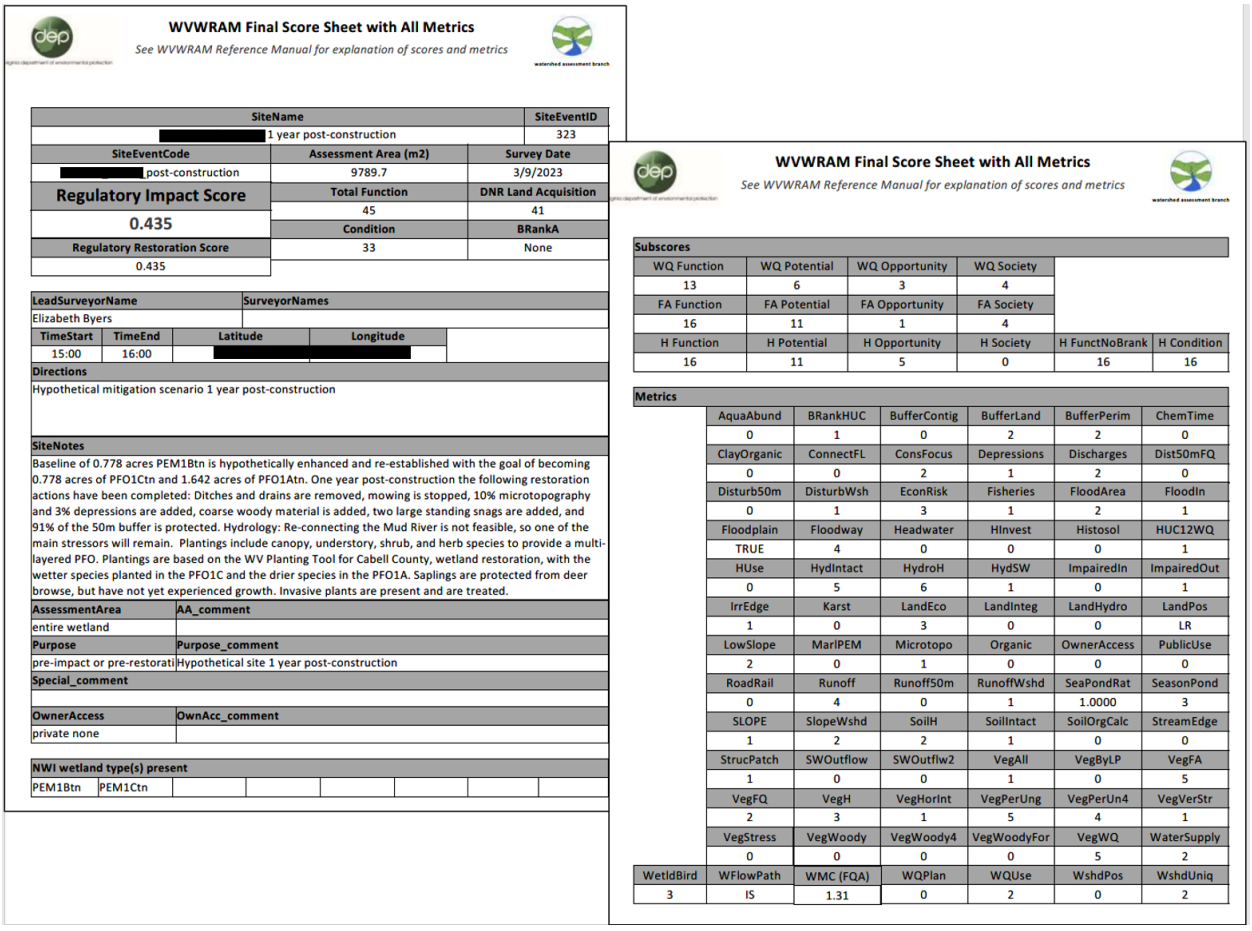
8.3 Design your restoration actions

- Use the WVWRAM Restoration Supplement to match your actions to increases in scores
- Some actions show results immediately, e.g., removing stressors
- Some actions take time, e.g., vegetation growth
- Lay out actions on a time-scale
    - 1-year post-construction
    - 5 yrs
    - 10 yrs
    - Maturity

8.4 Calculate scores over time

For 1 yr, 5 yrs, 10 yrs, and maturity

- Map expected wetland types & submit to GIS tool
- Fill out database for each scenario (you can make duplicates to avoid re-entering repeated data)
- Import GIS results & calculate WVWRAM restoration scores
- Track the changes in individual metrics with each scenario



WVWRAM Final Score Sheet with All Metrics

See WVWRAM Reference Manual for explanation of scores and metrics

SiteName	SiteEventID
[redacted] 1 year post-construction	323

SiteEventCode	Assessment Area (m2)	Survey Date
[redacted] post-construction	9789.7	3/9/2023

Regulatory Impact Score	Total Function	DNR Land Acquisition
	45	41
0.435	Condition	BRankA
	33	None

Regulatory Restoration Score
0.435

LeadSurveyorName	SurveyorNames
Elizabeth Byers	

TimeStart	TimeEnd	Latitude	Longitude
15:00	16:00	[redacted]	

Directions

Hypothetical mitigation scenario 1 year post-construction

SiteNotes

Baseline of 0.778 acres PEM1Btn is hypothetically enhanced and re-established with the goal of becoming 0.778 acres of PFO1Ctn and 1.642 acres of PFO1Atn. One year post-construction the following restoration actions have been completed: Ditches and drains are removed, mowing is stopped, 10% microtopography and 3% depressions are added, coarse woody material is added, two large standing snags are added, and 91% of the 50m buffer is protected. Hydrology: Re-connecting the Mud River is not feasible, so one of the main stressors will remain. Plantings include canopy, understory, shrub, and herb species to provide a multi-layered PFO. Plantings are based on the WV Planting Tool for Cabell County, wetland restoration, with the wetter species planted in the PFO1C and the drier species in the PFO1A. Saplings are protected from deer browse, but have not yet experienced growth. Invasive plants are present and are treated.

AssessmentArea	AA_comment
entire wetland	
Purpose	**Purpose_comment**
pre-impact or pre-restorati	Hypothetical site 1 year post-construction
Special_comment	
OwnerAccess	**OwnAcc_comment**
private none	

NWI wetland type(s) present							
PEM1Btn	PEM1Ctn						

WVWRAM Final Score Sheet with All Metrics

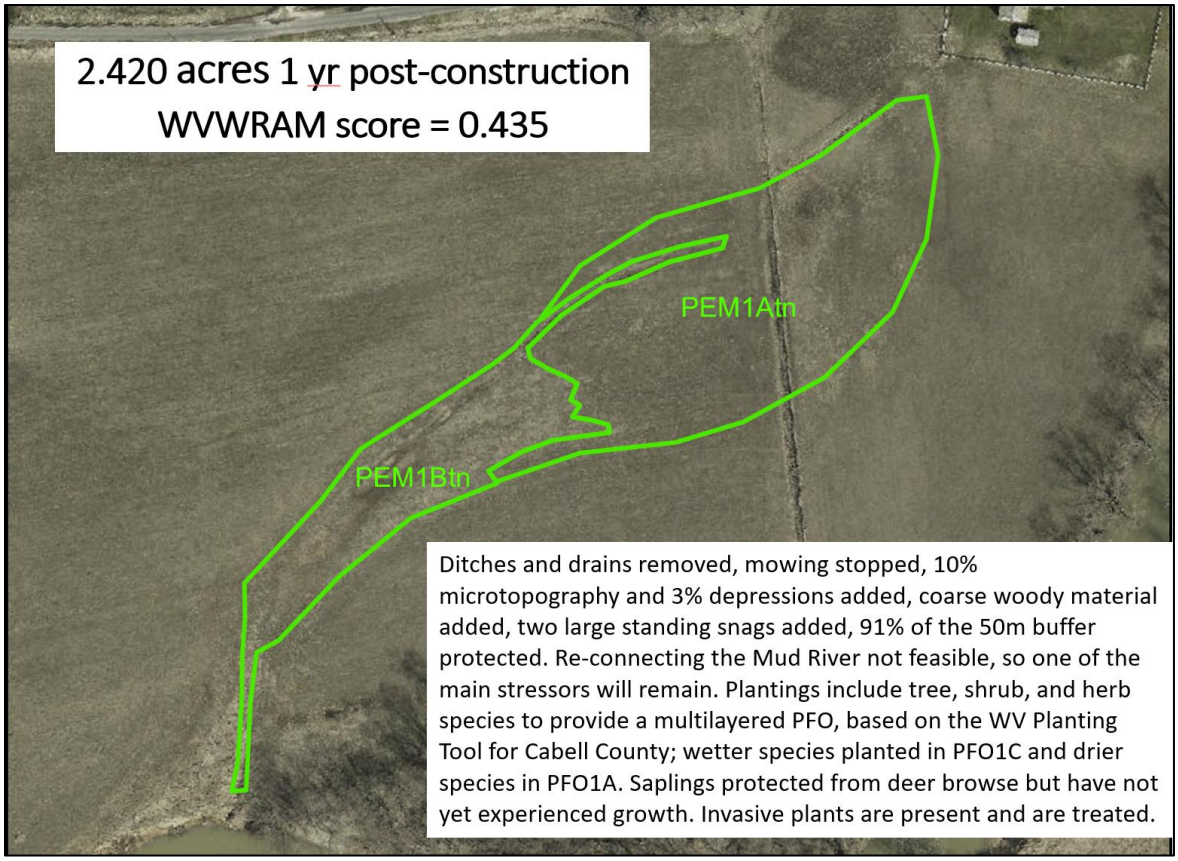
See WVWRAM Reference Manual for explanation of scores and metrics

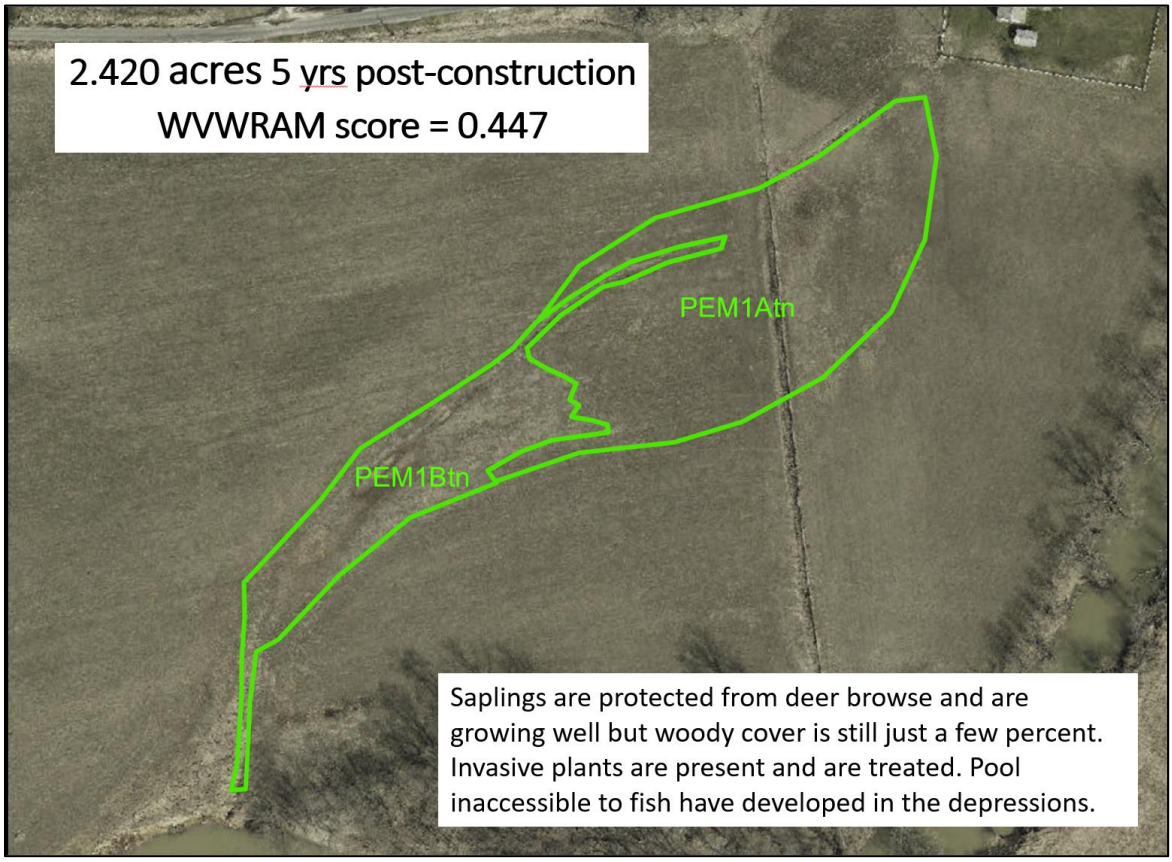
Subscores

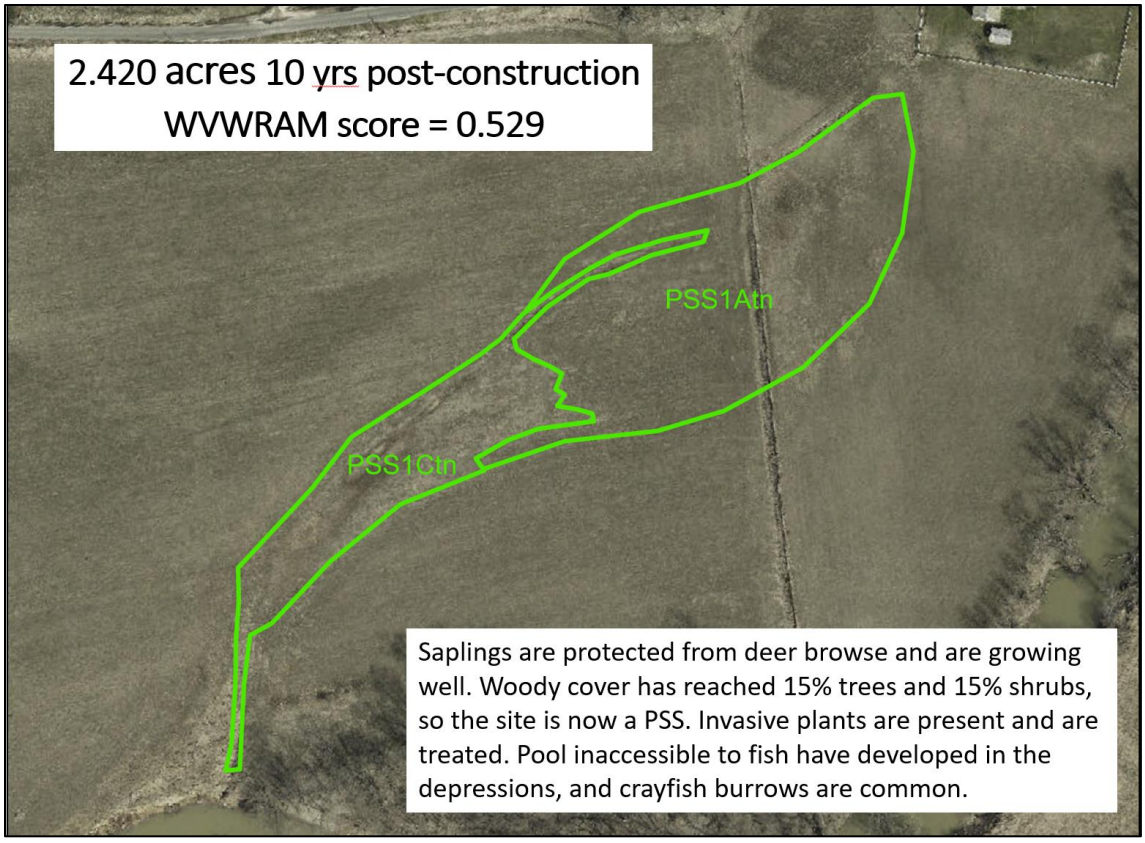
WQ Function	WQ Potential	WQ Opportunity	WQ Society		
13	6	3	4		
FA Function	FA Potential	FA Opportunity	FA Society		
16	11	1	4		
H Function	H Potential	H Opportunity	H Society	H FunctNoBrank	H Condition
16	11	5	0	16	16

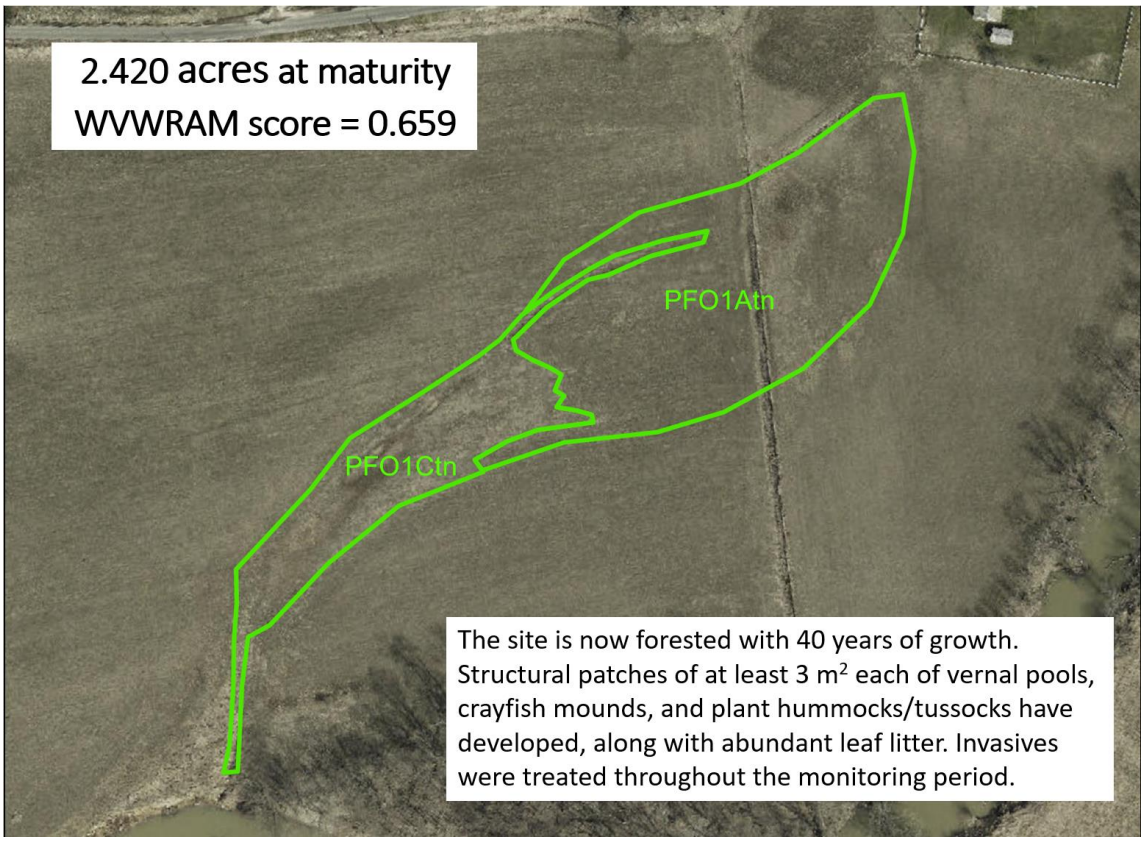
Metrics

	AquaAbund	BRankHUC	BufferContig	BufferLand	BufferPerim	ChemTime
	0	1	0	2	2	0
	ClayOrganic	ConnectFL	ConsFocus	Depressions	Discharges	Dist50mFQ
	0	0	2	1	2	0
	Disturb50m	DisturbWsh	EconRisk	Fisheries	FloodArea	FloodIn
	0	1	3	1	2	1
	Floodplain	Floodway	Headwater	HInvest	Histosol	HUC12WQ
	TRUE	4	0	0	0	1
	HUse	HydIntact	HydroH	HydSW	ImpairedIn	ImpairedOut
	0	5	6	1	0	1
	IrrEdge	Karst	LandEco	LandInteg	LandHydro	LandPos
	1	0	3	0	0	LR
	LowSlope	MarlPEM	Microtopo	Organic	OwnerAccess	PublicUse
	2	0	1	0	0	0
	RoadRail	Runoff	Runoff50m	RunoffWshd	SeaPondRat	SeasonPond
	0	4	0	1	1.0000	3
	SLOPE	SlopeWshd	SoilH	SoilIntact	SoilOrgCalc	StreamEdge
	1	2	2	1	0	0
	StrucPatch	SWOutflow	SWOutflw2	VegAll	VegByLP	VegFA
	1	0	0	1	0	5
	VegFQ	VegH	VegHorInt	VegPerUng	VegPerUn4	VegVerStr
	2	3	1	5	4	1
	VegStress	VegWoody	VegWoody4	VegWoodyFor	VegWQ	WaterSupply
	0	0	0	0	5	2
WetIdBird	WFlowPath	WMC (FQA)	WQPlan	WQUse	WshdPos	WshdUniq
3	IS	1.31	0	2	0	2


2.420 acres 1 yr post-construction
WVWRAM score = 0.435
PEM1Atn
PEM1Btn
Ditches and drains removed, mowing stopped, 10% microtopography and 3% depressions added, coarse woody material added, two large standing snags added, 91% of the 50m buffer protected. Re-connecting the Mud River not feasible, so one of the main stressors will remain. Plantings include tree, shrub, and herb species to provide a multilayered PFO, based on the WV Planting Tool for Cabell County; wetter species planted in PFO1C and drier species in PFO1A. Saplings protected from deer browse but have not yet experienced growth. Invasive plants are present and are treated.


2.420 acres 5 yrs post-construction
WVWRAM score = 0.447
PEM1Atn
PEM1Btn
Saplings are protected from deer browse and are growing well but woody cover is still just a few percent. Invasive plants are present and are treated. Pool inaccessible to fish have developed in the depressions.


2.420 acres 10 yrs post-construction
WVWRAM score = 0.529
PSS1Atn
PSS1Ctn
Saplings are protected from deer browse and are growing well. Woody cover has reached 15% trees and 15% shrubs, so the site is now a PSS. Invasive plants are present and are treated. Pool inaccessible to fish have developed in the depressions, and crayfish burrows are common.


2.420 acres at maturity
WVWRAM score = 0.659
PFO1Atn
PFO1Ctn
The site is now forested with 40 years of growth. Structural patches of at least 3 m² each of vernal pools, crayfish mounds, and plant hummocks/tussocks have developed, along with abundant leaf litter. Invasives were treated throughout the monitoring period.

Summary of score changes over time

Wetland ID	Form of Mitigation	Acres	WVWRAM baseline	WVWRAM 1-yr	WVWRAM 5-yr	WVWRAM 10-yr	WVWRAM maturity
W1	Enhancement	0.778	0.329	0.435	0.447	0.529	0.659
W2	Re-establishment	1.642	0	0.435	0.447	0.529	0.659

9. Summary of point breakdowns

The maximum subscores for individual metrics are shown in the table below. The metric groups that can be improved through restoration action are highlighted in yellow, and the individual metrics that can be improved through restoration actions are asterisked.

WVWRAM Maximum Points Breakdown for Regulatory Scores		
**indicates metrics that can be improved through restoration actions*		
non-highlighted areas are metrics that are a function of landscape and cannot be improved through restoration actions		
Water Quality		**Non-**
Intrinsic potential to provide function	**Floodplain**	**Floodplain**
Headwater location (Headwater)	0.012	0.012
*Vegetation (**VegWQ*, capped as shown)	0.118	0.059
*= *VegPerUng (0.059) + *VegWoody (0.059) + *VegByLP (0.012)*		
Surface depressions (**Depressions*)	0.059	-
Surface water outflow (**SWOutflow*)	-	0.047
Organic soil material (**ClayOrganic*, prorated by **SeaPondRatio*)	-	0.035
Time and space for chemical reactions to occur (**Chemtime*, capped as shown)	-	0.035
*= *SeasonPond,* prorated by *Slope (0.035) + *IrrEdge (0.012)*	-	-
Subtotal WQ Potential	*0.188*	*0.188*
Landscape opportunity to provide function		
Discharges to the wetland (Discharge)	0.024	0.024
Land use disturbance within buffer (Disturb50m)	0.035	0.035
Land use disturbance in contributing watershed (DisturbWshd)	0.012	0.012
Roads and railroads (RoadRail)	0.024	0.024
Impaired waters, algal blooms, powerboat use (ImpairedIn)	0.024	0.024
Subtotal WQ Opportunity (capped as shown)	*0.059*	*0.047*
Maximum Water Quality Subscore	***0.247***	***0.235***
Flood Attenuation		
Intrinsic potential to provide function		
Headwater location (Headwater)	0.012	0.012
Median percent slope (*LowSlope*)	0.024	0.024

Vegetation (**VegFA*, capped at 0.059 for non-floodplain) = **VegAll* (0.012) + **VegPerUn4* (0.047) + **VegWoody4* (0.047)	0.106	0.059
Runoff and Storage (**Runoff*, capped as shown) *= *SeasonPond (0.035) + *Microtopo (0.024) + *ConnectFL (0.024)*	0.059	0.047
Surface Water Outflow (**SWOutflw2*)	-	0.024
Subtotal FA Potential	*0.200*	*0.165*
Landscape opportunity to provide function		
Overland flow delivered to wetland (FloodIn) *= SlopeWshd + Runoff50m + RunoffWshd,* prorated and capped at 0.024*)*	0.024	0.024
Connectivity to historic floodplain (**ConnectFL*)	0.024	-
Subtotal FA Opportunity	*0.047*	*0.024*
Maximum Flood Attenuation Subscore	***0.247***	***0.188***
Habitat/Ecological Integrity		
Intrinsic potential to provide function	0.353	0.353
Vegetation (**VegH*: structure and floristic quality) *= *VegFQT (*VegSum (0.106) + *VegStress (-0.024 to 0)) + *VegVerStr (0.035) + *VegHorInt (0.035)*	0.176	0.176
Hydrology (**HydroH*: intact regime, floodplain connectivity) *= *HydIntact (0.071) + *ConnectFL (0.024) + *HydSW (0.012)*	0.106	0.106
Soils and structural patches (**SoilH*) *= *SoilIntact (0.024) + SoilOrgCalc (Histosol + Karst, capped at 0.012) + *StrucPatch (0.035)*	0.071	0.071
Subtotal Habitat Potential	*0.506*	*0.506*
Landscape opportunity		
Buffer and landscape integrity (**BufferLand*) *= *BufferPerim (0.024) + *BufferContig (0.024) + LandInteg (0.035)*	0.082	0.082
Landscape-level hydrologic connectivity (*LandHydro*) *= WshdPos (0.012) + AquaAbund (0.024)*	0.035	0.035
Landscape-level ecological connectivity (LandEco) *= BRankHUC + ConsFocus + WshdUniq + WetldBird,* prorated & capped at 0.035	0.035	0.035
Subtotal Habitat Opportunity	*0.153*	*0.153*
Maximum Habitat Subscore	***0.506***	***0.506***
Total maximum score	**1.000**	**0.929**
Wetlands of Special Conservation Concern, including Exemplary Wetlands		
Documented rare natural heritage element occurrences: score range	0.012 - 1.176	
Total maximum including wetlands of special conservation concern	*2.176*	*2.105*

9.1 Variable names and brief descriptions

See WVWRAM Reference Manual for definitions of variables.

AquaAbund: aquatic area abundance
BRankHUC: biodiversity rank of 12-digit HUC watershed
BufferContig: contiguous 300m wildlife buffer
BufferLand roll-up: buffer condition and extent
BufferPerim: undisturbed perimeter
Chemtime roll-up: time and space for chemical reactions to occur
ClayOganic roll-up: organic soil near surface, prorated
ConnectFL: connectivity to the historic floodplain
ConsFocus: conservation focus areas
Depressions: surface depressions
Discharge: discharges to wetlands within 100 m (328 ft)
Disturb50m: water quality 50m buffer
DisturbWshd: land use disturbance in contributing watershed
FloodIn roll-up: floodwaters delivered to wetland
Headwater: headwater location
HydIntact: intactness of hydrologic regime
HydroH roll-up: hydrology for habitat and ecological integrity
HydSW: available surface water
ImpairedIn: impaired waters impacting wetland
IrrEdge: complex upland/wetland boundary
Karst: karst and limestone-influenced wetlands
LandHydro roll-up: landscape-level hydrologic connectivity
LandInteg: landscape integrity
LowSlope: low slope with wetland
Microtopo: microtopographic complexity
Organic: organic soil near surface
RoadRail: roads and railroads
Runoff roll-up: microtopography slows and stores runoff
Runoff50m: lands producing runoff within 50m
RunoffWshd: runoff from contributing watershed
SeaPondRatio: seasonal ponding ratio
SeasonPond: seasonal ponding
Slope: median percent slope
SlopeWshd: mean slope of contributing watershed
SoilIntact: lack of soil disturbance
SoilOrgCalc roll-up: deep organic or limestone-influenced soil
StrucPatch: structural patches
SWOutflow: surface water outflow
VegAll: all vegetation types
VegByLP: vegetation finging open water
VegFA roll-up: vegetation for flood attenuation
VegFQT: floristic quality
VegH roll-up: vegetation structure and quality
VegHorInt: horizontal interspersion of vegetation
VegPerUn4/VegPerUng: persistent ungrazed vegetation
VegStress: vegetation stressors
VegSum: raw floristic quality score
VegVerStr: vertical structure of vegetation
VegWoody/VegWoody4: woody vegetation
VegWQ roll-up: vegetation for water quality
WetldBird: wetland breeding bird occupancy
WshdPos: watershed position
WshdUniq: watershed wetland size and uniqueness

10. Annotated field form showing metric names

(see following pages)

West Virginia Wetland Rapid Assessment Datasheet

WVWRAM Field Form 2/7/2023

Identifiers *(refer to page 22 of WVWRAM User Manual)*

Site name _____ Date_____ SiteEventCode

Crew leader name _____ Field crew name(s) _____

Time (24 hr) Start _____ End _____ ❑ gear decontaminated prior to entering site *(p.19)*

Directions to site: ❑ all datasheets checked by crew leader at end of sampling

Notes on land use history, site conditions, wildlife observed, discussions with landowner or other on-site personnel, or deviations from protocol:

ID & QC

GPS make/model _____ GPS datum: ❑ NAD83 ❑ other _____

Coordinates (decimal degrees): _____

❑ Photos of inlet, outlet, NWI types, soils, stressors, and any other key features *(p.23)*

Assessment Area *Check one (p.25)*

❑ AA is the entire Wetland Unit (most sites).
❑ AA is a portion of the very large WU (> 25 acres)
❑ AA is only the Project Area, smaller than the WU - see manual for exceptions when project area survey is acceptable

QC

Comment _____

Mapping *All boxes should be checked at completion (p.28)*

❑ current land use compared to air photo for 50m (164 ft) and 300m (984 ft) buffer
❑ NWI wetland types GPS'ed and/or drawn on air photo
❑ perimeter walked; inlet, outlet, or other features GPS'ed and/or drawn on air photo
❑ soil sample locations GPS'ed and/or drawn on air photo

QC

Purpose of Assessment *Check all that apply*

❑ pre-impact ❑ replicate ❑ other
❑ restoration ❑ baseline
❑ random ❑ years post- _____
❑ reference

ID

Comment _____

Special Conservation Concern *Check one(p32)*

_____ B-rank from topmost box in list below. Read definitions in manual!

❑ old-growth swamp (B3)
❑ large bog or fen (B4)
❑ mature forested swamp (B5)
❑ summit sinkhole (Ridge&Valley only)(B5)
❑ no known special concern (none)

BRANK

Comment _____

PERIMETER AND NATURAL BUFFER *(p.33)*

Natural perimeter *Check one (p.34)*

❑ 100% ❑ 75-99% ❑ < 75%

BUFFERPERIM

50m (164') natural buffer for water quality *Check one (p.35)*

❑ > 90%
❑ 75-90%
❑ 50-75%
❑ < 50%

DISTURB50m

Contiguous 300m (984') natural wildlife buffer *Check one (p.35)*

❑ > 90% ❑ 60-90% ❑ < 60%

BUFFERCONTIG

NON-REGULATORY ADDITIONAL INFORMATION *For land acquisition and full functional scores (p.36)*

Ownership/Access *Check one (p.36)*

❑ public, or private with permanent unrestricted access
❑ private, with seasonal, partial, or case-by-case access
❑ private, without public access

Comment _____

Investment *Check one (p.36)*

❑ compensatory mitigation site
❑ conservation easement
❑ other conservation investment
❑ no known conservation investment

Comment _____

Recreation Infrastructure *Check all that apply (p.37)*

❑ maintained parking
❑ boardwalk
❑ informational kiosk or brochure
❑ maintained road w/i 30m (100') with view
❑ maintained trail
❑ boat access
❑ no infrastructure

Comment _____

NOT SCORED - LAND ACQUISITION and ALERTS

Planning or scientific use *Check all that apply (p.37)*

❑ water quality plan includes wetland
❑ habitat plan includes wetland
❑ monitored > 2yrs, non-regulatory, data available to public
❑ no known planning or sustained scientific use

Comment _____

Other Public Use *Check all that apply (p.38)*

❑ wetland visible from public area <100m (328')
❑ evidence of non-consumptive use
❑ evidence of consumptive use
❑ no evidence of public use

Comment _____

TOPOGRAPHY AND STRUCTURE *(p.38)*

Depressions *Check one (p.38)*

❑ none ❑ trace-10% ❑ 10-33% ❑ >33%

DEPRESSIONS

Microtopographic complexity *Check one (p.39)*

❑ < 3% ❑ 3-40% ❑ > 40%

MICROTOPO

Karst topography *Check all that apply (p.39)*

❑ limestone spring
❑ sinkhole
❑ sinking stream (not on mined land)
❑ isolated closed depression over limestone
❑ limestone/dol outcrop
❑ cave adjacent
❑ no evidence of karst

KARST

Structural Patch Type. ≥ 3 m^2 (32 ft^2) patch unless otherwise specified. *Check all that apply (p.40)*

❑ Open water
❑ Oxbows, secondary channels, swales
❑ Pools inaccessible to fish
❑ Springs or upwelling groundwater
❑ Non-vegetated flats (mudflats, sandflats)
❑ Animal mounds or burrows
❑ Beaver dams or lodges
❑ Abundant deciduous leaf litter
❑ Plant hummocks or tussocks
❑ Plant hummocks or tussocks > 25% cover of wetland (abundant)
❑ Coarse woody debris at least 10 cm (4") diameter and 91 cm (36") long
❑ Coarse woody debris, abundant: > 3% cover of wetland
❑ Standing snags at least 7.6 cm (3") diameter and 137 cm (4.5') tall
❑ Standing snags, abundant: ≥ 3/acre with dbh > 25 cm (10")
❑ Upturned tree root wads (tip-up mounds) and pits

HYDSW

STRUCPATCH

Comment _____

Site name _____ Date _____

VEGETATION STRUCTURE *(p.43)*

Forested NWI wetland types (combine all PFO) *Check all that apply*
Stratum covers ≥ 5% of PFOs or occupies ≥ 0.1 acre: *(p.44)*
❑ Canopy ❑ Understory ❑ Shrub ❑ Herb ❑ Moss

Forest regeneration (combine all PFO) *Check one (p.44)*
All native tree canopy species with >10% cover are present in the sapling layer.
❑ Yes ❑ No VEGVERSTR

Emergent NWI wetland types (combine all PEM) *Check all that apply*
Height stratum covers ≥ 5% of PEMs or occupies ≥ 0.1 acre: *(p.44)*
❑ < 30 cm (1 ft) ❑ 30-100 cm (1-3.3 ft) ❑ > 100 cm (3.3 ft)

Tall (>100 cm) graminoid marsh *Check one (p.45)*
Tall marsh with at least seasonal standing water and cattails, sedges, bluejoint grass, or bulrushes occupies ≥ 0.1 acre.
❑ Yes ❑ No VEGHORINT

Vegetation fringing open water *Check one (p.45)*
At least 90% of open water (lake, pond ≥ 0.1 acre, perennial stream) boundaries are fringed by band of wetland vegetation ≥ 10 m (33 ft) wide.
❑ Yes ❑ No ("no" includes sites not adjacent to open water) VEGBYLP

Mowed or grazed wetland *Check one (p.46)*
Mowed < 15 cm (6") tall or livestock-grazed areas
❑ none ❑ trace - 33% ❑ 33-67% ❑ > 67%
VEGPERUNG

HYDROLOGY *(p.46)*

Check one (p.46)
❑ Floodplain Wetland Unit (≥10% of wetland receives overland flow in 100-yr flood or more frequently, or major beaver influence in headwater wetlands)
❑ Non-floodplain Wetland Unit (may have stream associated with it but overland flow or beavers impact <10% of wetland)
FLOODPLAIN

Largest water source *Check one; note stream order if perm. flowing (p.47)*
❑ relatively permanently flowing and→ ❑ 1st or 2nd ❑ 3+ order
❑ intermittent or ephemeral
❑ underground spring
HEADWATER & QC
❑ no visible inlet (dispersed groundwater and precipation only)
❑ bidirectional (no stream; water level follows lake level or river flood stage)

If largest water source is a surface stream: *Check one if applicable*
❑ natural ❑ altered or constructed
Comment _____

Largest outlet is… *Check one (p.48)*
❑ relatively permanently flowing
❑ relatively permanently flowing but highly constricted
❑ intermittent or ephemeral
❑ no surface outlet (groundwater only)
SWOUTFLOW

If largest outlet is a surface stream: *Check one if applicable*
❑ natural ❑ altered or constructed
Comment _____

Overbank flooding and connection to river continuum *Check all that are observed within the wetland. Skip if no stream nearby/potentially connected.*
(pp.49-52)
❑ active beaver dam
❑ flood deposits (sediment deposits, debris, drift deposits, flood wrack)
❑ vegetation flattened and aligned along flow lines
❑ tree trunks with flood lines (water marks, silt coatings, staining, moss or lichen trim lines) or flood impact scars
❑ absence of leaf litter under deciduous trees as a result of flooding (not livestock impacts)
❑ braided stream channels, backwater sloughs, backchannels, or other flood drainage patterns present
CONNECTFL
❑ flood-prone area (inundated at 2 x maximum bankfull depth) overlaps at least 10% of wetland

Disconnection from river continuum *Check all that are observed at the stream that controls the floodplain. Skip if no stream potentially connected.*
(pp.49-52)
❑ physical barriers between wetland & stream (roads, railbeds, hardened levees)
❑ artificial drainage of floodplain between wetland and stream (ditches, drains, grading of land to improve drainage)
❑ stream channel hardened (riprap, gabions, concrete)
❑ stream channel straightened and/or moved to toeslope (meanders eliminated)
❑ dam upstream significantly reduces flooding
❑ land subsidence or significant streamflow reduction (sinking stream) in mined areas NOT on karst
❑ stream channel banks are steep, eroding, have abundant bank slides or slumps, have < 50% cover of roots, or are unvegetated
❑ stream is entrenched or moderately entrenched (Rosgen ER < 2.2 or Rosgen types A, F, G, B). Entrenchment is calculated as the flood-prone width divided by the bankfull width. Flood-prone width is measured at the elevation equal to twice the maximum bankfull depth. Maximum bankfull depth is the height of bankfull flow above the thalweg.
❑ stream is incised; bank height ratio (BHR) > 1.5. Bank height ratio is calculated as the height of lowest bank divided by maximum bankful depth.
❑ flood prone area (inundated at 2 x maximum bankfull depth) does not extend to more than 10% of wetland

Optional workspace for entrenchment, incisement, and flood-prone area measurements *(pp.50-52)*
See user manual for diagrams and definitions. Any units may be used as long as they are consistent.

maximum bankfull depth: _____
2 x maximum bankfull depth: _____
bankfull width: _____
flood-prone width: _____
lowest bank height: _____

_____ / _____ = _____
flood-prone width / bankfull width = entrenchment ratio (ER)

_____ / _____ = _____
lowest bank height / maximum bankfull depth = bank height ratio (BHR)

Site name _____ Date _____

Hydrology Stressors. *Check all that apply, then review total disturbance below. (p.53)*

- ❍ Ditch
- ❍ Tile or drain
- ❍ Weir, spillway, standing pipe or water control structure
- ❍ Impoundment impacting hydrology (excluding beaver dams)
- ❍ Berm
- ❍ Road or impervious surface (paved and/or not at grade)
- ❍ RR track
- ❍ Undersized or perched culvert
- ❍ Pump, spring box, water well
- ❍ Filling/excavating/grading the land surface
- ❍ Dredging of aquatic bed
- ❍ Point source discharge
- ❍ Stormwater input
- ❍ Agricultural runoff
- ❍ Invasive vegetation concentrated along watercourses, with at least twice as much invasive cover as areas away from watercourses
- ❍ Adjacent stream channel/riparian zone aggrading, with fresh splays of sediment, partially buried culverts, or bar formation
- ❍ More than 25% of the upland-wetland edge is abrupt and straight, not a gradual and complex transition zone > 3 meters (10 ft) wide
- ❍ Other_____

HYDINTACT

Review the total hydrologic disturbances above and rank severity of impact by checking one box below.

❑ Intact: Hydrologic regime is characterized by natural patterns, with no major hydrologic stressors present.

❑ Mild on-going disturbance and/or past disturbance but now essentially recovered. For example, small ditches or diversions; berms or roads at/near grade; or minor flow additions.

❑ Moderate on-going disturbance and/or in the process of recovering from more severe disturbance in the past. For example, dams upstream or downstream moderately affect hydroperiod; ditches or diversions < 1 m (3.3 ft) deep; two lane roads; culverts adequate for base stream flow but not flood flow; or moderate flow additions. Outlets may be moderately constricted, but flow is still possible.

❑ Severe on-going disturbance. For example, dams upstream or downstream moderately to substantially affect hydroperiod; a 4-lane highway; diversions upstream or > 1 m (3.3 ft) deep that withdraw a significant portion of flow; large amounts of fill or excavation; significant artificial groundwater pumping; or heavy flow additions. Outlets may be substantially constricted, blocking most flow.

❑ Hydrology is entirely artificial; no natural inflows. E.g., a water treatment wetland constructed below the outflow from a wastewater treatment plant.

Water Quality Stressors. *Check all that apply. (p.53)*

DISCHARGES

❑ No water quality stressors observed.

❑ Discharges to the wetland: stormwater discharges, livestock or agricultural runoff, straight pipes, drainage ditches, industrial discharges, oil slicks, sediment plumes, algal mats, odors, adjacent spoil piles, leaking silt fences, road salt, ROW herbicide, or erosion on the upland edges.

❑ Contiguous water body has algal bloom, power boat use, or other observable impairment.

❑ Other _____

Vegetation Removal or Alteration. *Check one box that best describes the wetland. (p.54)*

VEGSTRESS (VEGFQ)

❑ Minimal or no signs of anthropogenic vegetation removal or alteration OR impacts occurred in the past (typically > 80 years ago) and the wetland appears to have recovered to near-natural conditions. Examples: mature forested swamps, undisturbed beaver systems, undisturbed peatlands.

❑ Moderate. Vegetation removal or alteration is on-going and has moderate impact in terms of either severity or extent OR impacts occurred in the past and wetland is still in the process of recovering. Examples: successional swamps (black willow, box elder), young/unstructured swamps, many shrub/emergent.

❑ Severe. More than half of wetland is impacted by regular mowing, clearing, grazing, timbering, farming, dredging of aquatic bed, herbicide/pesticide/fertilizer application, burning, excessive herbivory or other form of on-going vegetation removal or alteration. Comment_____

Soil Stressors. *Check all that apply, then review total disturbance below. (p.55)*

- ❍ Livestock (trampling, pugging, compaction, or heavy grazing that leads to erosion)
- ❍ Machinery (plowing, filling, grading, dredging, compaction)
- ❍ ATV or vehicles (ruts, compaction, other disturbance)
- ❍ Removal of soil (mining, excavation)
- ❍ Replacement of soil with waste or fill (mining spoil, landfill)
- ❍ Other trampling or soil compaction
- ❍ Other erosion, sedimentation, or stressor. Comment _____

SOILINTACT

Review the total soil disturbances above and rank severity of impact by checking one box below.

❑ Intact: no anthropogenic disturbance.

❑ Small to moderate stress to soil profile. On-going stressors affect < 10% of wetland OR impacts occurred in the past and the soil profile has largely recovered. Depth of disturbance typically < 10 cm (4"); ponding/channeling of water in disturbed areas has little or no impact on overall site hydrology.

❑ Substantial stress to soil profile with extensive and long-lasting impacts; depth of disturbance > 10 cm (4"), may cause significant ponding or channeling of water that alters hydrology and vegetation.

WV Wetland Rapid Assessment Datasheet - Soils

Site name _____ Date _____

NWI Wetland Types *Refer to NWI code sheets. List all NWI codes present in assessment area; minimum 1 soil sample per each NWI code; minimum 1 soil sample per each 5 acres; NWI codes may be sampled more than once.*
Assign System, Class, and Subclass of the NWI code based on vegetation (ex. PEM1). Then sample soil and assign Water Regime, pH, and Soil organic/mineral modifiers. Add Special modifiers if present (ex. PEM1Abtn). *(p.55)*

NWI Wetland Type Code (refer to NWI Codes diagram)						Sampled	Not sampled (permanently ponded)	Soil notes Optional notes on soil profile or soil features.
NWI System & Class	Sub-class	Wat. reg.	Special	pH	Soil			
Examp. PEM	1	B	d	t	n	■	❑	0-5cm sapric,5-15cm mucky mod min,15-30+cm silt loam 25%redox conc
1.						❑	❑	
2.						❑	❑	
3.						❑	❑	
4.						❑	❑	
5.						❑	❑	
6.						❑	❑	
7.						❑	❑	

GIS Tool Input including HYDSW, IRREDGE, VEGALL, VEGWOODY

NWI Water Regime *Refer to NWI code diagram, NWI Water Regime Non-tidal Modifiers, and NWI Water Regime Restriction reference sheets. (p.56)*

SEASONPOND/SEAPONDRATIO

Add Water Regime modifier to NWI code at top of page:

temporarily flooded (A)	*seasonally flooded (C)*	*seasonally flooded-saturated (E)*	*permanently flooded (H)*
seasonally saturated (B)	*continuously saturated (D)*	*semipermanently flooded (F)*	*intermittently flooded (J)*
		intermittently exposed (G)	*artificially flooded (K)*

Special Modifiers *Only if applicable. Refer to NWI Code diagram and definitions. (p.58)*

If applicable, add Special modifier to NWI code at top of page. Add only the first applicable modifier, in this order: b, d, f, m, h, r, s, x
beaver (b), partly ditched/drained (d), farmed (f), managed (m), diked/impounded (h), artificial substrate (r), spoil (s), excavated (x)

Soil pH *pH value of soil at 10 cm (4") below the surface (p.59)*

Soil sampling site #	Ex.	1	2	3	4	5	6	7
	5.7	____	____	____	____	____	____	____

QC

Add pH modifier to NWI code at top of page:
pH < 5.5 = acid (a)
pH 5.5-7.4 = circumneutral (t)
pH > 7.4 = alkaline (i)

ORGANIC MATERIAL

2 cm (0.8") Organic Material Near Surface *Remove duff layer. Collect sample from top 8 cm (3") of soil profile. Refer to Organic Soils reference sheet. Peat, mucky peat, muck, or mucky modified mineral soil in top 8 cm (3") below the soil surface.* *(p.59)*

ORGANIC

Soil sampling site #	1	2	3	4	5	6	7	
	❑	❑	❑	❑	❑	❑	❑	Present: at least 2 cm (0.8") thick organic layer or mucky modified mineral layer
	❑	❑	❑	❑	❑	❑	❑	Not present

Total Depth of Surficial Organic Material *(not required for impact assessment; required for condition & restoration monitoring)*

Soil sampling site #	Ex.	1	2	3	4	5	6	7
	15	____	____	____	____	____	____	____

❑ cm
❑ inches

Description of Organic Material: peat/fibric, mucky peat/hemic, muck/sapric, or mucky modified mineral soil. *Ex. 0-5cm sapric, 5-15cm mucky mod min*

Not scored - carbon tracking

Deep Organic Soil. *Excavate each soil hole to either 40 cm (16") depth of organic soil, or 80 cm (32") total soil depth, whichever comes first.*
Histosol : Peat, mucky peat, or muck soil with at least 12-18% organic matter by weight and >= 40 cm (16") deep within the upper 80 cm (32") of soil profile.
Histic epipedon : Peat, mucky peat, or muck soil with at least 12-18% organic matter by weight and >= 20 cm (8") thick, but < 40 cm (16") thick, as a surface horizon. Aquic conditions or artificial drainage is required. Note that mucky modified mineral soil is NOT included in this section. *(p.60)*

HISTOSOL

Soil sampling site #	1	2	3	4	5	6	7	
	❑	❑	❑	❑	❑	❑	❑	Histosol present; NWI soil modifier = organic (g)
	❑	❑	❑	❑	❑	❑	❑	Histic epipedon present, but no histosol; NWI soil modifier = mineral (n)
	❑	❑	❑	❑	❑	❑	❑	Neither histosol nor histic epipedon present; NWI soil modifier = mineral (n)

Add Soil modifier to NWI code at top of page:
organic (g)
mineral (n)

West Virginia Wetland Rapid FQA Datasheet

(refer to WVWRAM User Manual pages 62-70) *WVWRAM Field Form*

Site name _____ Date _____

NWI Wetland Type Code *(p.65)* *NWI codes must match codes on Soils sheet*	**Dominant species identified** *see worksheet on back*	**% of AA** *field estimate or GIS (p.65)*	**Notes**
1. _____	❑		
2. _____	❑		
3. _____	❑		

Species Checklist. Circle space when species has at least 10% cover in wetland type. At the end of each wetland type meander, record cover within circles. Highly invasive wetland species are ***underlined*** and must be recorded even if they have < 10% cover. Write in any dominant species not listed. Use absolute cover, not relative cover. Typical cover values are 0.1, 1, 3, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, or 100 percent.

Aquatic Plants (true aquatic plants that are submergent or have floating leaves)

NWI wetland type # 1 2 3		NWI wetland type # 1 2 3		NWI wetland type # 1 2 3	
___ ___ ___	*Brasenia schreberi*	___ ___ ___	*Lemna valdiviana*	___ ___ ___	*Potamogeton crispus*
___ ___ ___	*Callitriche heterophylla*	___ ___ ___	***Myriophyllum aquaticum***	___ ___ ___	*Potamogeton sp.(not P. crispus)*
___ ___ ___	*Ceratophyllum demersum*	___ ___ ___	***Myriophyllum spicatum***	___ ___ ___	*Wolffia brasiliensis*
___ ___ ___	***Hydrilla verticillata***	___ ___ ___	*Nuphar lutea ssp. advena*	___ ___ ___	_____
___ ___ ___	*Lemna minor*	___ ___ ___	*Nymphaea odorata*	___ ___ ___	_____

Trees (woody plants that typically mature to a maximum height > 6 m)

NWI wetland type # 1 2 3		NWI wetland type # 1 2 3		NWI wetland type # 1 2 3	
___ ___ ___	*Abies balsamea*	___ ___ ___	*Crataegus sp.*	___ ___ ___	*Prunus serotina*
___ ___ ___	*Acer negundo*	___ ___ ___	*Fagus grandifolia*	___ ___ ___	*Quercus alba*
___ ___ ___	*Acer rubrum*	___ ___ ___	*Fraxinus americana*	___ ___ ___	*Quercus bicolor*
___ ___ ___	*Acer saccharinum*	___ ___ ___	*Fraxinus nigra*	___ ___ ___	*Quercus palustris*
___ ___ ___	*Acer saccharum*	___ ___ ___	*Fraxinus pennsylvanica*	___ ___ ___	*Quercus rubra*
___ ___ ___	*Aesculus flava*	___ ___ ___	*Juglans nigra*	___ ___ ___	*Robinia pseudoacacia*
___ ___ ___	*Ailanthus altissima*	___ ___ ___	*Liquidambar styraciflua*	___ ___ ___	*Salix alba*
___ ___ ___	*Betula alleghaniensis*	___ ___ ___	*Liriodendron tulipifera*	___ ___ ___	*Salix nigra*
___ ___ ___	*Betula lenta*	___ ___ ___	*Nyssa sylvatica*	___ ___ ___	*Tsuga canadensis*
___ ___ ___	*Betula nigra*	___ ___ ___	*Picea rubens*	___ ___ ___	*Ulmus americana*
___ ___ ___	*Carpinus caroliniana ssp. virg.*	___ ___ ___	*Pinus rigida*	___ ___ ___	*Ulmus rubra*
___ ___ ___	*Carya cordiformis*	___ ___ ___	*Platanus occidentalis*	___ ___ ___	_____
___ ___ ___	*Carya ovata*	___ ___ ___	*Populus tremuloides*	___ ___ ___	_____

Shrubs (woody plants with that typically mature to a maximum height < 6 m, often multi-stemmed)

NWI wetland type # 1 2 3		NWI wetland type # 1 2 3		NWI wetland type # 1 2 3	
___ ___ ___	*Alnus incana ssp. rugosa*	___ ___ ___	*Lindera benzoin*	___ ___ ___	*Spiraea tomentosa*
___ ___ ___	*Alnus serrulata*	___ ___ ___	*Lonicera morrowii*	___ ___ ___	*Vaccinium angustifolia*
___ ___ ___	*Aronia melanocarpa*	___ ___ ___	*Physocarpus opulifolius*	___ ___ ___	*Vaccinium myrtilloides*
___ ___ ___	*Asimina triloba*	___ ___ ___	*Rhododendron maximum*	___ ___ ___	*Vaccinium oxycoccos*
___ ___ ___	*Cephalanthus occidentalis*	___ ___ ___	***Rosa multiflora***	___ ___ ___	*Viburnum dentatum*
___ ___ ___	*Cornus amomum*	___ ___ ___	*Rosa palustris*	___ ___ ___	*Viburnum nudum var. cassinoides*
___ ___ ___	*Elaeagnus umbellata*	___ ___ ___	*Rubus pensilvanicus*	___ ___ ___	*Viburnum recognitum*
___ ___ ___	*Gaylussacia baccata*	___ ___ ___	*Salix caroliniana*	___ ___ ___	_____
___ ___ ___	*Hypericum densiflorum*	___ ___ ___	*Salix sericea*	___ ___ ___	_____
___ ___ ___	*Ilex mucronata*	___ ___ ___	*Salix sericea*	___ ___ ___	_____
___ ___ ___	*Ilex verticillata*	___ ___ ___	*Sambucus nigra ssp. canadensis*	___ ___ ___	_____
___ ___ ___	*Kalmia latifolia*	___ ___ ___	*Spiraea alba*	___ ___ ___	_____

Woody Vines

___ ___ ___	*Apios americana*	___ ___ ___	***Lonicera japonica***	___ ___ ___	*Toxicodendron radicans*
___ ___ ___	*Clematis virginiana*	___ ___ ___	*Rubus hispidus*	___ ___ ___	_____

Non-vascular Plants *(note that non-vascular species are not included in the dominant species calculations)*

___ ___ ___	*Sphagnum spp.*	___ ___ ___	*Filamentous Algae*	___ ___ ___	_____
___ ___ ___	*Total mosses & liverworts*	___ ___ ___	_____	___ ___ ___	_____

Site Name: _____ **Date:** _____

Ferns

NWI wetland type # 1	2	3		NWI wetland type # 1	2	3		NWI wetland type # 1	2	3	
___	___	___	*Dennstaedtia punctilobula*	___	___	___	*Osmunda regalis var. spectabilis*	___	___	___	_____
___	___	___	*Onoclea sensibilis*	___	___	___	*Pteridium aquilinum*	___	___	___	_____
___	___	___	*Osmunda cinnamomea*	___	___	___	*Thelypteris noveboracensis*	___	___	___	_____

Forbs (broad-leaved herbs, excluding true aquatics which are in the first section of the checklist)

___	___	___	*Acorus calamus*	___	___	___	*Laportea canadensis*	___	___	___	*Ranunculus repens*
___	___	___	*Alisma subcordatum*	___	___	___	*Lobelia cardinalis*	___	___	___	*Rudbeckia laciniata*
___	___	___	*Apocynum cannabinum*	___	___	___	*Ludwigia palustris*	___	___	___	*Sagittaria latifolia*
___	___	___	*Asclepias incarnata*	___	___	___	*Lycopus uniflorus*	___	___	___	*Saururus cernuus*
___	___	___	*Asclepias syriaca*	___	___	___	*Lycopus virginicus*	___	___	___	*Scutellaria lateriflora*
___	___	___	*Bidens frondosa*	___	___	___	*Lysimachia ciliata*	___	___	___	*Solidago canadensis*
___	___	___	*Boehmeria cylindrica*	___	___	___	*Lysimachia nummularia*	___	___	___	*Solidago gigantea*
___	___	___	*Caltha palustris*	___	___	___	***Lythrum salicaria***	___	___	___	*Solidago rugosa*
___	___	___	*Chelone glabra*	___	___	___	*Mimulus ringens*	___	___	___	*Solidago uliginosa*
___	___	___	*Dipsacus fullonum*	___	___	___	*Nasturtium officinale*	___	___	___	*Symphyotrichum lanceolatum*
___	___	___	*Doellingeria umbellata*	___	___	___	*Oxypolis rigidior*	___	___	___	*Symphyotrichum prenanthoides*
___	___	___	*Eupatorium perfoliatum*	___	___	___	*Packera aurea*	___	___	___	*Symphyotrichum puniceum*
___	___	___	*Euthamia graminifolia*	___	___	___	*Peltandra virginica*	___	___	___	*Symplocarpus foetidus*
___	___	___	*Galium aparine*	___	___	___	*Pilea pumila*	___	___	___	*Trifolium pratense*
___	___	___	*Galium tinctorium*	___	___	___	*Polygonum amphibium*	___	___	___	*Veratrum viride*
___	___	___	*Glechoma hederacea*	___	___	___	*Polygonum caespitosum longisetur*	___	___	___	*Verbena hastata*
___	___	___	*Hibiscus laevis*	___	___	___	***Polygonum cuspidatum***	___	___	___	*Verbesina alternifolia*
___	___	___	*Hibiscus moscheutos*	___	___	___	*Polygonum hydropiperoides*	___	___	___	*Vernonia noveboracensis*
___	___	___	*Hypericum mutilum*	___	___	___	***Polygonum perfoliatum***	___	___	___	*Viola cucullata*
___	___	___	*Hypericum punctatum*	___	___	___	*Polygonum punctatum*	___	___	___	*Xanthium strumarium*
___	___	___	*Impatiens capensis*	___	___	___	*Polygonum sagittatum*	___	___	___	_____
___	___	___	***Iris pseudacorus***	___	___	___	*Ranunculus acris*	___	___	___	_____
___	___	___	*Justicia americana*	___	___	___	*Ranunculus hispidus var. nitidus*	___	___	___	_____

Graminoids (grasses, sedges, rushes)

___	___	___	*Acorus calamus*	___	___	___	*Dichanthelium clandestinum*	___	___	___	*Leersia virginica*
___	___	___	*Agrostis gigantea*	___	___	___	*Dichanthelium dichotomum*	___	___	___	***Microstegium vimineum***
___	___	___	*Agrostis hyemalis*				*ssp. microcarpon*	___	___	___	***Phalaris arundinacea***
___	___	___	*Andropogon gerardii*	___	___	___	*Dulichium arundinaceum*	___	___	___	***Phragmites australis***
___	___	___	*Anthoxanthum odoratum*	___	___	___	*Echinochloa crus-galli*	___	___	___	*Phleum pratense*
___	___	___	***Arthraxon hispidus***	___	___	___	*Eleocharis obtusa*	___	___	___	*Poa compressa/pratensis/trivialis*
___	___	___	*Calamagrostis canadensis*	___	___	___	*Eleocharis palustris*	___	___	___	*Poa palustris*
___	___	___	*Carex atlantica*	___	___	___	*Eleocharis tenuis*	___	___	___	*Rhynchospora alba*
___	___	___	*Carex canescens*	___	___	___	*Eriophorum virginicum*	___	___	___	*Schoenoplectus tabernaemontani*
___	___	___	*Carex crinita*	___	___	___	*Glyceria laxa*	___	___	___	*Scirpus atrovirens*
___	___	___	*Carex echinata*	___	___	___	*Glyceria melicaria*	___	___	___	*Scirpus cyperinus*
___	___	___	*Carex folliculata*	___	___	___	*Glyceria striata*	___	___	___	*Scirpus polyphyllus*
___	___	___	*Carex gynandra*	___	___	___	*Holcus lanatus*	___	___	___	*Sparganium americanum or*
___	___	___	*Carex intumescens*	___	___	___	*Juncus acuminatus*				*S. eurycarpum*
___	___	___	*Carex lupulina*	___	___	___	*Juncus brevicaudatus or*	___	___	___	***Typha latifolia, Typha sp.***
___	___	___	*Carex lurida*				*J. subcaudatus*	___	___	___	_____
___	___	___	*Carex prasina*	___	___	___	*Juncus effusus*	___	___	___	_____
___	___	___	*Carex scoparia*	___	___	___	*Juncus tenuis*	___	___	___	_____
___	___	___	*Carex stipata*	___	___	___	*Leersia oryzoides*	___	___	___	_____
___	___	___	*Carex stricta*								
___	___	___	*Carex trisperma*								
___	___	___	*Carex utriculata*								
___	___	___	*Carex vulpinoidea*								
___	___	___	*Cinna arundinacea*								
___	___	___	*Cinna latifolia*								
___	___	___	*Cyperus odoratus*								
___	___	___	*Danthonia compressa*								

Dominant species worksheet *(sum cover values across all strata within each wetland type)*

Sum of Species Cover *(p.67)*

___ ___ ___	**Stop when all dominant plant species** (≥ 10% total cover across all strata) **and highly invasive** (bolded) **plants have been identified AND the sum of species cover is ≥ 80%.** For NWI wetland types with total vegetative cover of < 100% (e.g., aquatic bed, mudflats), the sum of species must be ≥ 80% of the total vegetative cover. Example: PAB has total cover of 40%. 80% of 40% = 32% is the required sum of species cover.
Total cover if <100%	
___ ___ ___	