# Field Manual for Rapid Ecological Integrity Assessments of Wetlands in Riparian Areas in Maryland:

# Coastal Plain Version 1.0

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# 1.0 INTRODUCTION

## 1.0.1 Background

A watershed implementation plan (WIP) has been approved for the Chesapeake Bay and the State of Maryland and its local jurisdictions have waste load allocations to meet for reducing nutrients and sediment. An updated watershed management plan has also been developed for the Coastal Bays. There are certain practices in these plans (stream restoration, shoreline stabilization, and wetland restoration) which often require Maryland Department of the Environment (MDE) authorizations, and hundreds to thousands of additional applications are anticipated over the next few years. Although MDE must process incoming applications now and in a timely manner, by using existing policies, methods, guidance and tools, MDE seeks to continuously improve its methods, approaches, and tools to ensure that these activities are effective and that the processes MDE uses to review these activities are cost-effective and efficient.

Stream restoration is a creditable practice under the WIP for reducing nutrients and sediment. Proposals are made in settings with varying degrees of degradation. Some areas retain wetland characteristics and continue to provide important habitat benefits. In some cases, the stream restoration may result in tradeoffs in resource types and unintended consequences and effects. Potential unintended consequences and tradeoffs include loss of riparian/wetland forest; conversion of vegetated wetland to open water; increased temperature in the stream; lowered dissolved oxygen in the stream; lowered pH in the stream; and blockages to passages to aquatic life.

There is a need to improve assessment and recommendations for restoration projects to reduce resource tradeoffs and unintended consequences. The assessment and guidance produced under this project will better ensure that restoration projects are designed in a manner to protect aquatic resources that may be present or dependent on the site while still resulting in restoration which may receive credit for reducing nutrients and sediment.

The field criteria include new office and field ecological assessments based on the Key Wildlife Habitats for nontidal stream/wetland complexes described in the Maryland State Wildlife Action Plan. Assessments will focus on rapid indicators (including plant communities; indicators of disturbance and wildlife use) for classifying the type of habitat and suitability for an appropriate type of restoration. The Maryland State Wildlife Action Plan may be viewed at:

https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/SWAP_home.aspx

The information will be used by the Department of Natural Resources (DNR) and MDE as funding and review agencies to provide guidance to restoration practitioners in designing appropriate restoration projects to improve existing resource conditions, resulting in stream

restoration qualifying as a creditable practice for nutrient and sediment reduction while also maintaining or enhancing the habitat conditions essential for the Species of Greatest Conservation Need, as identified in the Maryland State Wildlife Action Plan.

### 1.0.2 Ecological Assessment

An ecological integrity assessment can be defined as "an assessment of the structure, composition, and function of an ecosystem as compared to reference ecosystems operating within the bounds of natural or historic disturbance regimes" (adapted from Lindenmayer and Franklin 2002; Young and Sanzone 2002; Parrish et al. 2003). To have ecological integrity, an ecosystem should be relatively unimpaired across a range of ecological attributes and spatial and temporal scales. Identification of reference or benchmark conditions based on natural or historic ranges of variation, although challenging, can provide a basis for interpretation of ecological integrity (Swetnam et al. 1999). Ecological integrity is key to maintaining a diversity of natural communities of plants and animals across Maryland's landscape into the future.

This document describes the protocols for applying rapid, field-based Ecological Integrity Assessments (EIA) to stream-associated wetland ecological targets as modified from the Level 2 EIA methodology of Rocchio et al. 2016, Faber-Langendoen et al. (2012, 2016a,b,c), and Shappell et al. (2016). This assessment relies on a general conceptual model that identifies and scores ground-level major ecological factors to assess the level of integrity relative to reference site conditions; uses a remote sensing approach to assess landscape context; and uses ecological classifications (Key Wildlife Habitats) to refine the assessment of metrics and overall ecological integrity.

The EIA method enables consistent and repeated assessment of biodiversity sites to determine if value is conserved, enhanced, or diminished. For each of the EIA metrics described in this manual, see Faber-Langendoen et al. (2012) for additional information on background, rationale, rating, scaling, and citations.

## 1.1 Purpose and Need

Guidance, assessment methods, and recommendations are needed to better ensure that restoration projects are designed in a manner to protect aquatic/wetland resources that may be present or dependent on the site while still allowing for projects which can receive credit toward nutrient and sediment reduction. The guidance and assessment method presented here is intended for restoration practitioners, planners, and regulators. It is assumed that the user is familiar with requirements of "Wetland Delineation Manual" and regional supplements used in Maryland (U.S. Army Corps of Engineers, USACE 2010) and U.S. Fish and Wildlife Service classification systems for the National Wetlands Inventory (https://www.fws.gov/wetlands/). In order to minimize the additional time and resources associated with conducting the

assessment, much of its information is derived from what is also recorded during wetland delineations according to the relevant Federal Manual.

This document includes multiple tools and supporting information as part of the guidance:

1) A classification system based on the vegetation communities of Key Wildlife Habitat (KWH), which support designated Species of Greatest Conservation Need, according to the Maryland Wildlife Action Plan with corresponding hydrogeomorphic (HGM) classifications;

2) Description of Key Wildlife Habitats (KWH) excerpted from the Maryland Wildlife Action Plan, with accompanying photos.

3) Office and field assessment to characterize wetland condition (ecological integrity) in relation to reference communities of KWH.

Recommendations for restoration based on the extent of degradation and condition of the KWH riparian resources present are summarized in a separate guidance document.

The specific goal of this EIA is to provide a repeatable and rapid protocol that provides information on the condition of a wetland in terms of its ecological value to wildlife, especially those Species of Greatest Conservation Need identified in the Maryland State Wildlife Action Plan (Maryland DNR 2015), as well as its ecological integrity relevant to unaltered or reference wetlands. To meet these goals, this EIA focuses on the condition of Key Wildlife Habitats (Appendix 1), those habitats that support the animal species considered to be Species of Greatest Conservation Need (SGCN) and associated rare plants and natural communities. SGCN include all state- and federally listed Threatened or Endangered species, rare species, endemic species, declining species, and responsibility species for which Maryland harbors a significant portion of the overall population. The distribution and abundance of SGCN and other Maryland wildlife species are directly related to the condition, extent, and location of their habitats. Because of the strong tie between species and habitats, it is critical to identify those habitats that support SGCN in order to conserve them. These species are listed by KWH in the Maryland State Wildlife Action Plan.

Because vegetation typically reflects biological, geological, and ecological patterns across the landscape, Key Wildlife Habitats are structured as ecological cover types based primarily on vegetation (Maryland DNR 2015). They are organized into a simple classification scheme which is scalable, allowing for compatibility with other ecological classifications. At the local level, this classification scheme is closely related to Maryland's natural community classification (Harrison 2016). This classification is a relatively fine-scaled classification system that uses an ecologically-based hierarchy and grouping of vegetation associations from the U.S. National Vegetation System (Federal Geographic Data Committee 2008) as the foundation.

In considering the potential impacts of stream restoration projects, an assessment of the current condition of Key Wildlife Habitats can be useful to determine how proposed projects may benefit or degrade existing wetlands associated with the stream. If an additional objective of the assessment is to determine whether the site is a rare community type in Maryland, then Harrison (2016) can be used to link to the standard plant associations and determine conservation status.

## 1.2 General Procedures and Guidelines

This EIA is designed to make use of data collected during the wetland delineation and site inspection process at an area proposed for a stream restoration project. This document provides the process for establishing assessment target boundaries (i.e., assessment area) and protocols for collecting data necessary to apply the EIA metrics at both landscape and site levels. Metric scoring is adjusted to wetland type where needed and is based on known reference conditions for U.S. National Vegetation Classification types (Meininger and McCarthy 1997, Thomson et al. 1999, Harrison and Knapp 2010, USNVC 2022, Harrison pers. comm.). Stressors are identified based on known impacts of threats to these systems and contribute to scoring. Once metrics are scored, they are rolled-up into four core ecological factors: landscape, soil/substrate, hydrology, and habitat structure and composition. These core factor scores are combined to calculate an overall EIA score/rank if useful for project objectives. Scores are meant to be compared only between similar Key Wildlife Habitats or associations. Stream restoration project reviewers may only be interested in the core metric scores, as they provide insight into current condition, stressors present, potential impacts of the project on KWH and the species that they support, and measures of success. On the other hand, if the goal is to compare or prioritize sites for conservation, restoration, or management actions between areas, an overall EIA score/rank may be needed. Overall EIA scores for ratings other than “Excellent” may be increased if the project site includes certain unique resources or limited habitat types.

The EIA is carried out using a combination of office and field assessments, preferably carried out in conjunction with the wetland delineation required for stream restoration project planning and permit application. If a formal wetland delineation has already been performed, some additional office and field assessments will be necessary (Table 1). If a rigorous wetland delineation has not been performed or is not finalized, the general steps of the process are outlined in Table 2. Assessment Areas (AAs) are identified and sampled in a manner consistent with a typical wetland delineation for this region (USACE 2010), including completion of a wetland determination data form for each vegetation community. For projects or wetlands with multiple AAs, the procedures for the field assessment should be repeated at each AA to adequately characterize the representative diversity and variability in the project area. Field

assessments are used to refine AA boundaries as needed. Data recording options are outlined below.

A landscape assessment for the entire stream restoration project area is carried out using imagery and data layers available on the Maryland Watershed Resources Registry. Data layers from USGS StreamStats and Maryland Department of the Environment Tier II High Quality Waters websites provide additional information. Data collected in the field are used to supplement remote imagery as needed and to provide information for the individual Assessment Area(s) within the entire restoration area. Assessment Areas are classified to Key Wildlife Habitat type in the field to target condition evaluation and to provide a set of expected characteristics. In addition to the data collection required for wetland delineations (USACE 2010), the field assessment portion includes descriptive information for landscape position, water source, and hydrological regime. It also includes scored metrics for soil/substrate, hydrology, and Key Wildlife Habitat structure and vegetation composition.

For the in-office assessment and field data collection, information can be recorded and interpreted for scoring in one of two ways:

1) Use the Condensed Field and Scoring Guidance (Appendix 4) to guide data collection and entry into a Microsoft Excel file or onto the KWH EIA Data Sheet for the Coastal Plain (Appendix 3). If the wetland delineation and the EIA are being carried out simultaneously and both the Microsoft Excel file for this assessment and the Microsoft Excel file available for wetland delineations are open (with macros enabled), the data entered on the wetland delineation file will autopopulate some of the data fields for the assessment (see instructions on the Excel sheet).
2) Use the KWH EIA Data Sheet with Scoring Guidance for the Coastal Plain (Appendix 5) to guide data collection and entry onto this form. Data can be entered into Microsoft Excel files as described above if the wetland delineation is being carried out simultaneously with the EIA.

This field manual provides background information, detailed instructions for the in-office and assessment, information on field metrics, scoring tables, and examples.

**Table 1. General step-by-step guidelines for applying the Ecological Integrity Assessment (wetland delineation completed).**

| | |
|---|---|
| Step 1 | Identify the Assessment Areas (AAs) as each delineated wetland in the area of interest. (Section 2) |
| Step 2 | Using imagery and tools available in the Maryland Watershed Resources Registry, establish the boundary for each AA and add buffers for landscape metric scoring (10m, 100m, 300m). Conduct the office assessment of landscape context surrounding each AA and determine if there are any unique resources present using mapped data layers. (Section 3) |
| Step 3 | Prepare for the field assessment to collect any additional data needed beyond the delineation data. Become familiar with metrics and protocols to ensure they are measured correctly. Verify the appropriate season and other timing aspects of the field assessment. Assemble needed materials and supplies. (Section 4) |
| Step 4 | Conduct the field assessment of on-site conditions for each AA using a site walkthrough approach (Section 4) and one of the methods described above to record and interpret data. The entire AA should be assessed, including--as much as is feasible--the 100 m buffer around the AA. Classify each AA to Maryland Key Wildlife Habitat (KWH) using the key provided in this document. Use the KWH type as needed to define metric scoring standards. If possible, use the vegetation and characteristics observed to classify the wetland to U.S. National Vegetation Classification Plant Association types that occur in Maryland (Harrison 2016). Use information from a Corps/MDE verified wetland delineation to reduce duplication in data collection. |
| Step 5 | If needed based on field assessment, delineate final AA boundaries and adjust landscape scoring (Sections 2, 3, 4). Determine the size of the AA and score the Comparative Size metric (Section 3.4). |
| Step 6 | Complete assessment scoring and calculate the final score, including bonus points as instructed (Section 5). |

**Table 2. General step-by-step guidelines for applying the Ecological Integrity Assessment (wetland delineation NOT completed- recommended).**

| | |
|---|---|
| Step 1 | Assemble background information about the current condition, management, and history of the site. (Section 2) |
| Step 2 | Identify a preliminary Assessment Area (AA) for each wetland type in the area of interest using project boundaries and other available information. (Section 2) |
| Step 3 | If the AA is not likely to change based on the field visit, use imagery and tools available in the Maryland Watershed Resources Registry to establish the boundary for each AA and add buffers for landscape metric scoring (10m, 100m, 300m). Conduct the office assessment of landscape context surrounding each AA and determine if there are any unique resources present using mapped data layers. (Section 3). If the AA boundaries depend on the field visit, complete the Steps in this order: 4, 5, 6, 3, 7. |
| Step 4 | Prepare for the field assessment. Become familiar with metrics and protocols to ensure they are measured correctly. Verify the appropriate season and other timing aspects of the field assessment. Assemble needed materials and supplies. (Section 4) |
| Step 5 | Conduct the field assessment of on-site conditions for each AA using a site walkthrough approach (Section 4) and one of the methods described above to record and interpret data. Simultaneous use of EIA and delineation Excel files for data entry will reduce duplication of effort. The entire AA should be assessed, including--as much as is feasible--the 100 m buffer around the AA. Classify each AA to Maryland Key Wildlife Habitat (KWH) using the key provided in this document. Use the KWH type as needed to define metric scoring standards. If possible, use the vegetation and characteristics observed to classify the wetland to U.S. National Vegetation Classification Plant Association types that occur in Maryland (Harrison 2016). |
| Step 6 | Delineate final AA boundaries based on the field assessment and adjust landscape scoring as needed (Section 2,3,4). Determine the size of the AA and score the Comparative Size metric (Section 3.4). |
| Step 7 | Complete assessment scoring and calculate the final score, including bonus points as instructed (Section 5). |

The EIA should preferably be carried out during the growing season for the characteristic plant community or communities of the wetland or wetlands to be assessed. In general, this window is from mid-April through September or October, although vernal pools may need to be assessed starting in March and ending in May depending on seasonal rainfall. To assist with determining the best timing for identification of rare plant species that might be present (including wetland obligate and facultative species), fruiting and flowering times for signature

species associated with Key Wildlife Habitats (Maryland DNR 2015) can be found in the expanded list of rare, threatened, and endangered plants of Maryland (Maryland Natural Heritage Program 2021 or most recent version).

# 2.0 SITE BACKGROUND INFORMATION AND DELINEATION OF PROJECT AREA AND WETLAND ASSESSMENT AREA

In advance of field data collection, review of available information on the stream restoration project area is invaluable to guide work at the site and to identify target areas for sampling. The Assessment Area(s) (AA) is/are the targeted area(s) within the proposed project that will be the focus of the Environmental Integrity Assessment sampling. The AA is "the entire area, subarea, or point of an occurrence of a wetland type with a relatively homogeneous ecology and condition" (Faber-Langendoen et al. 2016a,b,c), so there may be multiple different assessment areas within the overall project site. A single AA should be composed of only one Key Wildlife Habitat, consistent with guidance for wetland determinations to sample a single vegetation community or major landscape unit. AA(s) are located in or adjacent to the proposed stream restoration project footprint. The entire area directly affected by the restoration project will include all of the wetland assessment areas, including any areas of earth movement or direct vegetation removal, as well as indirect changes resulting from alteration of any water levels. If there is a likelihood that any characteristics related to surface or groundwater levels, duration of flow, discharges, or velocities of surface water are likely to occur upstream or downstream of the project site, a description of any changes should also be submitted with the application and assessment document.

The approach for AA delineation in this project will be polygon-based. This polygon will define the area for field data collection. If a rigorous wetland delineation has been completed, polygons for all wetland types (KWH) present can be used as the AA boundaries as long as they meet the AA description above. If wetland areas at the project site are not delineated, an initial polygon for each AA will be created in advance of the field visit using GIS-based resources. Multiple AAs are needed if there is more than one KWH present in the stream restoration project area and AA boundaries may need to be adjusted based on the field site visit. Stream restoration project area boundaries may not include an entire target AA, however, due to extent of the restoration project or private lands considerations. To the extent possible, metrics should be scored for an entire AA to capture its ecological integrity and KWH condition.

To create a preliminary AA boundary for an area that has not already been determined in the field, map the wetland area to be assessed using readily observable ecological attributes such as vegetation, soil, and hydrological characteristics. Aerial and satellite imagery, both current and historical, will be useful in addition to information on soil types and topographic maps. It is highly recommended that the most recent data layers and aerial imagery are used as site

conditions and land use can change drastically over short periods of time. Historical photos, such as those available on Google Earth, can assist with visualizing the AA and its history. Useful online map viewers and tools that include these and other data layers are listed in Appendix 2. Particularly useful are layers found in the Maryland Watershed Resources Registry (NWI and DNR wetlands layers, nontidal Wetlands of Special State Concern, floodplain data, geology, soils, imagery). The layers can also aid in pre-identification of existing priority resources, as well as modeled rankings for restoration or preservation. These tools should be used to create preliminary, mapped AA boundaries for all distinct wetland vegetation types at the project location if that information is not already available. An outline of the entire stream restoration project on aerial images will be needed for the Landscape Assessment (Section 3). LiDAR MD Statewide Hillshade (Maryland Watershed Resources Registry) should be used to look for additional channels in the project area and can help with outlining the wetland area. Mapped soil characteristics for the site should be downloaded from the USDA-NRCS Web Soil Survey (https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

# 3.0 LANDSCAPE LEVEL ASSESSMENT

Landscape level assessments provide an important perspective on wetland ecological integrity, especially for wetlands associated with streams and rivers. Watershed features such as the presence of impervious surface, widespread clearing of upland forests, point source inputs, and stream channelization can impact wetland structure and function by increasing sedimentation that can alter the chemical and hydrological characteristics of wetlands. Wetlands can become disconnected from recharge areas or become fragmented, and flood regimes and the input and cycling of nutrients can be altered. Point sources, such as municipal industrial sites, and non-point sources, such as agricultural lands and urban runoff, add materials to groundwater and surface water that upset the balance of wetland water chemistry and the biogeochemical cycling of materials in wetland ecosystems (Mitsch and Gosselink 2015). In this section, calculation of buffer metrics, aquatic context, and comparative size of the AA are used to provide information on the ecological integrity of the proposed stream restoration area. In addition, the mapped location of the stream restoration project area will be used to assess whether other unique resources are present (Section 3.5). Buffer metrics and aquatic context will be scored for the entire stream restoration project area and these scores will apply to each AA within the project area. Comparative size will be assessed for each individual AA.

The Landscape Level Assessment can be conducted prior to the field assessment when the boundary of the stream restoration project has been mapped out except when the project area is likely to be moved in the field. If the project area boundaries are likely to be moved, the Landscape Assessment portion should be completed *following* the field survey (Table 2). Viewing the aerial and satellite imagery in advance helps to identify potential stressors or ambiguous features that may be on the edge of the site (e.g., an abandoned ditch), in difficult

to access areas, or are otherwise likely to be overlooked or inaccessible in the field. A review of the imagery may also assist with identifying stressors in the 100-m buffer outside of the stream restoration project area, especially those that are not easily viewed during the site visit or if access to the buffer area is limited. Depending on the landscape complexity and observer experience, this portion of the assessment may take 30-60 minutes to complete.

Although most of the landscape-level assessments will be done in the office using mapped features and aerial imagery, additional features noted in the field that are not visible on available imagery may affect the assessment. In the field, as you are traveling to and assessing the AA, make note of the features described below to supplement the in-office assessment related to the buffer, presence of other wetlands, and size of the AA. Record these observations on the data sheet.

## 3.1 Imagery and Tools for Landscape Level Assessments

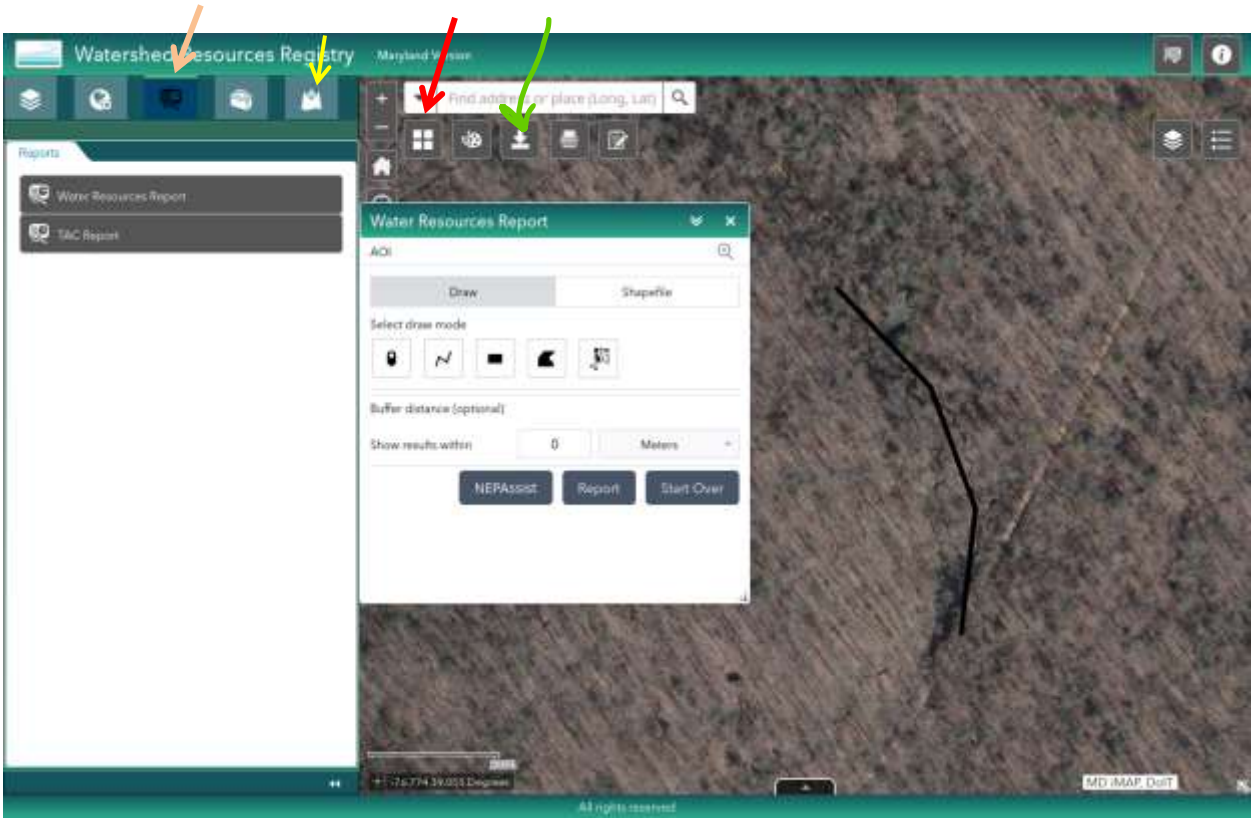
Aerial imagery, land cover data, data layers with additional resources, and tools available online in the Maryland Watershed Resources Registry (WRR) will be used for several of the landscape portions of the Ecological Integrity Assessment. Data layers in the WRR and information from other sources will be used to determine the presence of unique resources at the project site. The Maryland Department of the Environment Tier II High Quality Waters map shows whether the project site supports high levels of aquatic biodiversity and USGS StreamStats for Maryland and the District of Columbia provides two metrics for the basin surrounding the project area: percent Impervious Surface and percent Forest Cover. Instructions are covered in Section 3.5.

To use the WRR for buffer analyses, go to https://watershedresourcesregistry.org/states/maryland.html) and click on “View Map” . When you have reached the screen in Figure 1, use the button indicated by the red arrow to select a basemap image such as “Imagery with Labels”, “Topographic”, “MD NAIP Imagery” (growing season), “MD 6-inch” (non-growing season), or another layer that you can use to visualize the project area. Find the project area on the image or load a GIS file under the “Add Data” button in the toolbar. In this example (Figure 1), the project area is represented by the black line drawn with the polyline tool (jagged line) under the “Reports- Water Resources Report-Draw” tab (indicated by the blue arrow). The project area can also be represented by a polygon, as may be the case with an uploaded GIS file or if you use the polygon button under the “Reports-Water Resources Report-Draw” tab.

You will need to place buffers around the project area line or polygon. These images should be saved using the “Save Session” tab (green arrow) for use in subsequent analyses. Alternately, files with 10, 100, and 300m buffers around the outlined project area may be created in ArcGIS and imported into the WRR under the “Add Data” tab. To continue without uploading ArcGIS files with buffers, with your image including the project area line or polygon, select the

"Reports- Water Resources Report-Draw" tab (indicated by the blue arrow) and type in "10" and select "meters" for the buffer distance in the optional "Buffer distance" section. When you select "Report", the buffer will be displayed as a red line around your project area line or polygon. This file should be saved or downloaded ("Save Session" tab) for use in the calculation of the Buffer Perimeter metric (Section 3.2.1). Next, type "100" in for the Buffer distance (making sure "meters" is still selected) and select "Report". You will now have an image with the project area surrounded by a red line at 100m. Save or download this file for use in calculating the Buffer Condition metric (Section 3.2.2). Next, type "300" in for "Buffer distance" (with meters selected as units) and select "Report" to get an image with a red line at 300m around the outside of the project area. Save or download this file for use in calculating the Aquatic Context metric (Section 3.3).

**Figure 1. Example Imagery for Use of Watershed Resources Registry (WRR).** The black line indicates the project area for the following examples. The orange arrow indicates the "Water Resources Report" tab, yellow arrow "Add Data" tab, green arrow "Save Session" tab, and red arrow "Basemap Gallery". For more details, see the User Manual for the WRR.




## 3.2 Buffer Metrics

These metrics are calculated for the stream restoration project area and applied to all AA within that project area. The buffers immediately surrounding the project area (within a 10m zone and

within a 100m zone) are assessed using two metrics: percent of the perimeter with a natural buffer and condition of the buffer. Aerial photography and tools in Maryland Watershed Resources Registry (WRR) can be used in combination with observations in the field. Wetland buffers play a critical role in the condition of the wetland relative to key abiotic and biotic factors. Natural habitats in particular provide the greatest benefit. Natural habitats are defined in Table 3.

The buffer should be assessed in the field to the extent possible, and adjustments should be made to the score as needed based on actual observations. Demonstrated below are examples using the WRR.

### 3.2.1 Perimeter with Natural Buffer

For this metric, the percentage of the perimeter within 10m of the project area that represents a natural buffer will be calculated. See instructions in Section 3.1 to create the necessary imagery. Measurements can be made using the Drawing Tool (palette with brush symbol) in the WRR by selecting the polyline button and entering the units in meters. For this metric, you will need to estimate the length of the project area with a natural buffer and the length of the areas excluded from the natural buffer (Table 3) by drawing along the project line or the edge of the project polygon. Determine the total length of the project area with natural buffer habitat according to the definition in Table 3. To qualify as natural buffer, the area meeting the definition of natural must be at least 10 meters (33 feet) wide and extend along the perimeter of the wetland for at least 10 meters (33 feet) without a break. Open water is considered natural buffer. Use the length of natural buffer and the length of perimeter not in natural buffer to calculate the total perimeter length and the percent of natural buffer immediately surrounding the project area. Use Table 4 to rate the metric. An example of this process using the WRR is presented in Figure 2. In this case, the natural buffer perimeter is 421.2m and the total buffer perimeter is 421.2 + 43.8m = 465m. The percentage of natural buffer is 90.5%, yielding a rating of “Good” (score of 3).

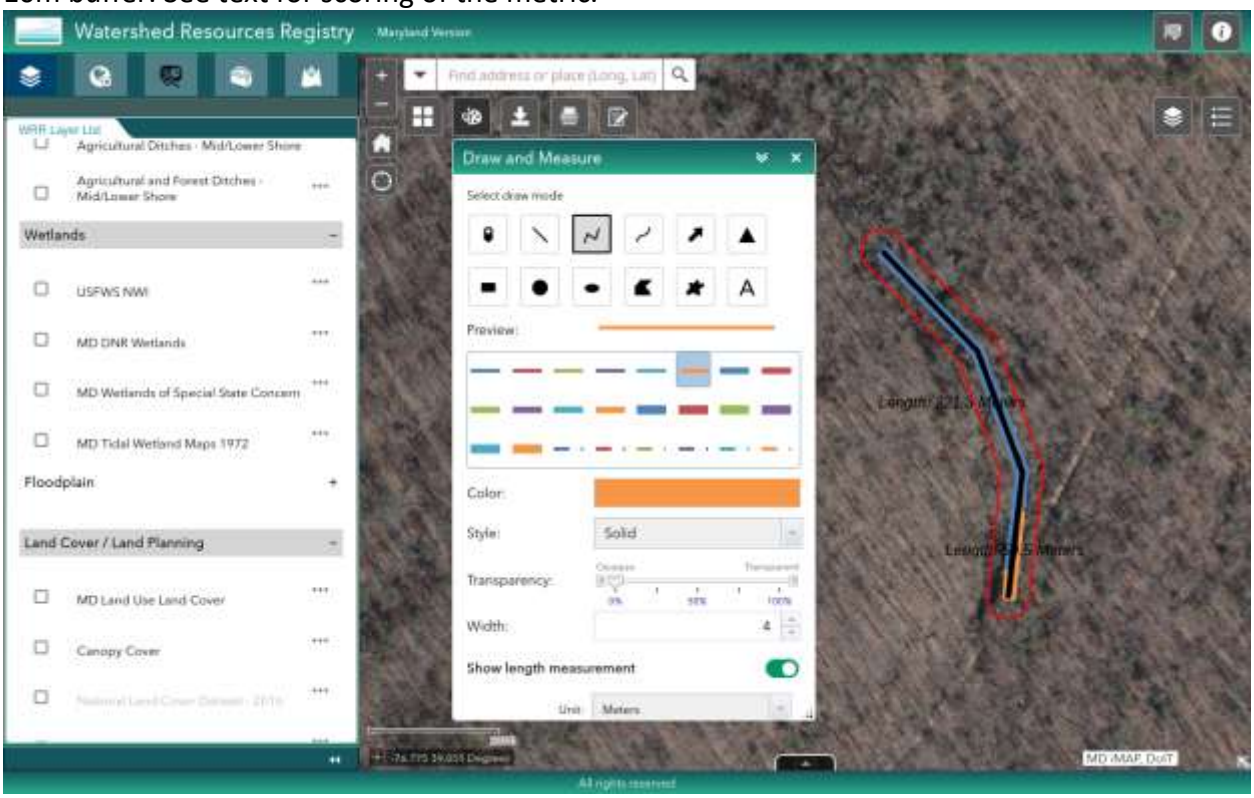
**Table 3. Guidelines for Identifying Natural Buffers.**

| Examples of Land Covers Included in Natural Buffers | Examples of Land Covers Excluded from Natural Buffers |
|---|---|
| Natural plant communities; naturally vegetated rights-of-way; natural swales and ditches; open water including streams; wetlands | Parking lots; commercial and private developments; roads (all types); intensive agriculture; intensive plantations; orchards; vineyards; railroads; planted pastures; planted hayfields; animal pastures; lawns; sports fields; traditional golf courses; fallow farm fields; ditches; stormwater ponds; ponds formed by unnatural blockages; culverts |

**Table 4. Buffer Perimeter Metric Rating Criteria**

| Metric Rating | Rating Criteria |
|---|---|
| 4 = Excellent | Natural buffer is >95% of perimeter |
| 3 = Good | Natural Buffer is 85-95% of AA perimeter |
| 2 = Fair | Natural Buffer is 75-84% of AA perimeter |
| 1 = Poor | Natural Buffer is < 75% of AA perimeter |

**Figure 2. Example Imagery for Buffer Perimeter Metric Calculation.** The red line indicates the 10m buffer around the linear project area. The blue line indicates the section of the perimeter that is in natural buffer (421.2 m) and the orange line indicates the sections of the perimeter that are not in natural buffer (43.8m) because of the presence of a road within a section of the 10m buffer. See text for scoring of the metric.




## 3.2.2 Condition of Buffer

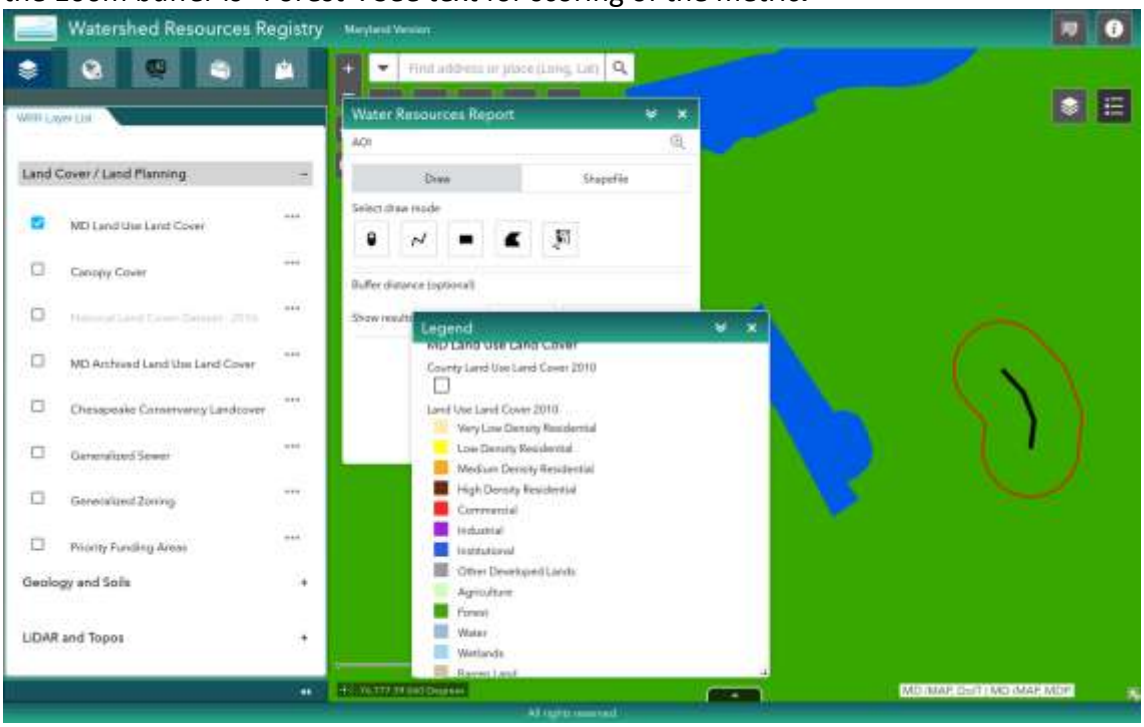
Buffer condition is estimated by determining the overall presence and condition of natural habitats within 100m of the project area. See instructions in Section 3.1 to create the necessary imagery. The evaluation can be made by using the MD Land Use Land Cover layer (under "Layers" tab second from the left, under Land Use/Land Cover) in the WRR in the office, followed by ground-truthing, as needed. For this exercise, natural habitats are those areas classified as Forest, Wetlands, and Water. Estimate the percent of the 100m buffer in these categories overall to represent the proportion of the buffer in natural condition. You can use

the Polygon button in the Measurement Tool to outline individual sections within the 100m buffer around the project area if needed to calculate the total proportion of Forest, Wetland, and Open Water compared to the total area included in the 100m buffer. An example of this process using the WRR is presented in Figure 3. In this case, all of the area within the 300m buffer is classified as "Forest", so the rating would be "Excellent" (score of 4).

**Table 5. Buffer Condition Metric Rating.**

| Metric Ratings | Buffer Condition |
|---|---|
| Excellent = 4 | Buffer is characterized by abundant (> 90%) natural cover (Forest, Wetland, or Open Water categories) |
| Good = 3 | Buffer is characterized by substantial (75–90%) natural cover. |
| Fair = 2 | Buffer is characterized by a moderate (50–74%) natural cover. |
| Poor = 1 | Low (< 50%) cover of natural habitats within the buffer. |

**Figure 3. Example Imagery for Buffer Condition Metric Calculation.** The red line indicates the 100m buffer around the linear project area. The only Land Use Land Cover category present in the 100m buffer is "Forest". See text for scoring of the metric**.**



## 3.3. Aquatic Context

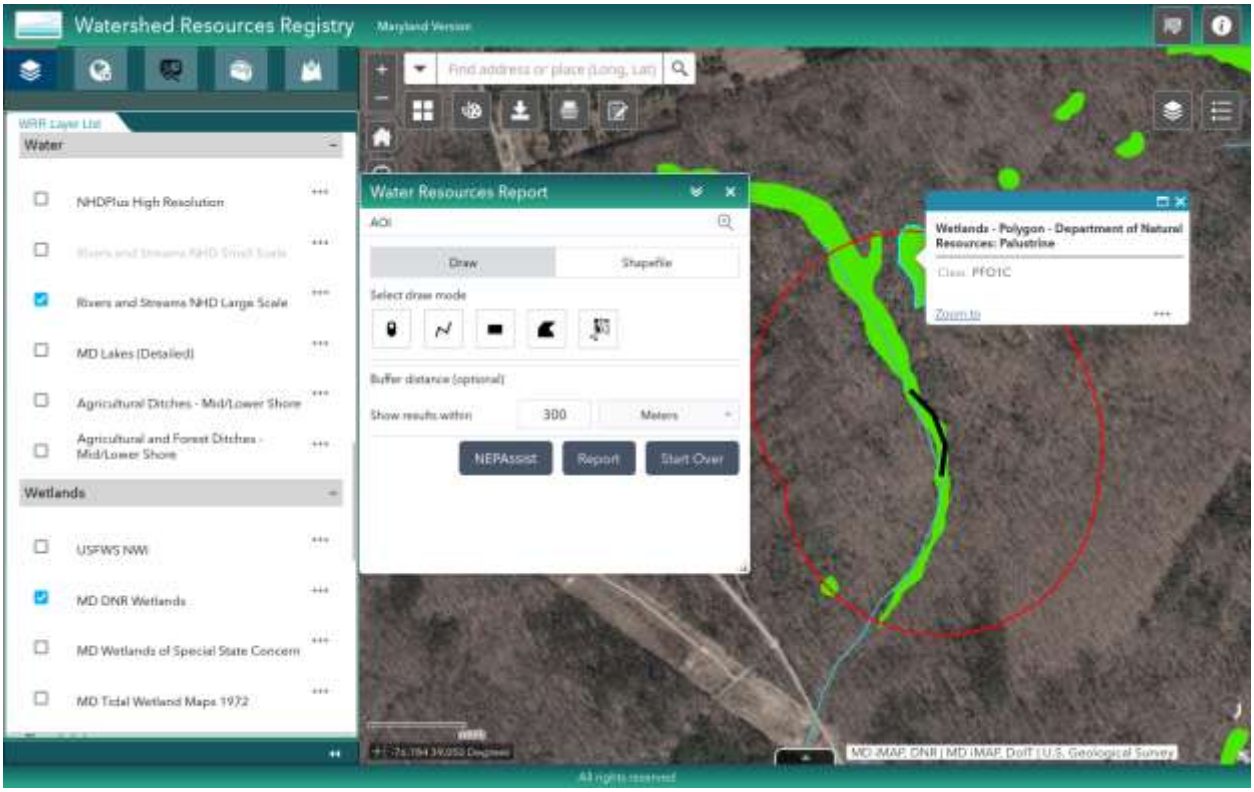
This metric will be calculated using the project area with a 300m buffer with the Watershed Resources Registry tools and imagery (see instructions in section 3.1). The MD DNR Wetlands Layer and the National Wetlands Inventory (NWI Layer (under Wetlands tab) and Rivers and Streams layer (under Water tab) will be used to determine how many different wetlands and additional streams are included within the 300m buffer of the entire stream restoration project area. To determine the different types of wetlands present, you will need to select areas and click to see the wetland class. If there is overlap with the NWI and DNR polygons, use the more recent DNR layer. If a wetland is shown on the NWI layer but not the DNR layer, include the NWI wetland in the total number of classes. Additional small-scale wetlands such as Springs or Vernal Pools may need to be identified during field data collection. The metric rating is calculated by adding up the number of wetland types and streams or rivers in addition to the project area present according to the rating criteria in Table 6. An example of this process using the WRR is presented in Figure 4. In this case, there were more than four distinct wetlands (by geography or by type), so the rating would be "Excellent" (score of 4).

Small habitat features like Vernal Pools may not be mapped on available wetland layers. Note these small wetlands in the field to provide a better score for the Aquatic Context metric.

**Table 6. Aquatic Context Metric Rating Criteria.**

| Metric Rating | Rating Criteria |
|---|---|
| Excellent = 4 | 4 or more types |
| Good = 3 | 3 types |
| Fair = 2 | 2 types |
| Poor = 1 | 0-1 type |

**Figure 4. Example Imagery for Aquatic Context Metric.** The project area is represented as a black line and the red line indicates the 300m buffer. Wetlands are colored green. Clicking on a wetland causes it to be outlined in light blue and the class is shown on the screen as you see here.




## 3.4 Comparative Size

Wetland size, especially when assessing wetlands as entire polygons, is an important indicator of the overall integrity of the AA. Size does interact with landscape context, such that small wetlands embedded in entirely natural landscapes do not, necessarily, have less ecological integrity than a larger example of the same wetland in a fragmented landscape. Conversely, a large wetland in a fragmented landscape is likely to be more buffered from landscape stressors than a small wetland in a similar landscape. Thus, careful consideration is given to the appropriate way to score size, considering this suite of contextual factors.

This metric examines the current absolute size (ha) of the entire wetland type polygon or patch, as well as indicator species and evidence of a reduction in size due to human-caused factors. It is assessed either with respect to expected patch-type sizes for the type across its range, or as a comparative size based on size distribution. Assessors are sometimes hesitant to use patch size as part of an EIA out of concern that a small, high-quality example will be down-ranked unnecessarily. These concerns are addressed, to a degree, by providing an absolute patch-type scale for KWH in the pilot project area, so that types that typically occur as very small patches (Spring, Vernal Pool) can use a different rating than types that may occur over large, extensive

areas (e.g., Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp). Size is also more accurately assessed at finer scales of classification (e.g., plant association; see Harrison 2016). The presence or absence of any area-sensitive indicator species dependent on the KWH can also be useful to determine wetland condition related to size if this information is available. A good surrogate is to look for the indicator species for different vegetation layers by KWH in Table 13. An estimate of size reduction for the metric rating should include consideration, to the extent possible, of human-caused factors including conversion or disturbance due to changes in hydrology due to roads, impoundments, development, human-induced drainage, or changes caused by recent cutting. Assigning a metric rating depends on the degree of reduction. Causes of the size of reduction should be indicated on the field data sheet.

The approximate size of the AA as a whole may include areas beyond the stream restoration project site. It is important to consider the size of the entire area encompassed by the KWH wetland type being evaluated as part or all of the AA. An assessment of size may require reference to aerial or satellite imagery or other data layers (see Appendix 2) in addition to information collected during the site visit, especially to refine AA boundaries. It is also important to know the spatial pattern typical of the wetland type being assessed based on knowledge of the typical sizes of KWH found in excellent condition in the pilot project area (Table 7). To complete scoring for comparative size, the AA will need to be classified to KWH using Table 12 and indicator species need to be noted (Table 13).

**Table 7. Patch Type Definitions for Typical Spatial Patterning of Key Wildlife Habitats.**
(modified from Comer et al. 2003; Harrison 2016).

| *Patch Type and Potential KWH* | *DEFINITION* |
|---|---|
| Large Patch:<br><br>Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp | Ecosystems that form large areas of interrupted cover and typically have narrower ranges of ecological tolerances than matrix types. Individual disturbance events tend to occupy patches that can encompass a large proportion of the overall occurrence (e.g., > 20%). Given common disturbance dynamics, these types may tend to shift somewhat in location within large landscapes over time spans of several hundred years. In undisturbed conditions, typical occurrences range from 50–2,000 ha (125-5,000 ac). |
| Small Patch:<br><br>Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Bog and Fen, Coastal Plain Seepage Swamp | Ecosystems that form small, discrete areas of vegetation cover, typically limited in distribution by localized environmental features. In undisturbed conditions, typical occurrences range from 1–50 ha (3 – 125 ac). |

| | |
|---|---|
| Very Small Patch: Vernal Pool, Spring, Coastal Plain Seepage Swamp | Ecosystems that form very small, discrete areas of vegetation cover (if present), typically limited in distribution by localized environmental features. In undisturbed conditions, typical occurrences range from 50$m^2$ or less-1 ha (to 3 ac). |
| Linear: Coastal Plain Floodplain | Ecosystems that occur as linear strips. They are often ecotonal between terrestrial and aquatic ecosystems. In undisturbed conditions, typical occurrences range in linear distance from 0.5–100 km (1 – 60 mi). |

After determining the KWH type in the AA, rate the Comparative Size Metric as informed by Patch Type (Table 7). Use Table 8 to assign a score based on the wetland's patch type and presence of indicator species. Consider the degree of reduction from observations at the site or through aerial image or site history information (e.g., changes in hydrology due to roads, impoundments, development, human-induced drainage; or changes caused by recent cutting).

**Table 8. Comparative Size Metric Rating Criteria.**
Use Table 13 for lists of Indicator Species by KWH and consider any evidence from the site or other resources to indicate whether the wetland has been reduced in size due to human activities resulting in conversion or disturbance.

| **Comparative size incorporating evidence of size reduction due to human activities** | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Very large size compared to other examples of the same type, based on current and historical spatial patterns. Occurrence is at, or only minimally reduced (< 5%) from its original, natural extent due to conversion or disturbance. |
| Good = 3 | Large size compared to other examples of the same type, based on current and historical spatial patterns. Some indicator species are not present. Occurrence is only somewhat reduced (5-10%) from its original natural extent due to conversion or disturbance. |
| Fair = 2 | Medium to small size compared to other examples of the same type, based on current and historical spatial patterns. Several to many indicator species are not present. Occurrence is modestly reduced (10-30%) from its original natural extent due to conversion or disturbance. |
| Poor = 1 | Small size to very small compared to other examples of the same type, based on current and historical spatial patterns. Most or all indicator species are not present. Occurrence is substantially reduced (> 30%) from its original natural extent due to conversion or disturbance. |

## 3.5 Unique Landscape-level Features

Additional metrics that characterize the project area in a broader context, especially in terms of its value as a KWH, are assessed using data layers in the Maryland Watershed Resources Registry, MDE Tier II High Quality Waters, and USGS StreamStats. The presence of these features enhances the value of the KWH(s) in the project area because they indicate that there are high quality habitats for one or more Species of Greatest Conservation Need. The metrics for these unique features and how to assess them for the project area are described below. The presence of any of these features at the project site is documented using the checkmarks on the Scoring Form (Appendix 3 or 5). It is recommended that these unique features be identified before the field data collection. Field observations may provide evidence of additional resources that further support KWH features in the project area (see Section 5.1).

The data layers for several priority conservation areas can be found in the Maryland Watershed Resources Registry (https://watershedresourcesregistry.org/states/maryland.html): Nontidal Wetlands of Special State Concern; Biodiversity Conservation Network Tier 1, 2, or 3; Targeted Ecological Areas; Sensitive Species Project Review Area; and Class 1 Forest Interior Dwelling Species (FIDS) area. Go to the website and navigate to the WRR Layer List (upper left). To see if the project area includes any of these resources, open the Priority Conservation Areas section then make these layers active by clicking on the boxes next to them: Targeted Ecological Areas, Biodiversity Conservation Network, Sensitive Species Project Review Area, and Forest Interior Dwelling Species. Next, select the Wetlands section then select the MD Wetlands of Special State Concern Layer. Zoom in on the map to locate the project area or load it from a file as previously described. A box will come up when you click on the project area as long as at least one layer overlaps. The box will show details related to the particular layers that overlap the site, including a page for each feature. The number of pages and which page you are viewing appears in the upper left corner of the box (e.g., 1 of 2, 1 of 3, etc.) and you can navigate between the boxes (layers that overlap) using the arrow in the upper right corner. Be sure to click through all of the boxes to capture all of the overlaps with these unique resource areas. If a layer as defined below overlaps the project area, check the appropriate box on the Scoring Form (Appendix 3 or 5). The presence of these resources will be used to add bonus points to the Overall Ecological Integrity Assessment rating if it is not “Excellent” (Section 5.1 and Table 30).

Nontidal Wetlands of Special State Concern are recognized in state regulations as supporting rare, threatened, or endangered species or unique habitats. The Biodiversity Conservation Network (BioNet) prioritizes areas into five tiers for terrestrial and freshwater biodiversity conservation that support not only the most rare and irreplaceable species and habitats in Maryland, but also high-quality common habitats and the larger landscapes required for migratory animals, dispersing populations, and habitat shifts resulting from climate change. For

this assessment, note if the project area intersects with Tier 1 (Critically Significant for Biodiversity Conservation); Tier 2 (Extremely Significant for Biodiversity Conservation); or Tier 3 (Highly Significant for Biodiversity Conservation). The Tier is displayed at the top of the box. An overlap with a Targeted Ecological Area indicates that the project area is located on lands and watersheds of high ecological value that have been identified as conservation priorities by the Maryland Department of Natural Resources (DNR) for natural resource protection. These areas represent the most ecologically valuable areas in the State. The Sensitive Species Project Review Area contains regulated areas such as Natural Heritage Areas, colonial waterbird nesting colonies, locally significant wildlife habitat areas, and Habitat Protection Areas (Critical Area Program) in addition to habitat for rare, threatened, and endangered species and rare natural community types. The last layer in WRR to screen supports Forest Interior Dwelling Species (FIDS), known to require habitat conditions in the interior of forests for optimal reproduction and survival. If there is overlap with this layer, look to see what "Habitat Classification" is in the pop-up box. If the overlap is with a Habitat Classification value of 1, the highest quality FIDS habitat, indicate this on the Scoring Form. This means that the project area is within a relatively unfragmented forest block.

Tier II High Quality Waters represent places where aquatic species thrive due to good water quality and other supporting habitat conditions. These areas are designated based on measured indices of biotic integrity (IBI) that are 4 or greater ("good") for both benthic macroinvertebrates and fish. Maps of stream segments that are designated as Tier II can be found here: https://mdewin64.mde.state.md.us/WSA/TierIIWQ/index.html. Locate the project area on the map. If any part of it falls within or adjacent to a Tier II stream segment, note this on the Scoring Form.

Two other features that have an impact on stream and KWH health have been mapped by USGS StreamStats (https://streamstats.usgs.gov/ss/): impervious surface area and forest cover. These can be calculated for the area ("basin") where the project area is located. At the website, type "Maryland" into the search box then select Maryland and District of Columbia. Zoom in to the project area far enough that you can see defined, rectangular blue stream segments. Click on the "Delineate" button and select a point in the middle of the project area. A project basin will be defined that you can modify if you need to by following the prompts to add an area and draw a shape to include your full project area. If you are getting a "no data" message, try a nearby area and modify the project basin to include the project area. Once you have identified a basin, select "Continue". Select the dropdown menu for "Basin Characteristics" and check the boxes next to FOREST and IMPERV. Click on "Continue" then "Open Report" when the report is available. If the value for "Impervious surface percentage" is less than 5, check the box on the Scoring Form as low impervious surface cover reduces stream flashiness. If forest cover

percentage in the basin is more than 90%, check the box on the Scoring Form. This value was selected because it is consistent with metrics for a "Good" buffer condition based on the positive impacts of high forest cover on water quality, wetland support, and stream-associated KWH.

# 4.0 FIELD DATA COLLECTION

This section provides guidance on how to populate the field data sheet and scoring sheet (Appendix 3), Condensed Field and Scoring Guidance (Appendix 4), and combined Data Sheet with Scoring Guidance (Appendix 5) for the Ecological Integrity Assessment using the information on measuring and scoring below. Data collected during the typical wetland delineation process for this region (USACE 2010) are used to measure certain metrics; measures for other metrics will be entered on the field data sheet or Excel file. Observations, modifications, or concerns due to abnormal circumstances should be recorded on the field data sheet or in the Excel file. The completion of the data sheet and calculation of final scores will take place either in the field or during a post-data collection office review. The first two sections below address basic site-level data. Thereafter, protocols for each metric and scoring are described. The majority of protocols used for the pilot EIA are the same as outlined by Faber-Langendoen et al. (2016a,b). Some metrics are scored depending on the Key Wildlife Habitat type present in the AA.

It is assumed that data will be collected during a walkthrough or meandering survey rather than by establishing plots, although especially for larger sites a point intercept method may be recommended for estimating vegetation cover (USACE 2010). In addition to standard footwear and attire for working in wetlands, the following materials and supplies are needed for applying the Ecological Integrity Assessment (EIA):

- EIA field data sheets and guidance (Appendices 3 and 4 or Appendix 5) or Excel file and guidance; wetland delineation form, if previously completed; clipboard, pencils; topographic map and aerial photos (printed and/or on phone or tablet)
- Local plant identification keys and field guides, hand lens; plastic bags for sample collection if needed, plant press (can be stored in vehicle); soil auger or shovel; measuring tape; Munsell soil color charts/book
- Compass, GPS receiver (NAD83 with sufficient memory and batteries or phone/tablet app), camera (with sufficient memory and battery charge), small trowel or shovel, pin flags and/or flagging/tape (helpful for assessment area layout).

## 4.1 Site/Assessment Area Information

The USACE (2010) manual should be followed when filling out information on site characteristics and determining the Assessment Area (AA). If multiple assessment areas are established at the site, provide a unique name/identifier for each assessment area. For

example, if there are multiple AAs at a site called “Nanjemoy Creek” the individual AAs should be labeled something like “Nanjemoy Creek-01” and “Nanjemoy Creek-02”.

In the Site Description section on the first page or on a separate sheet of paper, indicate the following:

Plots: if vegetation plots are established within the site/AA, give them unique plot codes. If transects are used, indicate this in the Site Description section.

Photos: If photos are taken, please provide the photographer’s name and associated file names. A brief description of each photo’s content should be documented in (1) a field notebook or (2) file name; or (3) in the photo’s metadata.

Site Description: Provide a written description of the site’s characteristics. Focus on the setting in which the site occurs, ecological and vegetation patterns within and adjacent to the site, notable stressors or human activity impacting the wetland and adjacent stream, signs of wildlife, characteristics of the adjacent stream, etc. as indicated on the data sheet. A drawing may also be helpful. Indicate the size of the AA, preferably using aerial or satellite imagery and adjusting as needed based on actual site conditions.

## 4.2 Environmental Information

These data should be entered in the appropriate section of the field data sheets (Appendix 3 or 5). Imagery (Section 3.1) and the presence of indicator plants associated with certain KWH (Table 13) can sometimes assist in determining landscape position and water source. Estimate the slope of the AA and the aspect if applicable.

Landscape Position: Select the landform feature (or features) that best fit the location of the AA and enter onto the data sheet; if needed, enter a landform not represented in Table 9.

**Table 9. Landscape Position.** (Check all features present on the data sheet).

| | | | |
|---|---|---|---|
| Active floodplain (depression or terrace) | Beaver pond/Natural impoundment | Riparian-Depression (in floodplain) | Riparian terrace (outside seasonal flooding; historic floodplain or current terrace) |
| Headwater stream/spring | Seep/groundwater discharge site- toe slope | Swale | Isolated Depression |
| Oxbow | Wetland charged by groundwater seeps- hill slope | Streambank | Point bar |
| Flats | Braided Channels | Other- describe | |

Water Source: Select the primary water source for the AA from those listed in Table 10 and enter onto the data sheet. If more than one water source is present, indicate which is primary, secondary, or tertiary. Classification to KWH (Table 12) may assist with determining the primary water source due to vegetation indicators and other factors used to classify KWH.

**Table 10. Water Source.** (If more than one source is present, indicate which is primary, secondary, and tertiary on the data sheet).

| | | | |
|---|---|---|---|
| Direct precipitation | Groundwater discharge | Natural surface flow | Urban run-off/culverts |
| Overbank flooding | High groundwater | Irrigation | Pipes/outfall (directly feeding wetland) |

Hydrological Regime: Although not influenced by oceanic tides, Nontidal Water or Hydrological Regimes are defined in terms of the growing season which, for the purposes of this classification, begins with green-up and bud-break of native plants in the spring and ends with plant dieback and leaf-drop in the fall due to the onset of cold weather. During the rest of the year, which is defined as the dormant season, even extended periods of flooding may have little influence on the development or survival of plant communities. Select the regime that best matches conditions in the AA (Table 11). The hydrological regime usually matches the mapped wetland type (WRR- DNR or NWI, or other data layers for Maryland).

**Table 11. Hydrological Regime.** (Adapted from Federal Geographic Data Committee FGDC–STD-004-2013 Classification of Wetlands and Deepwater Habitats).

| Hydrological Regime | Definition |
|---|---|
| H Permanently flooded | Water covers the substrate throughout the year in all years. |
| G Intermittently exposed | Water covers the substrate throughout the year except in years of extreme drought. |
| F Semipermanently flooded | Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface. |
| C Seasonally flooded | Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years. |
| E Seasonally flooded-saturated | Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the substrate typically remains saturated at or near the surface. |
| B Seasonally saturated | The substrate is saturated at or near the surface for extended periods during the growing season, but unsaturated conditions prevail by the end of the season in most years. Surface water is typically absent but may occur for a few days after heavy rain and upland runoff. |
| D Continuously saturated | The substrate is saturated at or near the surface throughout the year in all, or most, years. Widespread surface inundation is rare, but water may be present in shallow depressions that intersect the groundwater table, particularly on a floating peat mat. |

| | |
|---|---|
| A Temporarily flooded | Surface water is present for brief periods (from a few days to a few weeks) during the growing season, but the water table usually lies well below the ground surface for most of the season. |
| J Intermittently flooded | The substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation. The dominant plant communities under this regime may change as soil moisture conditions change. Some areas exhibiting this regime do not fall within our definition of wetland because they do not have hydric soils or support hydrophytes. This regime is generally limited to the arid West. |
| K Artificially flooded | The amount and duration of flooding are controlled by means of pumps or siphons in combination with dikes, berms, or dams. The vegetation growing on these areas cannot be considered a reliable indicator of regime. Examples of Artificially Flooded wetlands are some agricultural lands managed under a rice-soybean rotation, and wildlife management areas where forests, crops, or pioneer plants may be flooded or dewatered to attract wetland wildlife. Neither wetlands within nor resulting from leakage from man-made impoundments, nor irrigated pasture lands supplied by diversion ditches or artesian wells, are included under this Modifier. The Artificially Flooded Water Regime Modifier should not be used for impoundments or excavated wetlands unless both water inputs and outputs are controlled to achieve a specific depth and duration of flooding. |

## 4.3 Classification of Assessment Area to Key Wildlife Habitat and Characteristic Species

Use the information on landscape position, water source, and the key in Table 12 to classify the Assessment Area to Key Wildlife Habitat. If possible, use the vegetation and characteristics observed to classify the wetland to U.S. National Vegetation Classification Plant Association types that occur in Maryland (Harrison 2016). The presence of characteristic and indicator species by vegetation layer in Table 13 may also be useful to determine the category for the AA. Full descriptions of KWH can be found in Appendix 1. If your assessment objective is to determine whether a site meets the criteria for a rare community type, classify the native wetland or riparian ecosystem type to the USNVC community type/plant association level and provide a global or state conservation rank (see Harrison 2016). Stream KWH types are also mapped and described in Appendix 1. Most stream restoration projects will take place in streams that fit the lower order Coastal Plain Stream type rather than the larger Coastal Plain River type. Blackwater Streams, sluggish, low gradient systems, are characterized by low acidity, generally with pH levels less than 6; relatively high dissolved organic carbon; and low dissolved oxygen levels due to increased bacterial respiration from the decomposition of organic matter. Decomposing leaves and other organic inputs give these streams their dark, tea-like color. Given their lack of stable bedrock and boulder substrates, instream wood is of critical importance to Blackwater and Coastal Plain Stream systems to define hydrologic features and provide cover for the aquatic biota.

**Table 12. Maryland Key Wildlife Habitat Classification Key for non-tidal wetland habitats of the Coastal Plain, including HGM Class**. For descriptions and examples of KWH, see Appendix 1. HGM classes are defined in Smith et al., 1995.

**1a.** Wetlands bordering streams and rivers with overland, non-tidal flooding regimes (i.e., floodplains). Distinct alluvial landforms (e.g., backswamps, levees, terraces) and indicators present (e.g., scour marks, recent sediment deposition, vegetation damaged/bent in one direction, soils with alternating deposits, channel banks with flood marks). Likely to be 3rd order and higher but may be braided systems. Structurally and compositionally diverse vegetation present ranging from closed mixed forests to floodplain pools to open, beaver-created pools with floating aquatics**……COASTAL PLAIN FLOODPLAIN** HGM Class: Riverine

**1b.** Wetlands primarily controlled via groundwater discharge often associated with depressional and slope geomorphic features as well as the margins of small stream (1st and 2nd order) floodplain wetlands.

**2a.** Wetlands associated with toe slopes and floodplains of small streams of the Coastal Plain where groundwater discharge is a major contributing input source (mixed hydrological regime: occurs in very narrow part of the groundwater driven complex that is influenced by overbank flooding) with alluvial landform a minor part of the complex; smaller order stream floodplain margins where groundwater input also contributes to overall hydrology. These areas are generally small features along streams and are usually not as well-developed as seepage swamps in larger stream systems……**COASTAL PLAIN FLOODPLAIN** HGM Class: Riverine or Slope

**2b.** Wetlands associated with distinct depressional and slope geomorphic features.

**3a.** Basin wetlands, depressions, or very flat areas with evidence of ponded water, unidirectional flow not evident, lacks natural outlet, maintained by high water tables and seasonal precipitation. Hydrologic regimes range from saturated to seasonally flooded.

**4.** Seasonally flooded to saturated forested flats and depressions of broad coastal plain terraces (i.e., "wet flatwoods") with fluctuating water levels and intermittently ponded depressions. Soils are silt, sand, and clay loams, sometimes with a thin (< 30 cm [12 in]) mantle of coarse, fibric peat.

**5a.** Located on flat terraces and shallow depressions with seasonally perched water tables and braided channels……**COASTAL PLAIN FLATWOOD AND DEPRESSION SWAMP** Flatwood: HGM Class- Flat; Depression Swamp: HGM Class- Depression

**5b.** Small (<0.1 ha- 2 ha) shallow pools with a well-defined, discrete basin overlying a clay hardpan or other impermeable soil or rock layer impeding drainage, may or may not have vegetation in basin……**VERNAL POOL** HGM Class: Depression

**3b.** Slope wetlands associated with groundwater discharge zones (i.e., seeps, springs) and perennial, unidirectional flow towards a natural outlet such as a stream.

6a. Small (usually <1$m^2$), localized area of groundwater discharge, point source, rare in Coastal Plain…..**SPRING** HGM Class: Slope

**6b.** Larger wetland systems with diffuse drainage patterns, widespread.

**7a.** Open wetlands characterized by predominately shrub and herbaceous vegetation and localized groundwater discharge zones. (*note. Lack of natural disturbances [e.g., fire, beaver activity, grazing] in these habitats often promote woody plant succession.)* Saturated "bog-like" wetlands along gently sloping headwater streams, seepage toe-slopes, and oligotrophic spring-heads with considerable accumulation of peat mosses (*Sphagnum spp*.) at varying depths, soils acidic and infertile (*note. The term "bog" applied here is a technical misnomer since none of these wetland systems in Maryland are ombrotrophic.)*…….**COASTAL PLAIN SEEPAGE BOG AND FEN (rare)** HGM Class: Organic Soil Flat; Slope

**7b.** Saturated forests of sloping stream headwaters, large spring seeps, lateral seeps in ravines and stream bottoms with diffuse drainage patterns. Braided stream channels, muck-filled depressions, and hummock-and-hollow

microtopographic features evident……**COASTAL PLAIN SEEPAGE SWAMP**
HGM Class: Slope or Riverine

**Table 13. Maryland Key Wildlife Habitat Characteristic Species by Vegetation Layer: Coastal Plain Wetlands*.**

| Key Wildlife Habitat | Trees | Shrubs | Herbs | Vines | Indicator** |
|---|---|---|---|---|---|
| **Coastal Plain Floodplain** | *Platanus occidentalis, Liquidambar styraciflua, Liriodendron tulipifera, Quercus michauxii, Fraxinus pennsylvanica, Betula nigra, Acer rubrum*<br>*Additional for Blackwater Streams: Taxodium distichum, Nyssa sylvatica, Chamaecyparis thyoides (rare)* | *Lindera benzoin, Asimina triloba, Ilex opaca, Ilex verticillata, Carpinus caroliniana* | *Amauropelta(Thelypteris) noveboracensis, Mitchella repens, Arisaema triphyllum, Boehmeria cylindrica, Saururus cernuus, Cinna arundinacea, Galium circaezans, Medeola virginiana, Thalictrum thalictroides, Impatiens capensis, Glyceria striata* | *Toxicodendron radicans, Parthenocissus quinquefolia, Campsis radicans* | *Platanus occidentalis, Betula nigra, Amauropelta(Thelypteris) noveboracensis, Saururus cernuus, Cinna arundinacea*<br>*Additional for Blackwater Streams: Taxodium distichum, Nyssa sylvatica, Chamaecyparis thyoides (rare)* |
| **Coastal Plain Flatwood and Depression Swamp** | *Quercus phellos, Quercus palustris, Quercus michauxii, Quercus pagoda, Liquidambar styraciflua* | *Eubotrys racemosa, Vaccinium corymbosum, Clethra alnifolia* | *Woodwardia areolata, Osmunda cinnamomea, Mitchella repens, Osmunda regalis, Chasmanthium laxum* | *Smilax rotundifolia* | *Quercus pagoda, Quercus michauxii, Vaccinium corymbosum* |
| **Coastal Plain Seepage Bog and Fen** | *Nyssa sylvatica, Acer rubrum, Pinus rigida* | *Rhododendron viscosum, Toxicodendron vernix, Rubus hispidus, Ilex glabra, Clethra alnifolia* | *Carex atlantica, Andropogon glomeratus, Rhynchospora gracilenta, Eupatorium pilosum, Dichanthelium dichotomum var. dichotomum* | *Smilax pseudochina* | *Smilax pseudochina, Pinus rigida, Andropogon glomeratus, Rhynchospora gracilenta* |
| **Coastal Plain Seepage Swamp** | *Nyssa sylvatica, Acer rubrum, Magnolia virginiana* | *Clethra alnifolia, Viburnum nudum, Rhododendron viscosum* | *Woodwardia areolata, Osmunda cinnamomea, Osmunda regalis, Carex folliculate, Symplocarpus foetidus* | *Smilax rotundifolia* | *Magnolia virginiana, Clethra alnifolia, Viburnum nudum, Symplocarpus foetidus* |
| **Vernal Pools and Springs** have limited to sparse herbaceous and/or shrub vegetation in the wetland basin. Some Springs have *Sphagnum* species. The surrounding vegetation will represent one of the KWH listed here. Vernal Pools and Springs are most likely to be embedded in Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, or Coastal Plain Seepage Swamp. | | | | | |

*Species listed in each stratum represent species with high constancy values (>75%) for finer community types (i.e., association level) of Key Wildlife Habitats.

**Indicator species = High diagnostic value to type, high fidelity, and relative cover

## 4.4 Soil/Substrate

Healthy soil function supports plant life and biogeochemical processing for carbon and other nutrient storage and transformation. Surface features such as changes in elevation over a small area (microtopography) can add to the complexity of the habitat and increase biodiversity, and organic matter accumulation and nutrient dynamics are influenced by leaf litter and ground cover. Disturbance of the surface layer increases the potential for erosion or sedimentation. Conducting a rapid assessment of soil condition in wetlands is challenging. Metrics developed by and reviewed by an interagency team of the U.S. Army Corps of Engineers, MDE, MDNR, EPA, U.S. Fish and Wildlife Service SFWS, Natural Resources Conservation Service and Dr. Bruce Vasilas, University of Delaware for a draft assessment on wetland impacts and are adapted here for specialized use in this assessment and for restoration projects.

Prior to fieldwork, users should review expected reference soil characteristics as mapped for the site (Section 2). Deviations from the mapped soil characteristics that are noted in the field should be captured on the data sheet. Soil data collection in the field should follow the procedures for wetland delineation (USACE 2010). A sample that is at least 18" deep should be extracted from a representative area of the AA where the soil has not obviously been disturbed. USACE (2010) should be consulted for guidance related to scoring soils with red parent material or other problematic soils. Depths of O and A horizons (if present), depth to water table, and presence of extensive roots in the soil should be noted. From the wetland delineation, the presence of hydric soils and hydric soil indicators should be recorded onto the data sheet. Soil matrix Hue Value and Chroma should be assessed using the Munsell soil color book and noted on the data sheet. Note if soil compaction is evident in the AA and describe any impacts to the soil surface such as trampling/compaction from animals or machinery, ruts or other disturbances from ATV or other vehicular activity, or sedimentation. To estimate the relative effectiveness of biogeochemical processes in the soil, Redox Concentrations, Soil Organic Matter, Microtopography, and Organic Matter Accumulation are assessed. Microtopography, Organic Matter Accumulation, and Soil Disturbance Metrics also provide information on the integrity of the wildlife habitat present. NOTE: If the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions (e.g., relict conditions), Redox Concentrations and Soil Organic Matter metrics should not be scored. The depth to groundwater should be considered as well as whether other water sources are altered or still sufficient to contribute to reducing conditions.

**Soil Biogeochemical Processing:**

**Redox Concentrations**

Electron transfer or redox reactions in soils can cause the oxidation of iron particles that appear as areas of rusty red color. The concentration of these particles varies depending on the degree

of fluctuation in the water table (repeated wetting and drying) and can also be affected by soil microbiota. This metric assesses the presence and degree of redox concentrations. The soil sample may need to be broken open to effectively see evidence of rusty red redox concentrations. For example, photo A below appears to show no redox concentrations within 18 inches of the soil surface. In contrast, after the sample was cut into, an abundance of redox features is revealed (photo B). Photo C shows redox features that appear to be seeping throughout the matrix in a sandy soil, which is common in some areas of the Coastal Plain. Use the descriptions in Table 14 to assign a score for this metric.

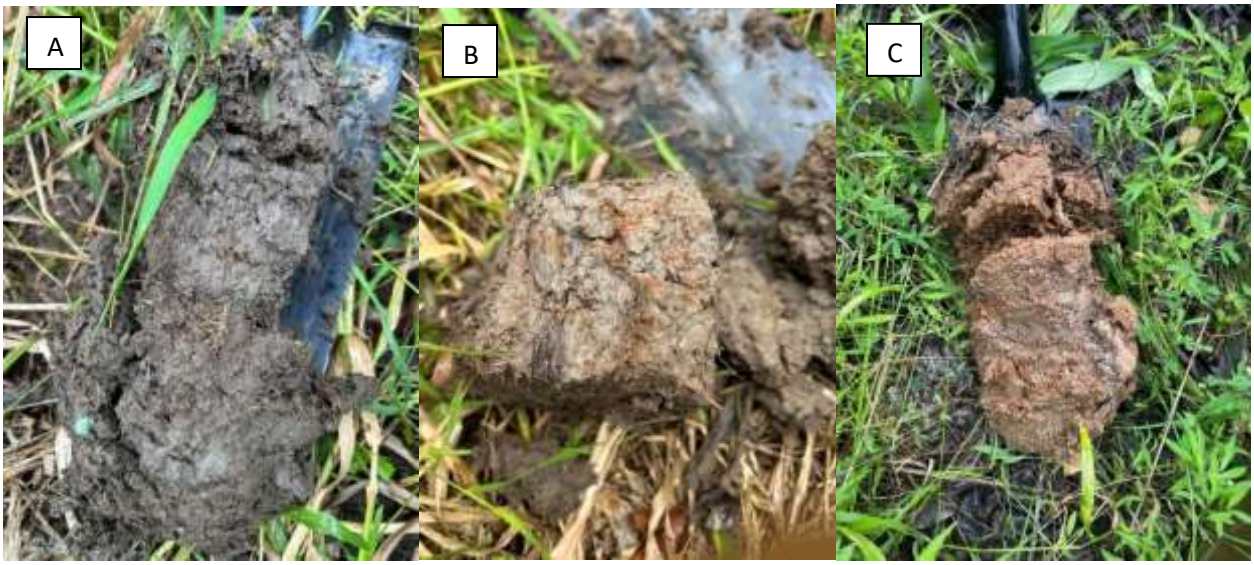



**Table 14. Redox Concentrations Metric Rating Criteria.**

| **All KWH: Do not score if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions (e.g., relict conditions).** | |
|---|---|
| Score | Assign rating to category with majority of features present |
| Excellent = 4 | Biogeochemical cycling excellent, with redox concentrations starting 0 to 6” from the soil surface and covering >10% of the surface area. |
| Good = 3 | Biogeochemical cycling good, with redox concentrations starting >6” to 12” from the soil surface and covering >10% of the surface area OR redox concentrations start 0-6” from the soil surface and represent <10% of the surface area. |
| Fair = 2 | Biogeochemical cycling fair, with redox concentrations starting >12” to 18” from the soil surface and covering >10% of the surface area OR redox concentrations start >6” to 12” from the soil surface and represent <10% of the surface area. |
| Poor = 1 | Biogeochemical cycling poor, with redox concentrations starting >12” to 18” from the soil surface and covering <10% of the surface area OR no redox concentrations within 18” of the soil surface. |

### Soil Organic Matter

Material in the soil that originates from living organisms impacts nutrient and water holding capacity, resistance to compaction, and soil structure. Soil organic matter can be an important source of dissolved organic matter for aquatic systems. For this metric, the presence or absence of organic soils is assessed. If only mineral soils are present, depth as well as value and chroma are assessed for scoring. Refer to Table 15 to score this metric.

This soil sample shows an abundance of organic matter. The sample was taken along a Blackwater Stream in a *Taxodium distichum* swamp, where there is standing water all year.

**Table 15. Soil Organic Matter Metric Rating Criteria.**

| **All KWH: Do not score if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions (e.g., relict conditions).** | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Organic surface horizon present (any thickness). |
| Good = 3 | Mineral surface layer(s) are ≥4" thick with matrix value ≤3 and chroma ≤2. |
| Fair = 2 | Mineral surface layer(s) are <4" thick with matrix value ≤3 and chroma ≤2. |
| Poor = 1 | Mineral surface layer(s) are <4" thick with matrix value >3 and ≤4 or chroma >2 and ≤3. |

### Microtopography

This metric assesses the presence of elevational changes of at least 3" due to soil elevations and woody debris in an advanced stage of decomposition. Microtopography is often present as vegetated hummocks, raised areas that support tree trunks and roots, or nursery logs. A

complexity of elevations provides a greater variety of microhabitats to support animal and plant species. Visually estimate the percent of the AA with microtopography and use Table 16 to score the metric. The percent cover diagrams in Appendices 4 and 5 may be helpful to visualize the percent cover.

This site exhibits excellent microtopography, as evidenced by the numerous hummocks and tussocks. Hummocks and tussocks are easily identified as mound-like protrusions from the soil that often have grasses or sedges tufting upwards.

**Table 16. Microtopography Metric Rating Criteria.**

| Score | Assign rating to category with majority of features present |
|---|---|
| Excellent = 4 | More than 50% of the AA shows at least a 3” increase in elevation over the base elevation of the AA. |
| Good = 3 | 30-49% of the AA shows at least a 3” increase in elevation over the base elevation of the AA. |
| Fair = 2 | 10-29% of the AA shows at least a 3” increase in elevation over the base elevation of the AA. |
| Poor = 1 | <10% of the AA shows at least a 3” increase in elevation over the base elevation of the AA. |

**Organic Matter Accumulation**

Plant matter from both above and below the surface contributes to the accumulation of organic matter in the AA, enhancing soil health. In some systems, the living and dead residue of herbaceous and woody plants provides the source of organic matter accumulation, while other systems receive inputs from leaves. This metric captures the inputs from both sources to reflect the differences between KWHs and variation during the growing season. Estimate the percentage cover of herbaceous and woody plants, both living and dead residue. Estimate how much of the AA is covered by leaf litter that is at least 1" thick or where there are decaying leaves that are stacked at least 5 layers deep. To capture organic matter inputs from multiple sources, the percent cover of herbaceous and woody plants is added to the percent cover of leaves meeting these criteria. The total percentage is used with Table 17 to score this metric.

In systems with little herbaceous vegetation, like this Coastal Plain Flatwood and Depression Swamp, organic matter accumulates as layers of leaves decay.

**Table 17. Organic Matter Accumulation Metric Rating Criteria.**

| Score | Assign rating to category with majority of features present |
|---|---|
| Excellent = 4 | Organic matter accumulation from root turnover/leaf litter is high as herbaceous and woody plant ground cover plus leaf litter covers >75% of the surface. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Good = 3 | Organic matter accumulation from root turnover/leaf litter is moderate as herbaceous and woody ground cover plus leaf litter covers >50-74% of the surface. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Fair = 2 | Organic matter accumulation from root turnover/leaf litter is low as herbaceous and woody ground cover plus leaf litter covers >25-50%. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Poor = 1 | Organic matter accumulation from root turnover/leaf litter is minimal as herbaceous or woody ground cover plus leaf litter covers <25%. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |

**Soil Disturbance:**

Disturbance to the soil in the AA can create areas of bare soil, soil compaction, and/or ruts. These changes can impact water flow and saturation in the AA and degrade the ability of the KWH to support plants and animals. Note impacts to the soil surface as indicated by bare soil, unless caused by natural factors or the soil is naturally bare. Look at the extent of impact across the AA and the greatest depth of the impact (including ponding or channeling of water). Use Table 18 to assign a score for the soil disturbance metric.

**Table 18. Soil Disturbance Metric Rating Criteria.**

| Score | Assign rating to category with majority of features present |
|---|---|
| Excellent = 4 | Little bare soil OR bare soil and soil disturbed areas are limited to naturally caused disturbances such as flood deposition, game trails, beaver activity, etc. OR soil is naturally bare. No human-caused impacts evident. |
| Good = 3 | Minor amounts or localized, small patches of bare or disturbed soil are present from factors such as cattle trampling or heavy grazing that leads to erosion, compaction or trampling by machinery, ruts or other disturbances from ATV or other vehicular activity, sedimentation due to human causes, or invasive earthworms. Extent of impact is minimal and greatest depth is limited to a few centimeters (a few inches) and does not show evidence of ponding or channeling of water. |
| Fair = 2 | Moderate amounts of bare or disturbed soil are present due to human-caused activities. Extent of impact is moderate and greatest depth may extend 5–10 cm (2–4 inches), with localized deeper ruts. Shows some evidence of ponding or channeling of water. |
| Poor = 1 | Substantial amounts of bare or disturbed soil are present due to human-caused activities. Impact is extensive with long-lasting impacts. Greatest depth of impact extends > 10 cm (4 inches); deeper ruts may be widespread and show some evidence of extensively altering hydrology (e.g., ponding or channeling of water). |

## 4.5 Hydrology

Hydrology is a complicated ecological factor to measure during a rapid assessment, and users will find that their evaluation of one metric partly relates to another. The primary focus of each metric is as follows:

- Water Source: water coming into the wetland, including any unnatural diversions of water from the AA.
- Stream Bank and Channel: characteristics of the stream channel in the project area.
- Hydroperiod and Hydrologic Connectivity: water level patterns and their duration within the wetland, regardless of source, and water exchange between the wetland and surrounding systems.

In this section, two aspects of the hydrology of the AA are scored by indicating the presence of natural and altered features of the Water Source and Hydroperiod and Hydrologic Connectivity. The scoring for these metrics varies depending on the type of KWH, so the correct scoring table needs to be used. The Stream Band and Channel metric, in contrast, is assessed for the entire project area using indicators of alteration as well as stabilization and recovery. The check boxes on the data form capture features used for scoring as mentioned in the sections below.

The office assessment can work outward from the AA to include identification of unnatural water sources, such as adjacent intensive development or irrigated agriculture, nearby wastewater treatment plants, and nearby reservoirs. Obstructions, alterations, and point source discharges may be visible on aerial photos or other available imagery. LiDAR Hillshade images may assist with identifying existing channels and other relevant features. The Maryland Watershed Resources Registry (https://watershedresourcesregistry.org/states/maryland.html) is an excellent resource for this purpose. Unnatural water sources identified in the office can then be checked in the field and captured on the field data sheet. To score the metrics, assign the rating to the category with the majority of features present. Remember that the Stream Bank and Channel metric is calculated for the project area and will apply to all AA in the project area.

### 4.5.1 Water Source

Water source encompasses the forms, or places, of direct inputs of water to the AA, as well as any unnatural diversions of water from the AA or other features that affect saturation of the wetland. Although some wetlands are altered, they may now be functioning in a way that mimics natural hydrology and are able to support the expected plant community for a given KWH (Table 13). The presence of a coldwater spring flow increases the value of an area as wildlife habitat. Diversions are considered an impact to natural water sources because they directly affect the hydrology of the AA. Changes to the channel and floodplain as well as obstructions can also alter the water source for a given wetland. This metric can be assessed initially in the office using available imagery, and then revised based on the field visit. The metric focuses on direct sources of water, comparing the natural sources to unnatural (anthropogenic) sources (e.g., irrigation via direct application or seepage, urban run-off, culverts, pipes directly feeding wetlands). If alterations are present, more information is recorded on the type, timing of impact, and what negative effects are observable based on field observations. The scoring for this metric varies depending on the water source (Section 4.2) and Coastal Plain Floodplain KWH may have more than one source of input. Beaver activity should be considered as a natural source of change for scoring purposes.

The example on the left of a Coastal Plain Seepage Swamp represents a groundwater-fed system. The flow from the groundwater seep is robust enough to carve a small channel throughout the wetland. Water at the site could be seen to seep from a gravel matrix. In contrast, the wetland on the right is impacted by input from a culvert, releasing sediment into the wetland.

### Table 19. Water Source Metric Rating Criteria.

This metric focuses on the forms and places of direct inputs of water to the AA, as well as any unnatural diversions of water from the AA or other features that affect saturation of the wetland. Focus on the main source of water for this evaluation and use the scoring table for the correct KWH. Note evidence of natural and unnatural/manipulated characteristics using the check boxes. Consider whether alterations are recent and if they are currently having a negative effect. Beaver activity, although it may have caused changes, should be considered as a natural change for scoring.

| **Coastal Plain Floodplain:** Groundwater discharge not a major input | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. No unnatural obstructions to water source or impact on overland flow and overbank flooding. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor |

| | |
|---|---|
| | point source discharges emptying into the wetland. Up to 25% of stream banks are affected due to dikes, rip rap and/or elevated culverts, or there is increased discharge due to other causes. Little change in plant community resulting from unnatural alterations. |
| Fair = 2 | Water sources are moderately impacted by anthropogenic sources but are still a mix of natural and non-natural sources. Between 25-75% of stream banks are affected (e.g., dikes, rip rap, concrete, and elevated culverts) or increased discharge due to other causes. Wetlands still present due to groundwater or other water inputs, but potentially reduced in extent and showing some plant community changes; or plant community changes due to increased unnatural water inputs. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. > 75% of stream banks are affected (for example due to dikes, rip rap, concrete, and elevated culverts) or increased discharge due to other causes. Wetlands are reduced in extent unless high groundwater or other surface water inputs maintain them. Plant community changes are observed due to unnatural water inputs. |

| **Coastal Plain Floodplain:** Mixed hydrologic regime | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. No unnatural obstructions to lateral or vertical movement of ground or surface water. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Little change in plant community resulting from unnatural alterations. |
| Fair = 2 | Water sources are moderately impacted by anthropogenic sources, but are still a mix of natural and non-natural sources. Wetland is still connected to its natural water source (e.g., modified ponds on a floodplain that are still connected to alluvial aquifers, natural stream channels that now receive substantial irrigation return flows, many small/few large storm drains), but moderately disconnected from floodplain due to multiple geomorphic modifications. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to increased unnatural water inputs. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. Wetland has reduced connection to natural water source (e.g., loss of overbank flow). Wetlands are potentially reduced in extent if no other surface water inputs maintain them. Plant community changes are observed due to unnatural water inputs. |

| **All other KWH:** Predominantly groundwater or precipitation water source, with potential limited flooding from small stream in relation to wetlands in riparian system | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. Groundwater or precipitation dominant or only water source; otherwise, no unnatural obstructions to lateral or vertical movement of ground or surface water, or, if perched water table, impermeable soil layer is intact. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Minor restrictions to the lateral or vertical |

| | |
|---|---|
| | movement of ground or surface waters by unnatural features, such as levees or excessively high banks (less than 25% of the site). If perched, impermeable soil layer partly disturbed. Little change in plant community resulting from water source alterations. |
| Fair = 2 | Water source is moderately impacted by anthropogenic sources, but still a mix of natural and non-natural sources. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features or alteration. Between 25-75% of the site is restricted by barriers to drainage. If perched, impermeable soil layer moderately disturbed. Drainage back to the wetland is incomplete due to impoundment. Wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to water source alterations. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. Most or all water stages are contained within artificial banks, levees, or comparable features. Greater than 75% of wetland is restricted by barriers to drainage. If perched, impermeable soil layer strongly disturbed. Wetlands reduced in extent and show plant community changes due to water source alterations. |

### 4.5.2 Stream Bank and Channel

The stream bank and channel metric applies to the project area and will be the same for all AA in the project area. This metric focuses on evidence of equilibrium, including recovery and the presence of aquatic life, and evidence of instability. The sources of instability are also identified. Signs of degradation or aggradation and connection to the floodplain should also be noted on the field form and scored using Table 20. Refer to Table 21 for field indicators of equilibrium, degradation, and aggradation. If available, the Bank Erosion Hazard Index and Near Bank Stress provide further information to describe the state of the stream bank and modeled inundation from storm events can provide further insight for the scoring process. Table 21 provides indicators of equilibrium and degradation/aggradation by KWH. Buried hydric soil and/or gravel layers should be noted if present, including the depth of the buried layer.

The Aquatic Life ratings, although not used in scoring for this metric, provide important information about the current ability of the stream to support fish and benthic macroinvertebrates. Although they are not available for all stream segments, the extensive sampling program of the Maryland Biological Stream Survey has covered many areas in the state through the years. To find the values for the Benthic Index of Biotic Integrity (IBI) and the Fish IBI, go to the Maryland Stream Health Index website by clicking on the link at https://dnr.maryland.gov/streams/Pages/streamhealth/default.aspx. Turn on the Stream Health layer. Zoom in to the project area and look for the closest Biological Stream Survey Site to the project area that falls within the same stream. If there is more than one site in the stream segment in or near the project area or, if the site has been sampled in more than one

year (for example, results pop-up shows “1 of 4”), select the most recent sample. Record the values on the data sheet and use the check boxes to determine the rating.

NOTE: This assessment is not meant to supersede more detailed stream channel assessments, such as for the Function-Based Rapid Stream Assessment, Maryland Biological Stream Survey habitat metrics, or EPA Rapid Bioassessment Habitat Forms for Streams, or actual bank erosion measurements or estimates. When more detailed channel information is available, those scores and metrics may be converted to scores for comparable Excellent-Good-Fair-Poor rankings in this assessment and used in conjunction with the hydrological connectivity metrics.

More detailed stream bank and channel assessments should provide indicators for vertical and lateral stability and other recommended metrics for consideration on the project that demonstrate water quality impairment and degradation of the project reach. In addition, biological scores such as a Benthic Index of Biological Integrity (IBI) are generally required to qualify the project for TMDL credit. Supporting documentation should be provided and be determined by persons currently certified by DNR for IBI.

**Table 20. Stream Bank and Channel Metric Rating Criteria.**

| **Stream Bank and Channel in Project Area (score applies to all AA present)** | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Indicators of channel equilibrium present. Minimal or no evidence of degradation or aggradation leading to channel instability or migration. Bank instability none or minimal. Channel is not unnaturally entrenched. If calculated, BEHI/NBS scores low. |
| Good = 3 | Minor channel incision. Channel is somewhat entrenched (overbank flow occurs during most floods). Some evidence of degradation or aggradation leading to a minimal level of channel instability or migration. Minor bank instability. If calculated, BEHI/NBS scores low. |
| Fair = 2 | Channel is incised. Channel is moderately entrenched (overbank flow only occurs during moderate to severe floods, functioning at risk). Uncharacteristic aggradation or degradation is present leading to a moderate level of channel instability or migration. Bank instability moderate. BEHI/NBS scores moderate. |
| Poor = 1 | Channel is incised. Channel is substantially entrenched (overbank flow never occurs or only during severe floods-not functioning). Channel entirely or extensively disconnected from the floodplain. Bank instability substantial. BEHI/NBS scores high, very high, or extreme. |

**Table 21. Channel and Hydroperiod Field Indicators by Key Wildlife Habitat. (*adapted from Collins et al. 2006)***

| *Condition* | *Field Indicators for Coastal Plain Floodplain – Channel and Hydroperiod* |
|---|---|
| Indicators of Channel Equilibrium | ● The channel (or multiple channels in braided systems) has a well-defined usual high water line, or bankfull stage, that is clearly indicated by an obvious floodplain. A topographic bench represents an abrupt change in the cross-sectional profile of the channel throughout most of the site.<br>● The usual high water line (consistent with ACOE ordinary high water mark) or bankfull stage corresponds to the lower limit of riparian vascular vegetation.<br>● The channel contains embedded woody debris of the size and amount consistent with what is available in the riparian area.<br>● There is little or no active undercutting or burial of riparian vegetation. |
| Indicators of Active Degradation (Erosion) | ● Portions of the channel are characterized by deeply undercut banks with exposed living roots of trees or shrubs. There are abundant bank slides or slumps, or the banks are uniformly scoured and unvegetated.<br>● Riparian vegetation may be declining in stature or vigor, and/or riparian trees and shrubs may be falling into the channel.<br>● The channel bed lacks any fine-grained sediment (unless it is the dominant bank material).<br>● Recently active flow pathways appear to have coalesced into one channel (i.e., a previously braided system is no longer braided). |
| Indicators of Excessive Aggradation (Sedimentation) | ● The channel through the site lacks a well-defined usual high water line.<br>● There is an active floodplain with fresh splays of excessive sediment covering older soils or recent vegetation.<br>● There are partially buried tree trunks or shrubs.<br>● Excessive cobbles and/or coarse gravels have recently been deposited on the floodplain.<br>● There are partially buried, or sediment-choked, culverts. |
| *Condition* | *Hydroperiod Field Indicators for Other KWH Types* |
| Reduced Extent and Duration of Inundation or Saturation | ● Upstream diversions, impoundments, pumps, ditching, or draining from the wetland.<br>● Water withdrawal (wells).<br>● Evidence of aquatic wildlife mortality.<br>● Encroachment of terrestrial vegetation.<br>● Encroachment of young, tall, vigorous trees if not usually present, shading of underlying mosses.<br>● Stress or mortality of hydrophytes or sphagnum.<br>● Compressed or reduced plant zonation.<br>● Organic soils occurring well above contemporary water tables.<br>● Increased discharges resulting in channel downcutting. |

| | |
|---|---|
| Increased Extent and Duration of Saturation | ● Berms, dikes, or other water control features that increase duration of ponding (e.g., pumps).<br>● Diversions, ditching, or draining into the wetland.<br>● Late-season vitality of annual vegetation.<br>● Recently drowned riparian or terrestrial vegetation (e.g., beaver-created impoundment).<br>● Extensive fine-grained deposits on the wetland margins. |

The photo above shows the bank of a Blackwater Stream that is in excellent condition. Although the slightly steep banks do not have a lot of vegetation, this low-energy system appears to have reached a stable equilibrium. There is no active undercutting of the banks and the associated wetlands are still connected to the floodplain. In contrast, this stream bank and channel below show some indicators of active degradation (scoured unvegetated banks, trees falling into channel, riparian vegetation declining).

This photo shows evidence of a buried hydric soil layer in a downcut stream bank.

### 4.5.3 Hydroperiod and Hydrologic Connectivity

The metric for hydroperiod is an assessment of the characteristic frequency, level, and duration of inundation or saturation of a wetland during a typical year. Hydroperiod integrates the inflows and outflows of water and varies by major wetland type. For non- tidal KWH wetlands with fluctuating hydroperiods, such as Coastal Plain Floodplain, Vernal Pool, and Coastal Plain Flatwood and Depression Swamp, cycles are governed by seasonal or annual patterns of rainfall and temperature. For non-tidal wetlands with more stable, saturated hydroperiods, such as Spring, Coastal Plain Seepage Bog and Fen, and Coastal Plain Seepage Swamp, these seasonal patterns are often overridden by groundwater flows. In Coastal Plain Floodplain KWH, the effects of recent beaver activity are viewed as a natural event and should not reduce the score.

Changes in hydroperiod can affect the structure and composition of the wetland plant community. Common indicators are presented for the different KWH. A basic understanding of the natural hydrology or channel dynamics of the KWH wetland type being evaluated is required to apply this metric and to determine if the natural variation is low or high. During the field assessment, visually survey the AA for field indicators appropriate to the KWH as indicated in Table 21 (adapted from Collins et al. 2006). For KWH other than Coastal Plain Floodplain, an office-based review of diversions or augmentations of flows or alteration of saturated conditions to the wetland may be needed. After reviewing the entire AA and comparing the conditions to those described in Table 21, assign a metric rating based on criteria in Table 22 for the appropriate KWH type. Assign the rating to the category with the majority of features present.

Hydrologic connectivity represents the ability of the water to flow from the stream into the wetland, or to inundate adjacent areas. The metric is assessed in the field by observing signs of alteration to horizontal water movement within the assessment area. For riverine wetlands and riparian habitats, Hydrologic Connectivity is assessed in part based on the degree of alteration of flooding regimes (e.g., channel entrenchment). Entrenchment varies naturally with channel confinement. Channels in steep canyons naturally tend to be confined and tend to have small entrenchment ratios indicating less hydrologic connectivity. Assessments of hydrologic connectivity based on entrenchment must therefore be adjusted for channel confinement based on the geomorphic setting of the riverine wetlands. Prevention of river flooding by human-created levees and dikes, or impairments caused by shoreline rip-rap, are other ways in which changes to hydrologic connectivity can be assessed (Collins et al. 2006). Natural levees may form as part of river dynamics, and may be breached during natural flooding events, also altering connectivity. Their form is distinct from human- created levees, helping to minimize misidentification.

Use the metrics appropriate to the KWH and other features as indicated on the data sheet and in Table 22 for the Hydrologic Connectivity metric. Refer to the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0), U.S. Army Corps of Engineers* (USACE 2010), for indicators of overbank flooding which indicate hydrologic connectivity to the floodplain. List the information used in determining connectivity to the floodplain on the field data sheet, such as field indicators of hydrology and flooding, monitoring wells, Bank Height Ratio, Entrenchment Ratio, and modeled results for overbank flooding occurrence if available.

This Blackwater Stream-associated Coastal Plain Floodplain system has good connection to the floodplain, with evidence of recent overbank flooding that has formed a temporary pool.

**Table 22. Hydroperiod and Hydrologic Connectivity Metric Rating.**

| **Coastal Plain Floodplain**<br><br>___Low natural variation of hydroperiod ___High natural variation of hydroperiod | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Evidence of recent overbank flooding. Completely connected to floodplain (backwater sloughs and channels). No major hydrologic stressors present that impact natural hydroperiod or impact due to natural events (e.g., beaver dams). No unnatural obstructions to lateral or vertical movement of ground or surface water. |
| Good = 3 | Evidence of overbank flooding. Minimally disconnected from floodplain. Minor alterations in frequency, levels, or duration of hydroperiod. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Flooding at 2-year storm interval. |
| Fair = 2 | Some evidence of overbank flooding, likely during larger storm events. Moderately disconnected from floodplain due to multiple geomorphic modifications. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Moderate flooding at 10-year storm interval. |
| Poor = 1 | Overbank flooding generally no longer occurs. Disconnected from floodplain, likely causing some drainage of groundwater. Flooding may or may not occur at 100-year or greater storm interval. |
| **Other KWH**<br><br>___Low natural variation of hydroperiod ___High natural variation of hydroperiod | |
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Overbank flooding present and recent but not predominant water source to wetland; no or little channel incision or effects on groundwater or other water sources; plant community reflective of characteristic KWH or not altered by changes to hydroperiod. |
| Good = 3 | Evidence of overbank flooding, limited channel incision; hydroperiod with little alterations in frequency, levels, duration due to groundwater and other inputs; with little change in plant community resulting from hydrologic alterations. Flooding at 2-year storm interval. |
| Fair = 2 | Some evidence of overbank flooding, likely during larger storm events, channel is incised, wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to increased unnatural water inputs. Flooding at 10-year recurrence interval. |
| Poor = 1 | Overbank flooding generally no longer occurs, channel incised resulting in loss of floodplain connectivity and likely causing some drainage of groundwater; wetlands potentially reduced in extent if no other surface water inputs, plant community changes due to change in hydrology. Flooding may or may not occur at 100-year or greater recurrence interval storm. |

## 4.6 Key Wildlife Habitat and Vegetation Composition

Vegetation structure and composition, including vegetation coarse woody debris and presence of native and invasive plant species, are of particular interest for assessing the condition of Key Wildlife Habitats based on the ecological needs of the animal Species of Greatest Conservation Need and Signature Plant Species that they support (Maryland DNR 2015). Metrics are added for these factors.

### 4.6.1 Interspersion and Patch Richness

An interspersion of vegetation patches and a variety of different obvious types of physical surfaces or features provides excellent habitat for aquatic, wetland, or riparian animal species. The interspersion metric is scored using the narratives below. Vegetative patches should represent at least 5% of the WAA in single or multiple locations. This metric is often reflective of the topographic complexity metric in many wetland types. Patch richness provides a measure of components that represent potential wildlife habitat. Features present in the AA and also within 10m (33 ft) of the AA boundary are counted, as they also contribute to the condition of the KWH: spring or upwelling groundwater; depression; vegetated pool; unvegetated pool; unvegetated flat; island; animal mound or burrow; beaver dam or lodge; oxbow, swale, secondary channel; wind-thrown tree hole; mound; bank overhang with tree roots; tip-up tree root mound; brush piles; abundant deciduous leaf litter; partially buried natural debris; debris jam; plant hummock/tussocks; or other wildlife habitat**.** Wetland-associated wildlife species such as frogs, waterbirds, crayfish, fish, mussels, etc. are noted if they are observed at the site. Figure 5 shows a visual representation of interspersion scoring by KWH type. For patch richness, tally the features present as stated above and use Table 23 to assign a score. Calculate the mean of the Interspersion and Patch Richness Metrics and use Table 24 to assign an overall score for this metric.

A high degree of interspersion at this Coastal Plain Flatwood and Depression Swamp results from the variety of scattered and intertwined vegetation types.

**Figure 5. Interspersion Metric Scoring Diagrams.** The figures below show a range of patterns for the interspersion. Different vegetation types, such as hummocks, sphagnum, shrub areas, patches of herbaceous vegetation, and patches or lines of trees of different heights or ages should be noted.

| | |
|---|---|
| **Coastal Plain Seepage Swamp, Coastal Plain Bog and Fen, Coastal Plain Flatwood and Depression Swamp, Vernal Pool, Spring**. (Source: US ACE 2015 Texas Rapid Assessment Method)<br><br>***Scoring*: High = 4** Vegetation patches are large and intertwined or numerous and scattered<br>**Moderate = 3** At least two types of vegetation patches are present but patches are slightly smaller or less scattered/intertwined than "High" category<br>**Low = 2** Two types of vegetation patches are present but in smaller, very localized, and/or isolated patches<br>**None = 1** Only one type of vegetation patch is present | **Coastal Plain Floodplain**: The red box represents the boundary of the AA and each color represents a unique plant zone such as shrub areas, patches of herbaceous vegetation, or tree clumps of different ages or heights. The speckled background represents the background matrix of vegetation and the blue line represents the stream. For multithread stream systems, evaluate the channel with the highest complexity of plant zones for scoring. (Source: California Rapid Assessment Methods for Wetlands Riverine Wetlands Field Book 2013)<br>**Scoring: Scoring: A = 4** High complexity of scattered and intertwined plant zones<br>**B = 3** Moderate complexity of intertwined plant zones<br>**C = 2** Minimal complexity of plant zones with little interspersion<br>**D = 1 Few plant zones with localized, isolated patches** |

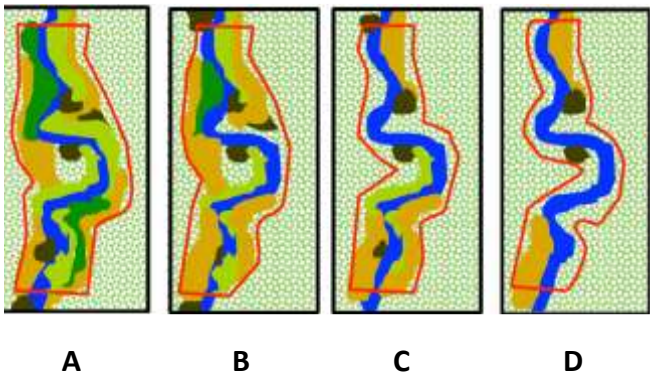




**Table 23. Patch Richness Scoring Metric.** The features present should be noted on the data sheet in addition to any observed wetland- or stream-associated animals such as frogs, waterbirds, crayfish, fish, mussels, etc.

| Score | Coastal Plain Floodplain, Coastal Plain Seepage Bog and Fen, Coastal Plain Seepage Swamp | Coastal Plain Flatwood and Depression Swamp | Vernal Pool/Spring |
|---|---|---|---|
| **4** | ≥ 6 | ≥ 7 | ≥ 4 |
| **3** | 5-6 | 6-7 | 3-4 |
| **2** | 3-4 | 4-5 | 2 |
| **1** | ≤ 3 | ≤ 4 | ≤ 2 |

**Table 24. Interspersion and Patch Richness Metric Rating Criteria.**

| Score | Mean of Interspersion and Patch Richness Metric Scores |
|---|---|
| Excellent = 4 | 3.5 – 4 |
| Good = 3 | 2.6 - 3.4 |
| Fair = 2 | 1.6- – 2.5 |
| Poor = 1 | 1 – 1.5 |

## 4.6.2 Vertical Structure

This metric provides an assessment of the overall structural complexity of vegetation layers and growth forms, including presence of multiple strata, age and structural complexity of canopy layer, and evidence of the effects of disease or mortality on structure (adapted from Faber-Langendoen et al. 2008). Structural complexity supports higher biodiversity. This metric should be assessed within the AA and out to 10m (33 feet) from the AA boundary.

For forested wetlands, the protocol uses a visual evaluation of variation in overall structure of the tree stratum, including tree size and density of tree canopy, overall canopy cover, frequency of canopy gaps with regeneration, and number of different size classes of stems. These values are based on field data from forested wetlands of varying ages and levels of alteration. Vernal Pools and Springs are expected to have only sparse woody and/or herbaceous vegetation in the basin area, if any. For these KWH, assess the vertical structure in the surrounding area. For non-forested Coastal Plain Seepage Bog and Fen systems, an evaluation of the integrity of dominant growth forms is made (e.g., whether shrubs have been removed, killed, or increased or herbaceous layer has been reduced or homogenized by stressors). Wetland delineation field survey data may be used for estimating vertical structure. As beaver activity can impact vertical structure, the vertical structure in the surrounding area and previous structure as indicated by snags and downed trees should be considered when assigning a score. Use the correct section of Table 25 based on the KWH present and assign the rating to the category with the majority of features present.

This Spring KWH site has little vegetation in the area immediately adjacent to waterflow. Vegetation metrics should be scored for the surrounding area rather than solely in the basin.


Coastal Plain Seepage Bog and Fen KWHs are rare and may or may not have a woody component. The site on the left is a bog/acidic fen type, which tends to have more shrubs and short trees compared to the more circumneutral fen on the right.

**Table 25. Vertical Structure Metric Rating Criteria.**

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp**

**Vernal Pool and Spring:** assess vegetation structure in area surrounding basin, as only limited to sparse herbaceous vegetation is usually present in the basin area.

**Note:** Recent beaver activity may lead to deviations from rating descriptions for Coastal Plain Floodplain. This should be noted on the data sheet and taken into account.

| Score | Assign rating to category with majority of features present |
|---|---|
| Excellent = 4 | Tree canopy or highest woody level present is a heterogeneous mosaic of patches of different ages or sizes. Gaps of varying size. Multiple layers are created through the presence of trees of varying ages and heights and the shrub layer. Large trees (> 60 cm or 24" dbh) expected to be present (> 10% of trees present). If large trees are absent, few or no large stumps are present and there is evidence of a natural disturbance event (e.g., large downed wood from wind storms, fire scars, beaver activity, tree senescence). Little impact from deer browse. |
| Good = 3 | Tree canopy or highest woody level present is largely heterogeneous in age or size. Multiple layers are present, but one layer missing or little variation in ages and heights of woody vegetation in at least one layer. Less than 10% of trees present are large trees (>60 cm or 24" dbh) due to human activities. At least 20% of trees present are >30 cm or 12" dbh. Minor presence of cutting, browsing, grazing and other degradation such as forest pest/pathogens. If large trees are absent, few or no large stumps are present and there is evidence of a natural disturbance event (e.g., large downed wood from wind storms, fire scars, beaver activity, tree senescence). Little impact from deer browse. |

| | |
|---|---|
| Fair = 2 | Tree canopy or highest woody level present is somewhat homogeneous in age or size. More than one layer present, but one or more layers missing. Little variation in ages and heights of woody vegetation in layers. Less than 20% of trees present are >30 cm or 12" dbh are present. Moderate levels of cutting, browsing, or grazing, or other degradation such as forest pest/pathogens has caused the loss of larger trees rather than a natural disturbance event. |
| Poor = 1 | Tree canopy or highest woody level present is very homogeneous in age or size. Only one or two layers present due to human activities. Most, if not all, larger trees (dbh 30-60 cm or 12-24") have been removed. Major cutting, heavy browsing, grazing, or other degradation such as forest pest/pathogens. |
| **Coastal Plain Seepage Bog and Fen** | |
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Mortality of woody vegetation, if present, is due to natural factors such as wind storms or senescence. Excellent potential for site recovery given structure present and lack of degradation (past or present).<br>Bogs/acidic fens: Peatland structure includes shrub and herb strata (some tall and some short). When present (peatland not too wet), trees are relatively short and stunted with rounded tops and furrowed bark. Shrubs are < 50 cm and open enough to allow for a nearly continuous ground cover of *Sphagnum* and other expected vegetation around tree/shrub bases AND in low hummocks, hollows, or other low areas.<br>Circumneutral/rich fens: Primarily short-statured vegetation and nearly continuous cover of mosses (except in tall sedge fens - which are naturally more vigorous, homogenous, and often with little bryophyte cover). Shrubs may be present as a mosaic with open areas. Tree species, when present, do not form a closed canopy. *Sphagnum* and other mosses actively growing. Never more than local, small patches of degenerating *Sphagnum*. |
| Good = 3 | Minor negative anthropogenic influences present, or the site is still recovering from major past human disturbances. Mortality or degradation due to grazing, peat mining, limited timber harvesting, or other anthropogenic factors may be present, though not widespread. The site can be expected to meet minimally disturbed conditions in the near future if negative influences do not continue.<br>Bogs/acidic fens: Shrubs and herbs show minor alterations from expected conditions. A few areas of dense and tall shrubs (> 1 m) may occur (dense enough to eliminate *Sphagnum*/moss growth). Some trees may have been or killed due to anthropogenic stressors.<br>Circumneutral/rich fens: Shrubs and herbs show minor alterations from expected conditions. |
| Fair = 2 | Expected structural classes are not present. Shrubs and herbs moderately altered from expected conditions. The site will recover to minimally disturbed conditions only with the removal of degrading influences and moderate recovery times.<br>Bogs/acidic fens: Shrub cover averages > 1 m tall and is beginning to reduce *Sphagnum* cover. Many trees have been cut or killed due to anthropogenic stressors.<br>Circumneutral/rich fens: Trampling or other physical disturbance has moderately reduced moss cover where expected. Overall, evidence of degradation includes moderate levels of cutting, mowing, browsing, fire or grazing. *Sphagnum* still regenerating in open areas. |
| Poor = 1 | Expected peatland structure is absent or much degraded due to anthropogenic factors, such as peat mining. Overall, evidence of degradation includes major cutting, mowing, browsing, fire or |

| | |
|---|---|
| | grazing. Woody regeneration is minimal and existing structure is in poor condition, unnaturally sparse, or depauperate. Shrubs and herbs substantially altered from expected conditions. Recovery to minimally disturbed condition is questionable without restoration, or will take many decades.<br>Bogs/acidic fens: Most if not all *Sphagnum* cover has been eliminated due to extremely dense and tall (> 1 m) shrubs. Trees have all been cut or killed by anthropogenic stressors.<br>Circumneutral/rich fens: Trampling or other physical disturbance has eliminated moss cover where it is expected. *Sphagnum* not regenerating, even in open areas. |

### 4.6.3 Standing and Downed Coarse Woody Debris

Standing or fallen woody debris (snags and downed branches and trees) plays a critical role in a variety of wetland systems, especially riparian systems, providing both habitat and the input of organic material. Estimation of coarse woody debris should be based on a walkthrough of the entire AA if possible. For large AA, estimation along transects may be preferred. In forested KWH, pay special attention to the amount of coarse woody debris when surveying the AA. Select the statement from the rating table (Table 26) that best describes the amount of woody debris and/or litter within the AA depending on the KWH type. Riverine wetlands that have incised banks, no longer experience flooding, experience overgrazing, or are no longer at a dynamic equilibrium may lack coarse woody debris. For wetlands dominated by shrub and herb layers, note the quantity and distribution of litter compared with the baseline that may be expected in the landscape and rate according to Table 26. As Vernal Pools and Springs may have only scattered woody debris, evaluate both the basin and the surrounding area. Active floodplain systems are typically low in litter. Peatlands are dominated by peat-forming species which contribute enough litter and debris to maintain carbon dynamics, playing a critical role in these systems that may naturally include little coarse woody debris.

**Table 26. Standing and Downed Woody Debris Metric Rating Criteria.**

| **Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp**<br>**Vernal Pool and Spring:** assess presence in immediate surrounding area as well as basin, which may only have scattered coarse woody debris, if any.<br>If non-natural sources have created standing and/or downed woody debris, such as cutting or forest pests/pathogens, indicate this on the data sheet. | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Wide diversity of sizes for both standing and downed logs, including larger sizes [> 30 cm (12 in) DBH and > 2 m (6 ft) long)] present with 5 or more snags per ha (2.5 ac), but not excessive numbers (suggesting disease or other problems). Downed logs are in various stages of decay, from sound and intact to soft pieces that no longer maintain their shape. |
| Good = 3 | Moderate diversity of sizes for both standing and downed logs, but larger sizes [> 30 cm (12 in) DBH and > 2 m (6 ft) long)] are rare. Larger size class present with 2-4 snags per ha, or an |

| | |
|---|---|
| | increased but not excessive number of snags (suggesting disease or other problems). Downed logs are in various stages of decay, with few soft pieces that no longer maintain their shape. |
| Fair = 2 | Moderate-low diversity of sizes for both standing and downed logs, but larger sizes [> 30 cm (12 in) DBH and > 2 m (6 ft) long)] very rare or not present. Larger size class present with 1-2 snags per ha, or moderately excessive numbers (suggesting disease or other problems). Downed logs are in various stages of decay, but few to no soft pieces that no longer maintain their shape. |
| Poor = 1 | Low diversity of sizes for both standing and downed logs. Larger size class [> 30 cm (12 in) DBH and > 2 m (6 ft) long)] present with < 1 snag per ha, or very excessive numbers (suggesting disease or other problems). Downed logs are mostly in early stages of decay. |

| **Coastal Plain Seepage Bog and Fen** | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Typical of the system. Woody vegetation mortality is due to natural factors. Peat accumulation appears to be stable or actively growing.<br>Bogs/acidic fens: *Sphagnum* is nearly continuous and growing around tree/shrub bases AND in low hummocks, hollows, or other low areas.<br>Circumneutral/rich fens: Dominant species are active peat-formers. |
| Good = 3 | Minor alterations to system present.<br>Bogs/acidic fens: Mortality or degradation of peat surface due to grazing, limited timber harvesting, anthropogenic fire or other anthropogenic factors may be present, but not widespread.<br>Circumneutral/rich fens: Mortality or degradation of peat surface due to grazing, limited timber harvesting, anthropogenic fire or other anthropogenic factors may be present, but not widespread. |
| Fair = 2 | Moderate alterations to system present.<br>Bogs/acidic fens: Ground cover has as much bare peat as *Sphagnum* cover, or nearly so.<br>Circumneutral/rich fens: Dominance of active peat-formers is being reduced in favor of non-peat-forming grasses and forbs. |
| Poor = 1 | Substantial alterations to system present.<br>Bogs/acidic fens: Ground cover is almost all bare peat with very little *Sphagnum* cover.<br>Circumneutral/rich fens: Cover of active peat-formers dramatically reduced and site is now dominated by non-peat-forming grasses and forbs. |

### 4.6.4 Vegetation Composition

Vegetation of the AA is assessed in the field using the five strata version of the wetland delineation determination (USACE 2010). The coverage of invasive species and native species (both diagnostic and those indicative of disturbance) should be noted even if they are not dominant species in the AA. State rare species should also be noted (for a list, see Maryland Department of Natural Resources 2021 or most current version). The species composition is assessed relative to the species expected in each stratum for the KWH in the Assessment Area (Characteristic and Indicator Species, Table 13), and whether exotic invasive plant species are

present. This information is used to calculate two measures relevant to condition: coverage and abundance of invasive plant species, and composition of native plant species present. In addition, the sources of stressors or alterations to the native plant community and suggestions for improvement are noted on the data sheet. The field data forms include areas to record the information on vegetation (or copy from a completed wetland delineation form). A visual aid for percentage cover estimation is included in the condensed scoring tables document and the data sheet with scoring guidance (Appendices 4 and 5). Adjusted Floristic Quality Index and Native Mean Coefficient of Conservation, estimates of nativity and habitat quality, are calculated in the office using an online program or Excel data sheet and recorded on the data form.

### 4.6.5 Invasive Species

Invasive species are non-native species that can spread into natural ecosystems, where they can displace native species and cause major alterations to KWH plant species composition and structure (Faber-Langendoen et al. 2016c). Potential negative impacts of invasive species to KWH include loss of habitat, loss of native biodiversity, decreased nutrition for herbivores, impaired hydrologic function, and alteration of biomass, energy cycling, productivity, and nutrient cycling (Faber-Langendoen et al. 2016c). This metric uses the absolute cover of invasive species to determine a score and rating (Table 27). The most common non-native plant invasive species in Coastal Plain stream-associated wetlands are *Microstegium vimineum, Glechoma hederacea, Rosa multiflora, Lonicera japonica, Ligustrum sinense, Phalaris arundinacea*, and *Phragmites australis*. *Murdannia keisak* may also be present. Additional invasive and exotic species in Maryland can be found at http://mdinvasives.org/species-of-concern/. Scoring for Vernal Pools and Springs should include observations from the basin and surrounding area, given the typical sparse vegetation in the basin for these two KWH.

**Table 27. Invasive Species Metric Rating Criteria.**

| **Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp, Coastal Plain Bog and Fen**<br>**Vernal Pool and Spring:** assess vegetation structure in area surrounding basin, as only limited to sparse vegetation may be present in the basin area. | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Invasive species are absent from all layers or absolute cover in any one woody layer (if present) and herbaceous layer is <1%. |
| Good = 3 | Invasive species are sporadic (no more than 5% absolute cover in any layer). |

| | |
|---|---|
| Fair = 2 | Absolute cover of Invasive species is 5-10% in any one woody layer (if present) and/or present with moderate absolute cover (5-30%) in the herbaceous layer. Patches of native vegetation are reduced in size and complexity due to the presence of invasive species. |
| Poor = 1 | Absolute cover of Invasive species is over 10% in any one woody layer (if present) and/or is very abundant (over 30%) in the herbaceous layer. vegetation reduced in size and complexity due to human disturbance. Patches of native vegetation are reduced in size and complexity due to the presence of invasive species. |

### 4.6.6 Native species

Similar to invasive species presence, the presence and composition of native species provides an indication of KWH ecological integrity (Faber-Langendoen et al. 2012, 2016c). This metric uses the presence of indicator species and characteristic native species for the KWH in the AA (see Table 13) as well as the presence of diverse native vegetation or native species that indicate human disturbance. Native species indicative of disturbance are those that seem to be more or less weedy and not picky about habitat, or they occur in young, often heavily altered wetland communities. These species include: *Phalaris arundinacea, Dichanthelium boscii, Typha latifolia, Dichanthelium sphaerocarpon, Elymus glabriflorus, Paspalum floridanum, Muhlenbergia schreberi, Echinochloa muricata, Carex blanda, Carex frankii, Coleataenia anceps, Dichanthelium scoparium*, and *Panicum dichtomiflorum*. Metrics are adjusted for Coastal Plain Bog and Fen systems and some Spring KWH due to the importance of *Sphagnum*. Recent beaver activity can affect the species present. This alteration should not degrade the score but should be described on the data sheet. Use Table 28 to score the native species metric by KWH. Provide information on stressors and suggestions for improving native species cover and a natural vegetation community.

**Table 28. Native Species Metric Rating Criteria.**

| **Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp, Coastal Plain Bog and Fen**<br><br>**Vernal Pool and Spring:** assess vegetation structure in area surrounding basin, as only limited to sparse vegetation is usually present in the basin area.<br><br>**Note:** Recent beaver activity may lead to deviations from rating descriptions for Coastal Plain Floodplain. This should be noted on the data sheet and taken into account. | |
|---|---|
| **Score** | **Assign rating to category with majority of features present** |
| Excellent = 4 | Herbaceous and woody layers (if present) dominated by indicator native species. Layers may be sparse and patchy in areas with deeper flooding, with patches of vegetation confined to |

| | |
|---|---|
| | hummocks. In other areas, diverse native vegetation present unless there has been a recent natural disturbance.<br><br>Bog and Fen, some Springs: *Sphagnum* is nearly continuous and growing around tree/shrub bases AND in low hummocks, hollows, or other low areas. |
| Good = 3 | Some indicator native species absent or substantially reduced in abundance OR low cover (<10%) of native species indicative of human disturbance. Layer may be sparse and patchy in areas with deeper flooding.<br><br>Bog and Fen, some Springs: *Sphagnum* and other mosses actively growing, but may be eliminated from some areas due to disturbance or invasive species. |
| Fair = 2 | Few indicator species are present. Native species indicative of human disturbance are present with moderate cover (10-30%). Patches of native vegetation are reduced in size and complexity due to human disturbance.<br><br>Bog and Fen, some Springs: *Sphagnum* cover reduced but still regenerating in open areas. Dominance of active peat-formers is being reduced in favor of non-peat-forming grasses and forbs. |
| Poor = 1 | Few to no indicator species are present. Native species indicative of human disturbance are present with >30% cover. Patches of native vegetation are reduced in size and complexity due to human disturbance.<br><br>Bog and Fen, some Springs; Very little *Sphagnum* cover. Cover of active peat-formers dramatically reduced and site is now dominated by non-peat-forming grasses and forbs. |

### 4.6.7 Floristic Quality Index and Associated Measures

The species identified in the AA during data collection for the wetland delineation can be used to provide information on KWH condition using the methodology developed by Swink and Wilhelm (1979, 1994) for Floristic Quality Assessments. This method uses characteristics of the plant community to derive an estimate of nativity or habitat quality based on a combination of the tolerance to disturbance or environmental stress and fidelity to specific habitat integrity of individual plant species. This combination of tolerance and fidelity is expressed numerically as a coefficient of conservatism or C-value (Swink and Wilhelm 1979, 1994). The C-values of plant species present are combined with the richness of native species to create the Floristic Quality Index (FQI), a metric for habitat condition or quality. For both C-values and FQI, high-quality habitats typically have high scores, while low-quality habitats have low scores. C-values vary from 0 to 10, while FQI varies with species richness and their C-values. Previous studies have found that mean C-value for dominant species correlates well with C-values calculated using all species present at a site (Bourdaghs 2014; Chamberlain and Brooks 2016; Gianopulos 2018) and that the use of an Adjusted FQI better reflects the influence of disturbance on the quality of the habitat being evaluated (Miller and Wardrop 2006).

To derive the Adjusted FQI and mean C-value, an office exercise will be completed or the Excel data sheet will use the scientific names of the plant species noted during the wetland delineation process. For the mid-Atlantic region, a Floristic Quality Assessment can be accessed at http://universalfqa.org using the database entitled "Mid-Atlantic Coastal Plain with invasives". Using this particular database is critical to make certain that the assessment includes invasive species, as it reflects the full database developed by the Mid-Atlantic Wetland Working Group. Record the Native Mean C and Adjusted FQI from the output of the online calculator in the places indicated on the data collection form (Appendix 3 or 5). These values will be calculated automatically if data have been entered into the Excel data sheet directly or through autofill from the wetland delineation Excel sheet. Only Native Mean C will be used to calculate a score and metric rating for the overall vegetation condition according to the following scale: > 4: Excellent; 4-3 Good; <3-2 Fair; <2 Poor. The Adjusted FQI should also be recorded on the scoring sheet, as it is useful for comparison between sites with the same KWH type.

# 5.0 CALCULATION AND USE OF ECOLOGICAL INTEGRITY ASSESSMENT SCORES

The major components of the EIA include four core factors: landscape, soil/substrate, hydrology, and KWH and vegetation composition. Together these are the components that capture the structure, composition, processes, and connectivity of an ecological system. Whether one needs to roll up the individual metrics or core factor scores is dependent on the project objective. Land managers may only be interested in the core factor or individual metric scores, as they provide insight into management needs, goals, and measures of success. On the other hand, if the goal is to compare or prioritize sites for conservation, restoration, or management actions, then an overall EIA score/rank may be needed. Individual Metric Scores and Mean Core Factor scores can be helpful for understanding current status of primary ecological drivers. Landscape context metrics address the "outer workings" while on-site condition metrics measure the "inner workings" of a wetland (Faber-Langendoen et al. 2016b). The individual Metric Scores take into account the stressors present in the AA and immediate surrounding buffer, providing further insight into site conditions and potential project impacts or opportunities. Addressing all of these characteristics and processes will contribute not only to understanding the current levels of ecological integrity, but to the resilience of the ecosystem in the face of climate change and other global stressors. The presence, scope, and severity of stressors noted for the AA, project area, and buffer during the field and office evaluations provide further information on the condition of the site and potential future trajectory as well as suggesting actions to retain good condition or to improve conditions for the KWH and the species that it supports. Information on conservation actions for KWH can be found in Maryland DNR (2015) and guidance on the use of Metric, Mean Core Factor, and Overall Ecological Integrity ratings is provided in a separate guidance document.

To calculate the Overall Core Factor scores, enter the scores and ratings for the Metrics, Mean Core Factor score, and Overall Core Factor score on the Ecological Integrity Assessment Score Sheet (Appendix 3 or 5). To calculate the Mean Core Factor score, add up the metric scores for that Core Factor and divide by the number of metrics. Note that if only Microtopography, Organic Matter Accumulation, and Soil Disturbance were scored for the Soil/Substrate Core Factor, you will divide by 3 rather than 5. Use the 4-part scale in Table 29 to assign a rating if separate ratings for the four core factors are desired (Mean Core Factor Score). See Section 5.1 for calculation of the overall score, completion of the checklist of additional resources present, and addition of points if warranted.

**Table 29. Ratings and Points for Mean Core Factor Scores and Overall Ecological Integrity Score.**

| Numerical Score | Rating |
|---|---|
| 3.5 – 4 | Excellent |
| 2.5 – 3.49 | Good |
| 1.5 – 2.49 | Fair |
| 1 – 1.49 | Poor |

## 5.1 Overall Ecological Integrity Assessment Score/Rating and Additional Resources

The Overall KWH Ecological Integrity Assessment (EIA) score is calculated using the Mean Core Factor scores. These values are combined using the following formula: (Landscape Mean Core Factor score *0.3) + (Soil/Substrate Mean Core Factor score*0.1) + (Hydrology Mean Core Factor score *0.2) + (KWH and Vegetation Composition*0.4). The associated rating for the EIA score is found in Table 29. The score and associated rating should be entered on the Scoring Form.

The presence of all unique resources in the project area from the landscape-level analysis (Section 3.5) should be noted on the Scoring Form. Data for some additional KWH resources may result from field observations. The presence of any of these should be noted on the Scoring Form:

- Other Maryland nontidal wetland(s) with significant plant or wildlife value (as defined by COMAR 26.23.01.01B80), such as a bog, area with bald cypress or Atlantic white cedar, or that supports vernal pools
- Areas with state rare plants or a state rare natural community noted during field data collection but not mapped in Biodiversity Conservation Network Tier 1, 2, or 3

- Presence of sensitive species (colonial waterbird nesting colony, native mussel bed, anadromous fish)
- Sites dominated by older, native trees (greater than 60cm or 24" diameter at breast height) (see Section 4.6.2 for relevant data)
- Sites dominated by native species that produce hard mast (i.e., acorns and nuts) in the tree strata (see Section 4.6.4 for relevant data).

If the EIA score is not "Excellent", additional points should be added for each unique resource that was noted to be present in the project area according to the instructions below and on the Scoring Form. Table 30 provides the point values to add on for each resource. Enter the Final Key Wildlife Habitat Ecological Integrity Assessment Score and rating for the AA on the Scoring Form.

**Table 30. Additional Points for Unique Resources (Sections 3.5 and 5.1).**
**NOTE:** Indicate all resources present at the project site, but award additional points only if the EIA rating is not "Excellent" according to the instructions below.

**From Maryland Watershed Resources Registry layers:**

**Indicate all categories present in WRR layers. Assign the single highest score for a maximum of +0.2 for WRR layers:**
Nontidal Wetlands of Special State Concern (+ 0.2)
Biodiversity Conservation Network Tier 1, 2, or 3 (+ 0.2)

Forest Interior Dwelling Species (FIDS) area: Class 1 (+ 0.1)
Targeted Ecological Area (+ 0.1)
Sensitive Species Project Review Area (+ 0.1)

**From MDE Tier II High Quality Waters (Section 3.5):**Upstream of, within, or adjacent to Tier II High Quality stream segment (+ 0.2)

**From StreamStats (Section 3.5):**Impervious surface area for project area basin is low (< 5%) (+ 0.2)

Forest cover in project area basin is >90% (+ 0.2)

**From field observations:**

Maryland nontidal wetland(s) with significant plant or wildlife value (as defined by COMAR 26.23.01.01B80) but not designated as a Nontidal Wetland of Special State Concern (add + 0.2 for each wetland to the Overall EIA score)
State rare, threatened, or endangered plants or state rare natural community noted during field data collection but not mapped in Biodiversity Conservation Network Tier 1, 2, or 3 (+ 0.2)
Sensitive species (colonial waterbird nesting colony, native mussel bed, anadromous fish) (+ 0.1)
Dominated by native trees greater than 30cm or 12" diameter at breast height (+ 0.1)
Dominated by hard mast (i.e., acorns and nuts) producing native species in the tree stratum (+ 0.1)

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# Appendix 1
# Key Wildlife Habitats for the Coastal Plain

The Maryland State Wildlife Action Plan forms the blueprint for the conservation of priority species and habitats over a 10-year period (2015-2025; Maryland Department of Natural Resources 2015 https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/SWAP_Submission.aspx). The plan identifies 610 animal species considered to be Species of Greatest Conservation Need (SGCN), including all state- and federally listed Threatened or Endangered species, rare species, endemic species, declining species, and responsibility species for which Maryland harbors a significant portion of the overall population. Because of the strong tie between species and habitats, it is critical to identify those habitats that support SGCN in order to conserve them. In general, the term "habitat" is described as the physical and biological environment that provides the necessary food, shelter, and other needs of a particular animal, plant, or other organism. Key Wildlife Habitats are no different in concept with the exception that the species dependent upon those habitats are considered Species of Greatest Conservation Need (SGCN). These habitats serve as critical foundations and support networks not only for SGCN but for all plant and animal species in Maryland.

Key Wildlife Habitats (KWH) are structured as ecological cover types based primarily on vegetation for most habitats, since vegetation typically reflects biological and ecological patterns across the landscape. Wetland and terrestrial KWH are organized into a simple classification scheme which is scalable, allowing for compatibility with other ecological classifications. At the local level, this classification scheme is closely related to Maryland's natural community classification (Harrison 2016). This classification is a relatively fine-scaled classification system that uses an ecologically-based hierarchy and grouping of vegetation associations from the U.S. National Vegetation System (Federal Geographic Data Committee 2008) as the foundation.

In riparian areas, terrestrial and wetland Key Wildlife Habitats are associated with stream and river habitats. These aquatic habitats are characterized into KWH types based on variables known to influence stream and river habitats at various spatial scales such as stream slope, size, elevation, climate, and geology. Stream and river KWH descriptions, as well as lists of SGCN associated with all KWH types, can be found at https://dnr.maryland.gov/wildlife/Documents/SWAP/SWAP_Chapter4.pdf

The best available current information regarding the description, condition, and distribution of wetland and stream Key Wildlife Habitats in the Coastal Plain is provided below (Maryland DNR 2015). Statewide general location maps and county distributions for KWH are presented in this document, along with statewide examples of public lands to visit, signature state rare plants, and state rare natural communities where relevant. These maps should be viewed as only generalized range maps, rather than depicting the full and complete distribution of habitats, especially for small wetland areas.

## Coastal Plain Floodplain

The Coastal Plain Floodplain key wildlife habitat is characterized by a variety of flooded habitats that border Coastal Plain streams and rivers. These floodplain habitats are influenced by temporary or seasonal overbank flooding, groundwater seepage, and beaver activity. The vegetation of Coastal Plain Floodplains is both structurally and compositionally diverse, and often occurs as a mosaic of forests, woodlands, shrublands, and herbaceous communities. Species composition varies widely with stream order, soil type, and flooding regime. Floodplain forests of small intermittent streams and braided streams may support combinations of sycamore *(Platanus occidentalis)*, green ash *(Fraxinus pennsylvanica)*, red maple *(Acer rubrum)*, sweetgum *(Liquidambar styraciflua)*, black gum *(Nyssa sylvatica)*, river birch *(Betula nigra)*, swamp chestnut oak *(Quercus michauxii)*, and willow oak *(Quercus phellos)*. Diverse understories are often present and characterized by mixtures of American hornbeam *(Carpinus caroliniana)*, pawpaw *(Asimina triloba)*, American elm *(Ulmus americana)*, American holly *(Ilex opaca var. opaca)*, spicebush *(Lindera benzoin)* and herbs of Jack-in-the-pulpit *(Arisaema triphyllum)*, false nettle *(Boehmeria cylindrical)*, poison-ivy *(Toxicodendron radicans)*, Virginia creeper *(Parthenocissus quinquefolia)*, wood reedgrass *(Cinna arundinacea)*, and various sedges. Similarly, floodplain forests of larger Coastal Plain Rivers with well-drained terraces or natural levees will often support species such as tulip-poplar *(Liriodendron tulipifera)*, beech *(Fagus grandifolia)*, and box elder *(Acer negundo)*. Poorly drained floodplains, backswamps, and depressions of small Coastal Plain streams and rivers may support seasonally flooded swamps dominated by green ash, red maple *(Acer rubrum)*, and plants tolerant of fluctuating water levels such as lizard's-tail. Bald Cypress Swamps and Atlantic White Cedar Swamps are rare natural communities that are also associated with poorly drained settings in seasonally flooded floodplains. Both are associated with slow-moving Blackwater Streams such as those in the Pocomoke and Nanticoke River watersheds. Only 6 acres have been identified by the Maryland Department of Natural Resources as old growth on state lands.

Richard Wiegand, MD DNR

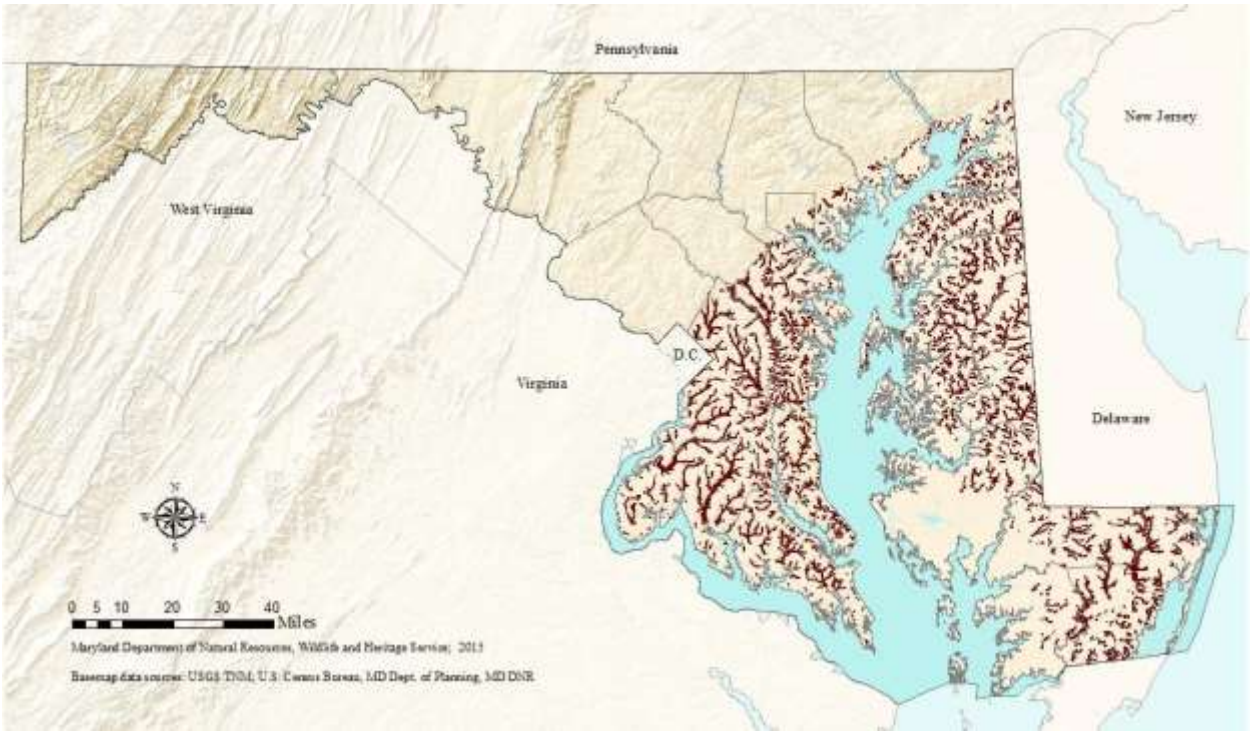
Floodplain pools, beaver ponds, and other open water habitats are also characteristic of Coastal Plain Floodplains. These habitats are subjected to irregular disturbances that change water levels, such as the breaching of beaver dams and storm events. These habitats are highly variable in size, structure, and species composition. They often support a variety of floating aquatic, emergent, and woody vegetation. Species common to these habitats include white water-lily *(Nymphaea odorata)*, spatterdock *(Nuphar advena)*, pondweeds *(Potamogeton* spp.*)*, duckweeds *(Lemna* spp.*)*, bladderworts *(Utricularia* spp.*)*, rice cutgrass *(Leersia oryzoides)*, common woodrush *(Luzula multiflora)*, smartweeds *(Polygonum* spp.*)*, pickerelweed *(Pontederia cordata)*, arrow-arum *(Peltandra virginica)*, three-way sedge *(Dulichium arundinaceum)*, broad-leaved cattail *(Typha latifolia)*, American bur-reed *(Sparganium americanum)*, swamp loosestrife *(Decodon verticillatus)*, and common buttonbush *(Cephalanthus occidentalis)*.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Kent, Prince George's, Queen Anne's, St. Mary's, Somerset, Talbot, Wicomico, Worcester

Places to Visit: Merkle Wildlife Sanctuary, Idylwild Wildlife Management Area, Pocomoke State Forest

Signature State Rare Plants: Flat-stem Spikerush (*Eleocharis compressa*), water-plantain spearwort (*Ranunculus ambigens*), catchfly cutgrass (*Leersia lenticularis*), veined skullcap (*Scutellaria nervosa*), red turtlehead (*Chelone obliqua*)

State Rare Natural Communities: Bald Cypress Swamp, Atlantic White Cedar Swamp



Mapped Locations of Coastal Plain Floodplains in Maryland. Sources: MD DNR, FEMA.

## Coastal Plain Seepage Swamp

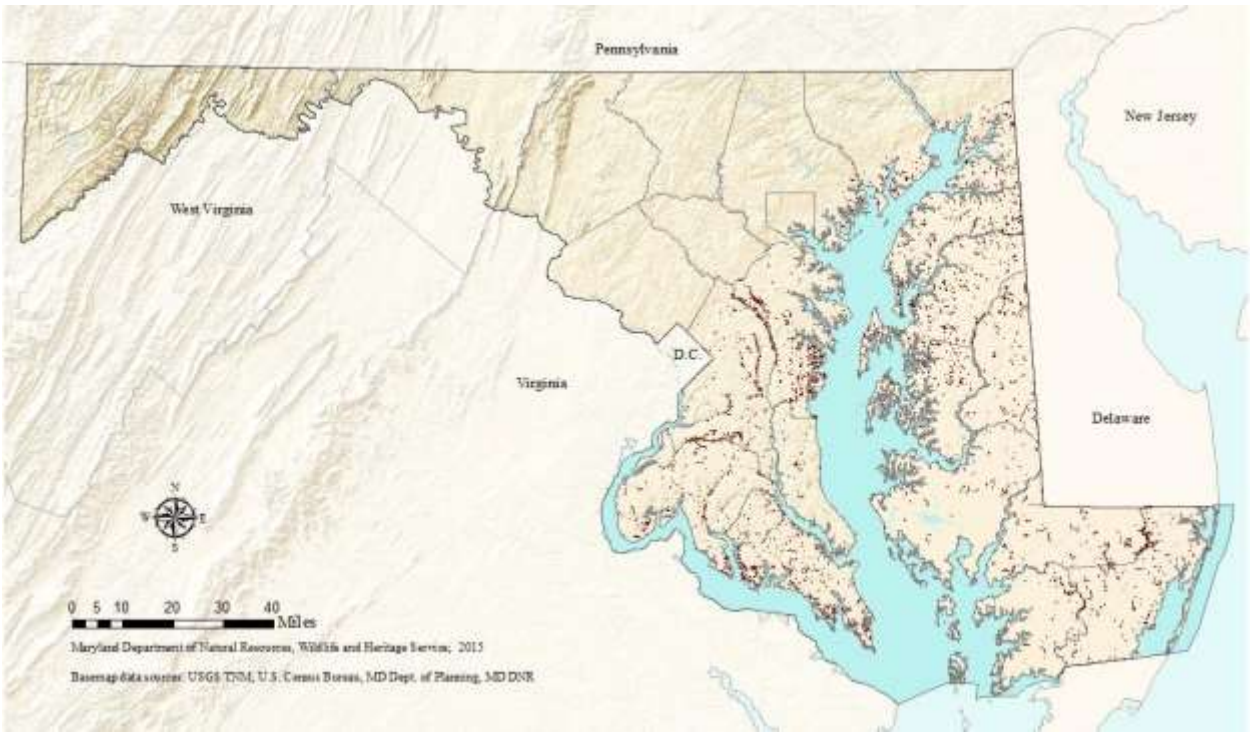
Richard Wiegand, MD DNR

The Coastal Plain Seepage Swamp key wildlife habitat is characterized by gently sloping forests of small headwaters, ravine bottoms, and toe-slopes where groundwater is discharged at ground surface and carried away as stream flow. Often the groundwater seepage is perennial and characterized by diffuse drainage and braided channels with sand, gravel, or peaty substrates. Soils are typically moderately to strongly acidic and nutrient-poor; however, basic seepage swamps may develop in ravines that have downcut into tertiary-aged shell marl deposits. Coastal Plain Seepage Swamps are associated with mostly closed to semi-open canopies of red maple *(Acer rubrum)*, black gum *(Nyssa sylvatica)*, tulip-poplar *(Liriodendron tulipifera)*, sweetbay magnolia *(Magnolia virginiana)*, green ash *(Fraxinus pennsylvanica)*, white ash *(Fraxinus americana)*, and pitch pine *(Pinus rigida)*. The shrub and herbaceous layers in many Coastal Plain Seepage Swamps are diverse and recognized by dense patches of skunk cabbage *(Symplocarpus foetidus)* and colonies of ferns such as cinnamon fern *(Osmunda cinnamomea)*, marsh fern *(Thelypteris palustris var. pubescens)*, royal fern *(Osmunda regalis var. spectabilis)*, New York fern *(Thelypteris noveboracensis)*, and netted chain fern *(Woodwardia areolata)*. Other notable plants include jewelweed *(Impatiens* spp.*)*, small green wood orchid *(Platanthera clavellata)*, Virginia bugleweed *(Lycopus virginicus)*, Jack-in-the-pulpit *(Arisaema triphyllum)*, false nettle *(Boehmeria cylindrical)*, and numerous sedges. In addition, hummocks of peat mosses can be quite abundant and diagnostic to Coastal Plain Seepage Swamps of acidic substrates. The shrub layer may include winterberry *(Ilex verticillata)*, sweet pepper-bush *(Clethra alnifolia)*, swamp azalea *(Rhododendron viscosum)*, spicebush *(Lindera benzoin)*, possum-haw *(Viburnum nudum)*, highbush blueberry *(Vaccinium corymbosum)*, and vines of poison-ivy *(Toxicodendron radicans)*, greenbrier *(Smilax* spp.*)*, and Virginia creeper *(Parthenocissus quinquefolia)*. Coastal Plain Seepage Swamps are naturally small-patched habitats vulnerable to hydrological disturbances, beaver activity, logging, and surface runoff.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester
Places to Visit: Elk Neck State Forest, Tuckahoe State Park, Pocomoke State Forest

Signature State Rare Plants: Swamp pink (*Helonias bullata)*, dwarf huckleberry (*Gaylussacia dumosa)*

State Rare Natural Community: Coastal Plain-Piedmont Acidic Seepage Swamp



Mapped Locations of Coastal Plain Seepage Swamps in Maryland. Sources: MD DNR, USFWS.

## Coastal Plain Flatwood and Depression Swamp

Scott Smith, MD DNR

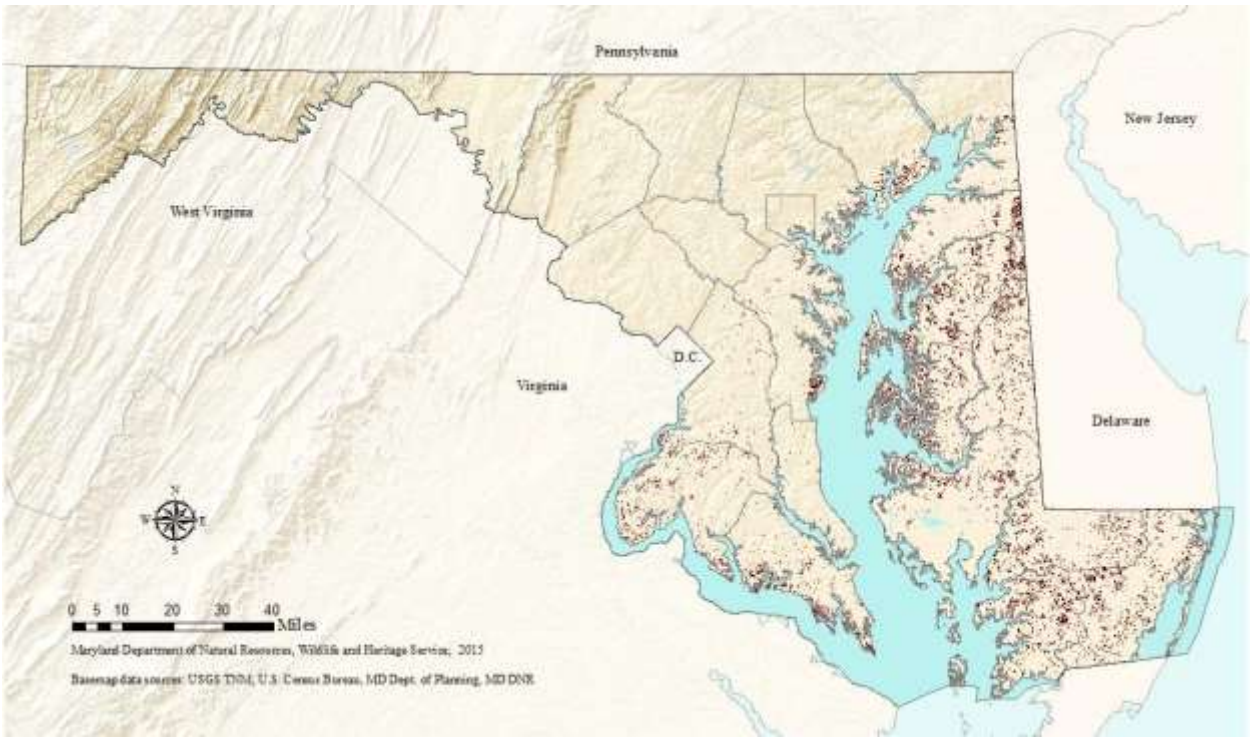
The Coastal Plain Flatwood and Depression Swamp key wildlife habitat includes seasonally flooded flatwoods and depressions of the Coastal Plain. These habitats develop on flat terraces and shallow depressions with seasonally perched water tables. This results in standing water throughout the early part of the growing season followed by a period of drawdown. Hydroperiods are variable between swamps and largely dependent on rainfall and drought cycles. The forested canopy structure of flatwoods and depression swamps range from open to closed with composition ranging from hardwood dominated to a mixtures of hardwoods and pines. Swamps dominated by oak species such as willow oak *(Quercus phellos)*, pin oak *(Quercus palustris)*, swamp chestnut oak *(Quercus michauxii)*, and cherrybark oak *(Quercus pagoda)* are generally considered as higher quality because much of today's remaining stands are characterized by successional hardwoods such as red maple *(Acer rubrum)*, sweetgum *(Liquidambar styraciflua)*, black gum *(Nyssa sylvatica)*, and American holly *(Ilex opaca var. opaca)*. Loblolly pine *(Pinus taeda)* is a prominent component of many flatwoods on the lower Coastal Plain. Other species commonly encountered in these habitats include green ash *(Fraxinus pennsylvanica)*, overcup oak *(Quercus lyrata)*, and swamp tupelo *(Nyssa biflora)*. State rare natural communities within this key wildlife habitat include depressions with mixtures of Atlantic white cedar *(Chamaecyparis thyoides)*, swamp tupelo, pond pine *(Pinus serotina)*, and sweetbay magnolia *(Magnolia virginiana)*. In the understory, shrubs and vines are common but variable, often including an abundance of common greenbrier *(Smilax rotundifolia)*. The herbaceous layer is often sparse and may include species of sedges, manna-grasses, and rushes. Slightly elevated hummocks of sphagnum mosses frequently form large patches. Coastal Plain Flatwoods and Depression Swamps have been greatly reduced in extent in Maryland through ditching, draining, logging, and conversion to agriculture and pine plantations.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Blackwater National Wildlife Refuge, LeCompte Wildlife Management Area, Millington Wildlife Management Area, Third Haven Woods (The Nature Conservancy)

Signature State Rare Plants: Three-angle spikerush (*Eleocharis tricostata)*, southern waxy sedge (*Carex glaucescens)*, white-bracted boneset (*Eupatorium leucolepis)*

State Rare Natural Communities: Coastal Plain Non-Riverine Hardwood Swamps, Atlantic White Cedar Swamp, Upland Depression Swamp



Mapped Locations of Coastal Plain Flatwoods and Depression Swamps in Maryland. Source: MD DNR

## Coastal Plain Seepage Bog and Fen

Wesley Knapp, MD DNR

The Coastal Plain Seepage Bog and Fen key wildlife habitat is a rare, small-patched habitat associated with seepage toeslopes, small stream bottoms, and the margins of long established millponds and sandpits. They typically develop at the base of sand and gravel terraces near streams where groundwater seepage is abundant and forced to the surface by an impermeable clay lens or aquiclude. The soils are usually peaty or sandy, very acidic, infertile, and often covered by dense mats of mosses (*Sphagnum* spp.) that support a unique flora. The term "bog" as applied to these wetlands, is a technical misnomer, since not all of these habitats are true peatlands and none is an ombrotrophic (i.e., fed by rainwater) system. This term, however, is now so widely used in the southeastern United States as a descriptor for open, acidic seepage wetlands that we have adopted it here for consistency. In Maryland, Coastal Plain Seepage Bogs and Fens exist in a variety of open settings and many are relicts of older, larger systems. Many natural examples have been destroyed by hydrologic alterations (e.g., ditching, draining, and impoundment construction), beaver activity, and a long history of fire suppression across the landscape. Remaining sites that support bog flora persist in artificially maintained habitats such as millponds, powerline rights-of-way, and sandpits where woody plant succession is usually controlled. The vegetation of Coastal Plain Seepage Bogs and Fens is very heterogeneous and patchy with scattered shrubs and graminoid dominated patches. The small openings found along the margins of slow-moving streams, millponds, and abandoned sandpits often support shrubs such as leatherleaf *(Chamaedaphne calyculata)*, big cranberry *(Vaccinium macrocarpon)*, sweet pepper-bush *(Clethra alnifolia)*, swamp loosestrife *(Decodon verticillatus)*, and giant cane *(Arundinaria gigantean)*. Hummocks of *Sphagnum* mosses are characteristic and usually support species such as northern pitcher-plant *(Sarracenia* spp.*)*, white beak-sedge *(Rhynchospora alba)*, rose pogonia *(Pogonia ophioglossoides)*, St. John's-wort *(Hypericum* spp.*)*, and Virginia meadow-beauty *(Rhexia virginica)*. Orchids, sundews *(Drosera* spp.*)*, bladderworts *(Utricularia* spp.*)*, and yellow-eyed grasses *(Xyris* spp.*)* are also common. Near the fall-line, globally rare Magnolia Bogs occur and share many floristic similarities to the New Jersey Pine Barrens region. Unlike true bogs, Magnolia Bogs are not characterized by accumulations of peat or organic soils. Nutrient poor and acidic seepage flow from groundwater often forms mucky depressions and braided channels around hummocks of sphagnum mosses. Historic accounts of Magnolia Bogs describe these areas with sweet bay and various shrubs fringing and forming clumps within a more open center dominated by herbaceous plants. Today, remaining examples exist mostly as open woodlands of black gum *(Nyssa sylvatica)* and sweet bay *(Magnolia virginiana)* with very dense shrubs and very small, scattered herbaceous patches. Shrubs common to these habitats include sweet bay, swamp azalea *(Rhododendron viscosum)*, highbush

blueberry *(Vaccinium fuscatum)*, fetterbush *(Leucothoe racemosa)*, dangleberry *(Gaylussacia frondosa)*, poison sumac *(Toxicodendron vernix)*, and Southern wild raisin *(Viburnum nudum)*. Herbaceous openings include species such as cinnamon fern *(Osmunda cinnamomea)*, woolly panicgrass *(Dichanthelium acuminatum)*, partridge berry *(Mitchella repens)*, halberd-leaved greenbrier *(Smilax pseudochina)*, wild yam *(Dioscorea* spp.*)*, Indian cucumber-root *(Medeola virginiana)*, and primrose-leaved violet *(Viola primulifolia)*. Regionally uncommon or rare "bog" species persisting in Magnolia Bogs include bog goldenrod *(Solidago uliginosa var. uliginosa)*, ten-angled pipewort *(Eriocaulon decangulare)*, Long's rush *(Juncus longii)*, spoon-leaved sundew *(Drosera intermedia)*, red milkweed *(Asclepias rubra)*, and sheep-laurel *(Kalmia angustifolia)*.

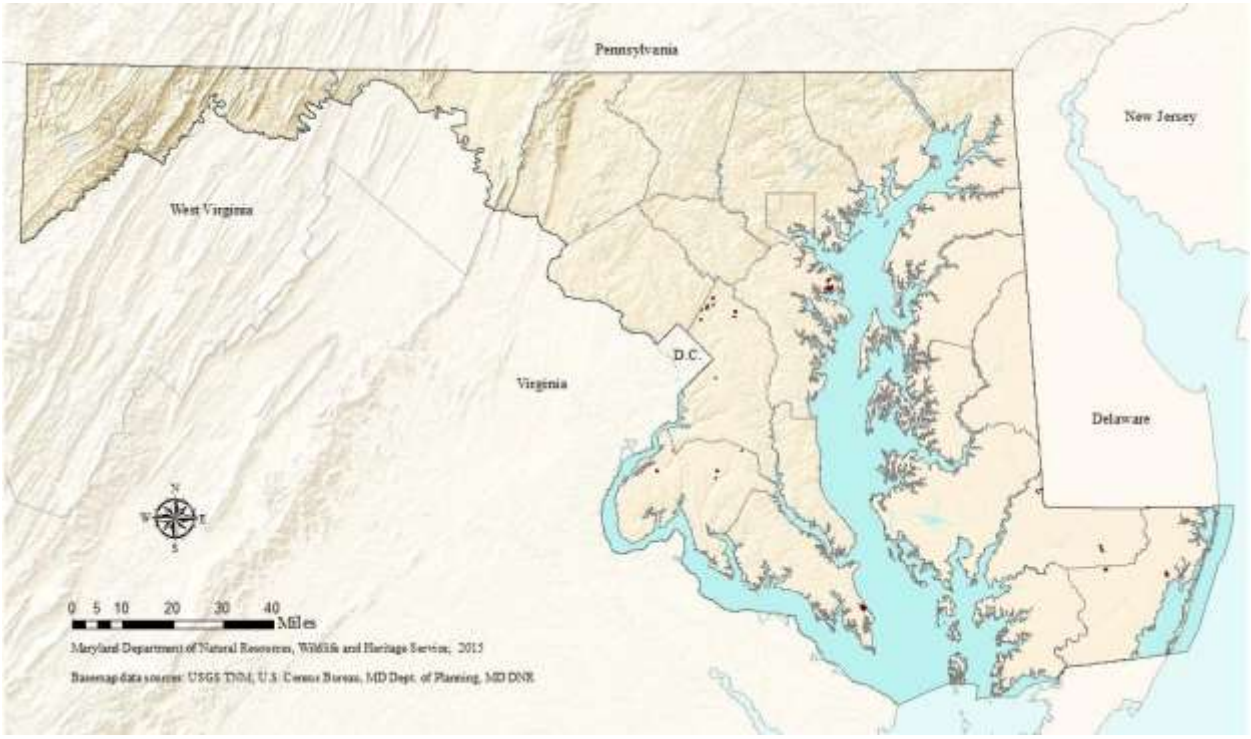
Sea-level Fens are small maritime seepage wetlands that occur above the high tide line at the bases of slopes where abundant groundwater discharges along the upper edges of estuarine bays. The hydrology of these sites is best characterized as saturated, although shallow standing water and small, muck-filled pools are locally present at all sites. Soils are characterized as organic and nutrient-poor. The vegetation exhibits characteristics of both inland seepage bogs and slightly brackish tidal marshes. Stands are generally a physiognomic mosaic of open woodland, scrub, and herbaceous patches. Woody species include red maple *(Acer rubrum)*, black gum *(Nyssa sylvatica)*, sweet bay *(Magnolia virginiana)*, and southern bayberry *(Morella cerifera)*. Characteristic herbs include twig rush *(Cladium mariscoides)*, beaked spikerush *(Eleocharis rostellata)*, white beaksedge *(Rhynchospora alba)*, spoon-leaved sundew *(Drosera intermedia)*, ten-angled pipewort *(Eriocaulon decangulare)*, coinleaf *(Centella erecta)*, brown-fruited rush *(Juncus pelocarpus)*, and bladderworts *(Utricularia* spp.*)*. Because of their small size and association with tidal salt marshes, Sea-level Fens are included as part of the Tidal Salt Marsh and Shrubland key wildlife habitat.

County Distribution: Anne Arundel, Calvert, Caroline, Cecil, Charles, Dorchester, Prince George's, Somerset, Wicomico, Worcester

Places to Visit: Suitland Bog

Signature State Rare Plants: New Jersey rush (*Juncus caesariensis)*, Long's rush (*Juncus longii)*, red milkweed (*Asclepias rubra)*, leatherleaf (*Chamaedaphne calyculata)*, brown-fruit rush (*Juncus pelocarpus)*, northern pitcher plant (*Sarracenia purpurea)*

State Rare Natural Community: Coastal Plain-Piedmont Acidic Seepage Bog/Fen



Mapped Locations of Coastal Plain Seepage Bogs and Fens in Maryland. Sources: MD DNR, USFWS.

## Vernal Pool


James McCann, MD DNR

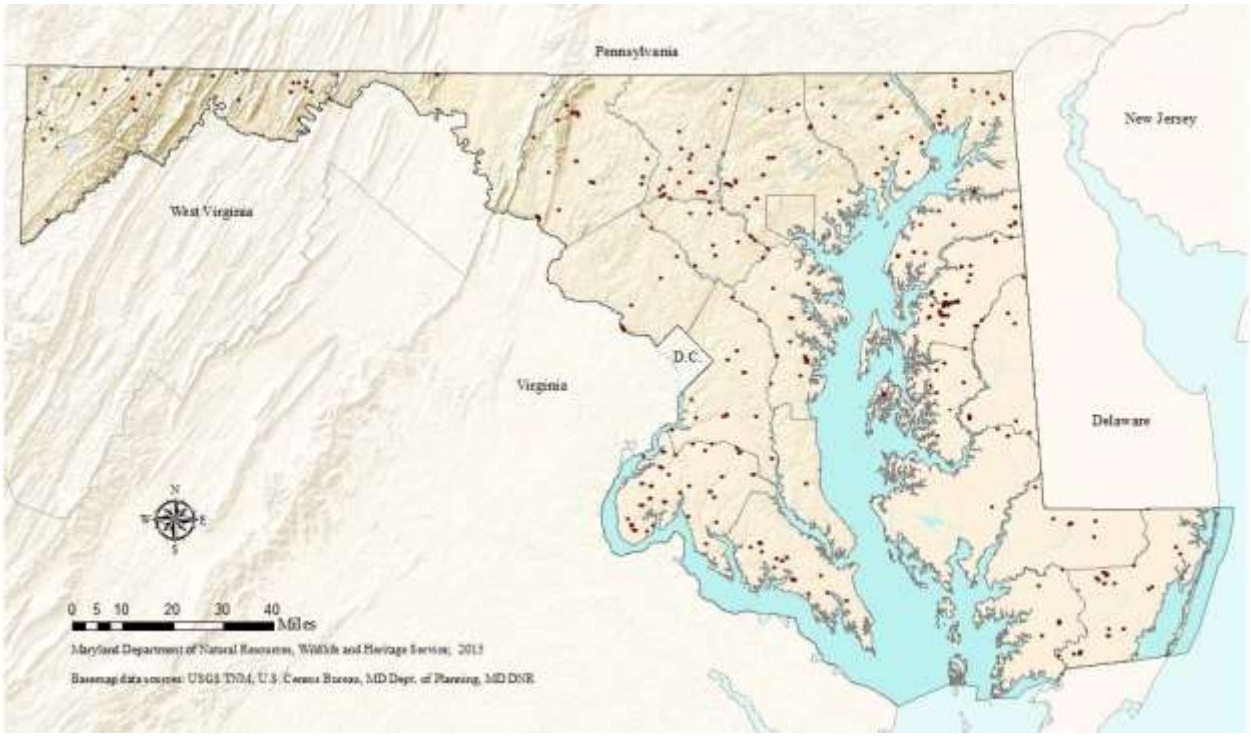
The Vernal Pool key wildlife habitat is defined as small (~0.1-2 ha), non-tidal palustrine forested wetlands. They exhibit a well-defined, discrete basin and lack a permanent, above-ground outlet. The basin overlies a clay hardpan or some other impermeable soil or rock layer that impedes drainage. As the water table rises in fall and winter, the basin fills forming a shallow pool. By spring, the pool typically reaches maximum depth (~0.5-2.5 m) following snowmelt and the onset of spring rains. By mid- to late summer, the pool usually dries up completely, although some surface water may persist in relatively deep basins, especially in years with above average precipitation. This periodic seasonal drying prevents fish populations from becoming established, an important biotic feature of Vernal Pools. Many species have evolved to use these temporary, fish-free wetlands. Some are obligate vernal pool species, so-called because they require a Vernal Pool to complete all or part of their life cycle. Vernal Pools occur throughout the state as scattered, isolated habitats. They are most numerous on the Lower Coastal Plain, especially on the mid to

upper Eastern Shore, and uncommon west of the Fall Line. They are typically situated in low areas or depressions in a forest, but they can also occur in floodplain forests as isolated floodwaters, among backwaters of old beaver impoundments, old sinkholes, or as perched spring- or seep-fed basins along mountain slope benches, or at the base of slopes. Vernal Pools may persist in cleared areas such as cropland, pastures, and clearcuts, but usually in a highly degraded ecological state. Because Vernal Pools occur throughout the state in a variety of forest types and settings, the vegetation in and around these habitats varies considerably. However, many Vernal Pools exhibit similar vegetative structure. For example, Pools tend to have a semi-open to closed forest canopy around them and the degree of canopy closure generally decreases with increasing pool size. The basin substrate consists of dense mats of submerged leaf litter and scattered, coarse woody debris. Herbaceous vegetation is usually absent to sparse in and around the basin, although small mossy patches frequently occur along the basin edge. A dense shrub layer may occur along the shoreline or in small patches within the basin, especially on the Coastal Plain, but many Pools also lack a well-developed shrub layer.

**County Distribution:** Statewide

**Places to Visit:** Seth Demonstration Forest

**State Rare Natural Community:** Vernal Pool



Mapped Locations of Vernal Pools in Maryland. Source: MD DNR.

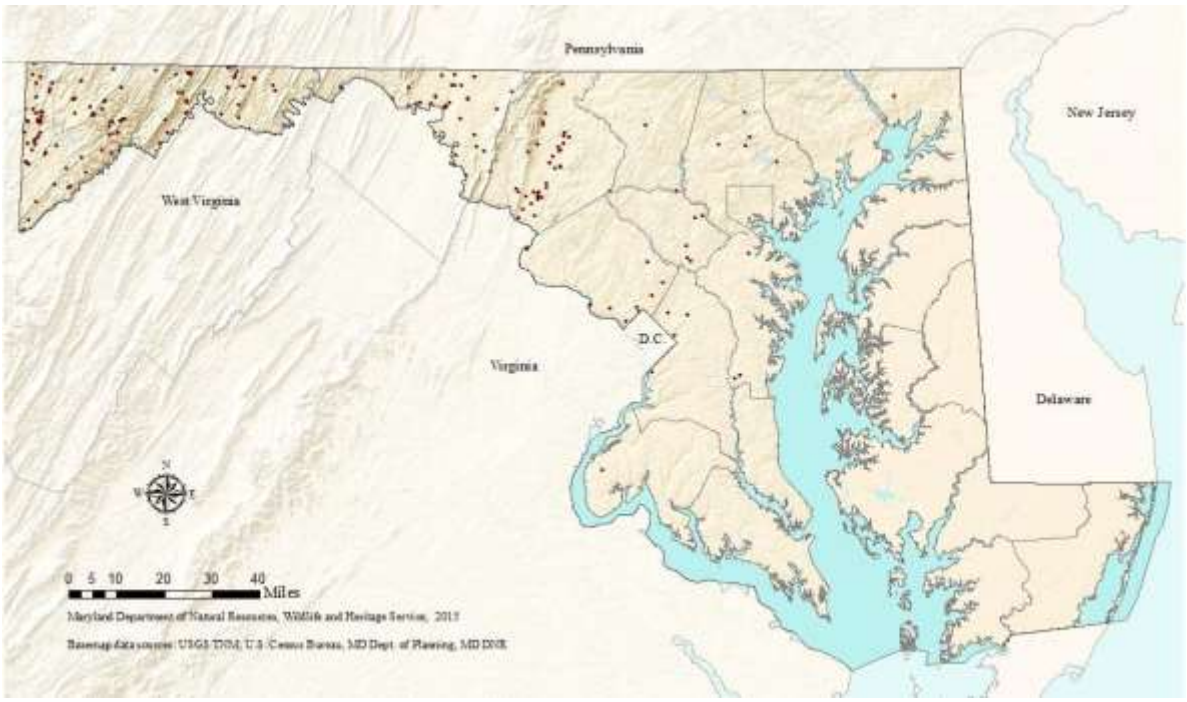
## Spring

MD DNR

The Spring key wildlife habitat is a concentrated discharge of groundwater at a small (usually < 1 $m^2$), distinct site or opening in the ground. Springs are uncommon, isolated features and most occur west of the Fall Line. They provide critical habitat for highly rare aquatic snails and subterranean invertebrates, salamanders, crayfish and other invertebrates. Because some Springs discharge directly into streams or wetlands, they also play a vital role in maintaining the ecological integrity of these habitats which, in turn, may harbor species of conservation concern (e.g., pearl dace, brook trout, rare dragonflies and damselflies). Springs emit groundwater due to hydrostatic pressure resulting from gravity or artesian flow, although other physical forces may play a role (e.g., buoyant effect of dissolved gases). Several types of Spring key wildlife habitats exist in Maryland including contact, scree, and fault Springs. Perhaps the most common type is fracture or crevice springs. Here, groundwater moves downward due to gravity, flowing through fractures and crevices underneath the ground and emerging as a spring where a major fracture in a rock formation occurs at the earth's surface, usually along a ravine or swale. The flow or discharge rates of Maryland's Springs range from less than one gallon per minute to nearly 10,000 gallons per minute. Springs differ from seeps in that the latter appear on the ground surface as broad, diffuse zones of wetness or percolation rather than distinct discharge sites. Also, seeps and associated wetlands often support distinct plant communities while springs are essentially aquatic and geological features.

**County Distribution:** Statewide

**Places to Visit:** Henryton Spring, Annapolis Rock Spring




**Mapped Locations of Springs in Maryland.** Sources: MD DNR, Geographic Names Information System (USGS).

## Coastal Plain Stream

MBSS, MD DNR

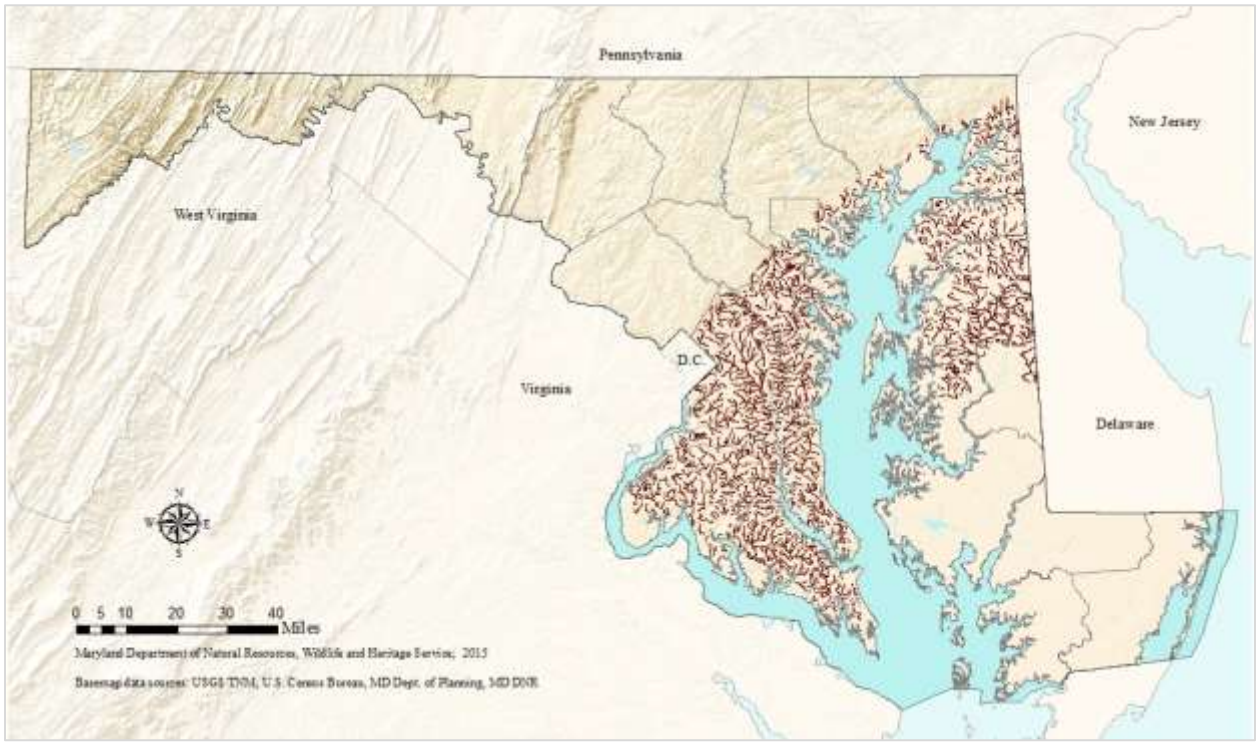
Maryland's Coastal Plain Streams extend from the Fall Line eastward toward the Atlantic Ocean. These streams are typically low in gradient (<1%) and found at elevations of less than 50 feet above sea level. They represent the lower non-tidal and upper fresh tidal (salinity < 0.5 ppt) sections of larger stream and river systems, and form transition zones between upper non-tidal reaches and increasingly larger, saline tidal sections. Silt, sand, gravel, and small cobble are the dominant substrates. Most Coastal Plain Streams contain only runs, glides and pools; however, gravel riffles are common in those streams draining the rolling hills on the western and upper eastern shore. Streams on the lower eastern shore are extremely sluggish with broad floodplains and braided channels. Since Coastal Plain Streams lack stable substrates such

as bedrock and boulders, wood and submerged aquatic vegetation are important channel features. Submerged logs and tree roots slow the flow of nutrients and sediment, provide cover for fishes and stream insects, and control stream bank erosion. Beaver activity along Coastal Plain Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Eastern mudminnow *(Umbra pygmaea)*, bluespotted sunfish *(Enneacanthus gloriosus)*, creek chubsucker *(Erimyzon oblongus)*, and least brook lamprey *(Lampetra aepyptera)* are common Coastal Plain Stream fishes. These streams are also important habitat for the American eel *(Anguilla rostrate)* from the juvenile to adult stage. Sandy and gravel substrates of Coastal Plain Streams support a diverse community of freshwater mussels (Unionidae), many of which are listed as In Need of Conservation, Threatened, or Endangered in Maryland. Many of these riverine fish and mussel species are favorite prey items of river otter and muskrat. The Chester, Choptank, Nanticoke/Wicomico, Pocomoke, Lower Potomac, Patapsco, Gunpowder, Elk, Lower Susquehanna, Bush, Potomac Washington Metro, West Chesapeake, and Patuxent River basins all contain Coastal Plain Streams, comprising approximately 2,500 stream miles.

Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), the average condition of Coastal Plain Streams in Maryland is fair, meaning that many of these streams are at least partially degraded. Approximately 38% of Coastal Plain Streams are considered severely degraded. Thirty-four percent of Coastal Plain Streams are considered to be minimally impaired and 6% of the 2,500 miles of Coastal Plain Streams are designated as “high quality waters” by Maryland’s Anti-degradation regulation (COMAR 26.08.02.04-1).

**County Distribution:** Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Harford, Howard, Kent, Prince George’s, Queen Anne’s, St. Mary’s, Talbot

**Places to Visit:** Tuckahoe State Park, Millington Wildlife Management Area, Myrtle Grove Wildlife Management Area




**Mapped Locations of Coastal Plain Streams in Maryland.** Sources: Versar, Inc., USGS, MD DNR.

## Blackwater Stream

Blackwater Streams are sluggish, low gradient (<1%) systems located within the Pocomoke and Nanticoke/Wicomico basins and a few other scattered areas of Maryland's Coastal Plain physiographic province. They are characterized by low acidity, generally with pH levels less than 6, and dissolved organic carbon greater than 8 mg/L. In contrast to other streams, dissolved oxygen levels are low (< 5mg/L) due to increased bacterial respiration from the decomposition of organic matter. Substrate consists primarily of silt, sand, and organic matter, with minor and isolated amounts of small gravel. Because of the lack of larger, more stable substrate, instream wood is of critical importance in defining hydrologic features and providing cover for the aquatic biota. Biodiversity in Blackwater Streams is typically low, and limited to only those organisms

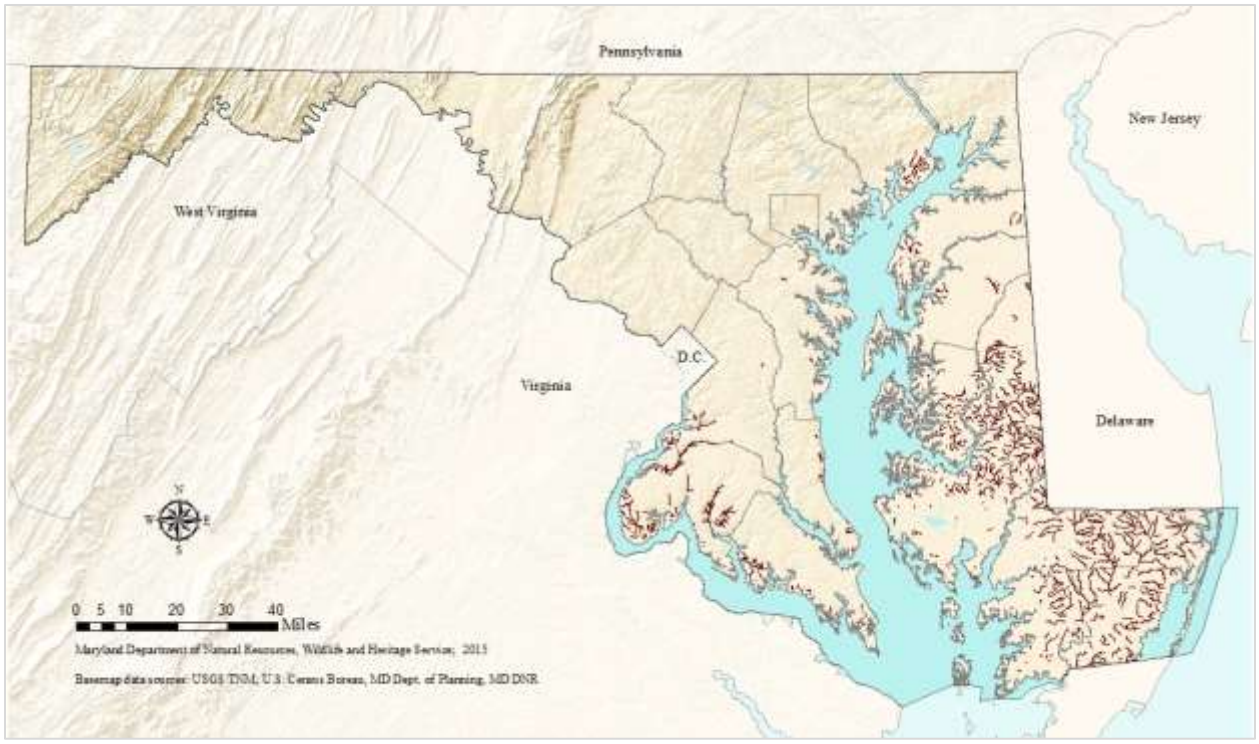
that are tolerant of the naturally acidic conditions. Beaver activity along Blackwater Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Common fishes include eastern mudminnow *(Umbra pygmaea)*, pirate perch *(Aphredoderus sayanus)*, golden shiner *(Notemigonus crysoleucas)*, creek chubsucker *(Erimyzon oblongus)*, tadpole madtom *(Noturus gyrinus)*, and redfin pickerel *(Esox americanus)*. The benthic macroinvertebrate community is dominated by dragonfly, amphipod, and isopod taxa. There are approximately 1,275 miles of Blackwater Streams in Maryland.

Jay Kilian, MD DNR

Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), 30 percent of Blackwater Streams remain in good biological condition. Approximately, 64 miles of Blackwater Streams are considered "high quality waters" as designated by Maryland's Anti-degradation regulation (COMAR 26.08.02.04-1). However, approximately half of all Blackwater Streams in Maryland are considered degraded, largely due to intensive agricultural practices, removal of forests, stream channelization, and other stressors.

**County Distribution:** Anne Arundel, Calvert, Caroline, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

**Places to Visit:** Pocomoke State Park, Zekiah Swamp Natural Environmental Area




**Mapped Locations of Blackwater Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.**

## Coastal Plain River

Jason Harrison, MD DNR

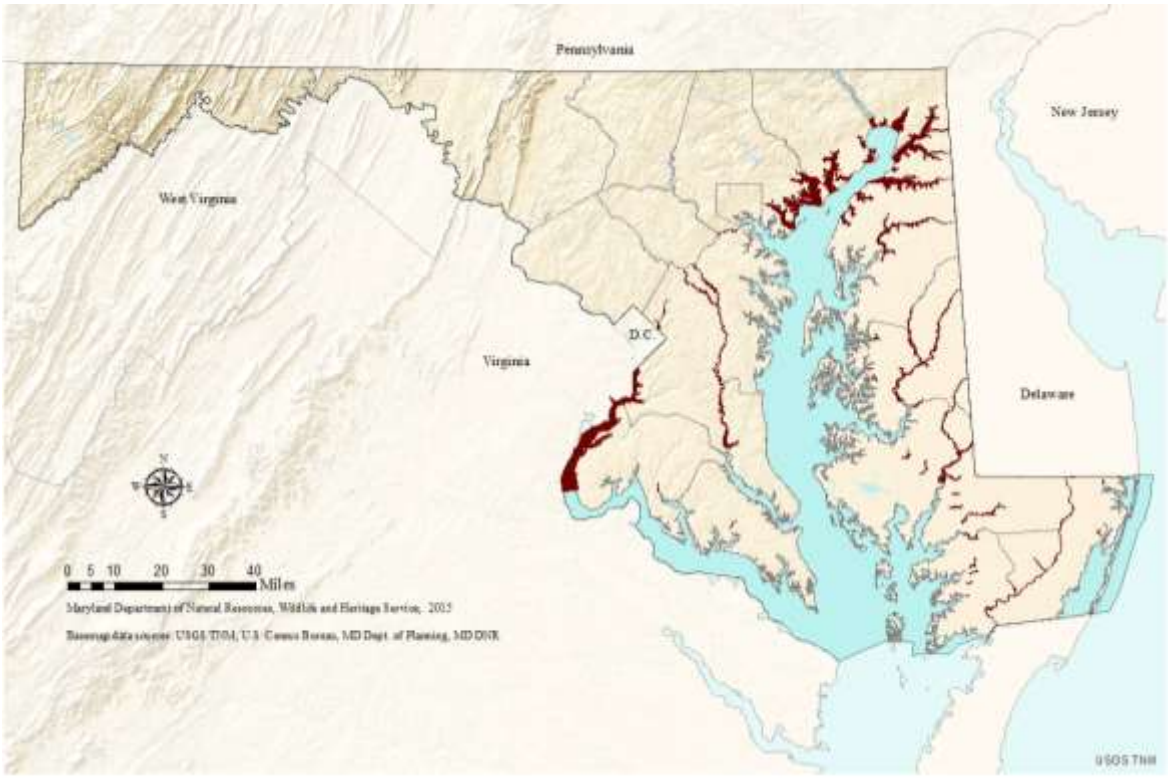
Coastal Plain Rivers are low gradient, slow flowing rivers (typically 5th order and larger) in the Lower and Upper Coastal Plain physiographic provinces. They represent the lower non-tidal and upper fresh tidal (salinity < 0.5 ppt) sections of larger river systems, and form transition zones between upper non-tidal river reaches and increasingly larger, saline tidal sections that eventually flow into and form part of the Chesapeake Bay proper. Coastal Plain Rivers consist of predominantly pool/glide habitat with sand and silt substrates. Large woody debris is an important element in structuring pool habitat and serves as an important source of coarse organic matter to riverine food webs. Open tree canopies allow for the growth of periphyton, phytoplankton, and aquatic macrophytes. These primary producers also form the base of energy flow within these systems.

Connectivity between river channels and the adjacent floodplain is important for the movement and exchange of organic matter in Coastal Plain River systems. Floodplains provide refugia for aquatic species during periods of high flows and for prey species from main channel fish predators. Extensive pool habitat common in Coastal Plain Rivers is home to many large predator fish species typically uncommon in headwater Coastal Plain Streams. Fish species common to Coastal Plain Rivers include American eel *(Anguilla rostrate)*, pumpkinseed *(Lepomis gibbosus)*, redbreast sunfish *(Lepomis auritus)*, bluegill *(Lepomis macrochirus)*, shorthead redhorse *(Moxostoma macrolepidotum)*, quillback *(Carpiodes cyprinus)*, longnose gar *(Lepisosteus osseus)*, and warmouth *(Lepomis gulosus)*. Popular game fishes in these rivers include largemouth bass *(Micropterus salmoides)*, chain pickerel *(Esox niger)*, and black crappie *(Pomoxis nigromaculatus)*. Coastal Plain Rivers also provide spawning habitat to many migratory fish species of Chesapeake Bay such as blueback herring *(Alosa aestivalis)*, alewife *(Alosa pseudoharengus)*, white perch *(Morone americana)*, yellow perch *(Perca flavescens)*, American shad, and hickory shad. Sandy and gravel substrates of Coastal Plain Rivers support a diverse community of freshwater mussels (Unionidae), many of which are listed as In Need of Conservation, Threatened, or Endangered in Maryland. Many of these riverine fish and mussel species are favorite prey items of river otter and muskrat. Coastal Plain Rivers also serve as wintering habitats for migratory waterfowl. Coastal Plain River habitats can be found in portions of the Chester, Choptank, Nanticoke, Lower Potomac, Patapsco, Patuxent, Pocomoke, Potomac Washington Metro, and Wicomico river basins. Coastal Plain River habitat comprises approximately 115 stream miles within these basins.

Degradation and loss of species associated with Coastal Plain and Blackwater Stream tributaries have ultimately affected the downstream conditions of Maryland's Coastal Plain River habitats. Maryland Coastal Plain Rivers are located in predominately agriculturally-focused watersheds. Nutrient enrichment and sedimentation associated with agricultural land use practices have reduced habitat quality and quantity available to many fish and mussel SGCN. Stream blockages have also reduced upstream access to spawning habitats for migratory fishes.

**County Distribution:** Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

**Places to Visit:** Tuckahoe State Park, Idylwild Wildlife Management Area, Pocomoke State Park




**Mapped Locations of Coastal Plain Rivers in Maryland. Sources: Versar, Inc., USGS, MD DNR.**

# Appendix 2

## Resources for Site Background Information and Assessment Area Determination

*Current aerial imagery and additional layers:*

Maryland Watershed Resources Registry:
https://watershedresourcesregistry.org/states/maryland.html

*Relevant content*: riparian, wetland, and upland preservation and restoration site scores; LiDAR Hillshade; stormwater infrastructure scores; permit and site visit information; water quality; fish passage connectivity; coastal resiliency, historical shoreline, and floodplain data; aquatic biota; geology and soils; Protected Lands, parcel boundaries/SDAT data, NWI and DNR Wetlands.

US EPA, "WATERSGeoViewer": https://www.epa.gov/waterdata/waters-geoviewer

*Relevant content*: base maps; watershed reports, water quality status/permitting; rivers and streams (National Hydrography Dataset, NHD), and wetland data (National Wetlands Inventory, NWI).

USGS StreamStats: (https://streamstats.usgs.gov/ss/)

*Relevant content:* delineated basin reports, impervious surface, limestone, forest cover, additional metrics.

USGS National Map Viewer: https://www.usgs.gov/tools/national-map-viewer

*Relevant content*: base maps (satellite, orthoimagery, topography), elevation contours, NHD including flow direction, National Land Cover Database (NLCD), protected areas (status, type, owner/manager), and wetland data (NWI). All of the data layers accessible here may be exported and viewed in ArcGIS or Google Earth.

Maryland Department of Natural Resources (MD DNR), "Merlin Online":
https://maryland.maps.arcgis.com/apps/webappviewer/index.html?id=434b195197364344a661da85c9bab3c9

*Relevant content*: base maps (satellite imagery, topography, street maps); parcel boundaries/SDAT data; watersheds, living resources, trail data, Protected Lands, Green Infrastructure, Soils, DNR Wetlands, and NWI wetland data (National Wetlands Inventory).

MD DNR, "The GreenPrint Map": https://geodata.md.gov/greenprint/

*Relevant content*: base maps (satellite imagery, topography, street maps); parcel boundaries/SDAT data; watersheds, living resources, trail data, Protected Lands, Green Infrastructure, BioNet, DNR Wetlands, Water Quality, and provides Conservation Benefits Assessment scores.

*Historical aerial photos:*

Google Earth for limited time periods: earth.google.com

https://www.sciencebase.gov/catalog/item/4f4e4a94e4b07f02db658dba

http://www.mgs.md.gov/publications/mgs_data_preservation/aerial_photos.html

*Wetland, hydrography, and soils:*

DNR Wetlands published by Maryland Department of Natural Resources (MDDNR) – downloadable here: https://data.imap.maryland.gov/datasets/maryland-wetlands-wetlands-polygon-department-of-natural-resources

NWI data published by US Fish & Wildlife Service (USFWS) - Interactive mapper, GIS & Google Earth data downloads: http://www.fws.gov/wetlands/

EPA WATERS data, Google Earth download - Includes NHDPlus surface water features, water quality feature: http://www.epa.gov/waterdata/viewing-waters-data-using-google-earth USGS National Hydrography Data: http://nhd.usgs.gov/data.html

USDA soils – Interactive mapper: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm GIS data: https://gdg.sc.egov.usda.gov/

NatureServe's Ecological System's map (http://www.natureserve.org/conservation-tools/terrestrial-ecological-systems-united-states )

Maryland's interactive wetlands mapper (https://www.fws.gov/wetlands/Data/Mapper.html)

# Appendix 3

# Field Data Sheet

# MARYLAND WETLAND ECOLOGICAL INTEGRITY ASSESSMENT: Coastal Plain Region

**Project/Site Name:**_____ **City/County:**_____ **Sampling Date:**_____
**Assessment Area Name (if >1 AA):** _____ **Observer(s):**_____
Delineation performed: ☐previously ☐ concurrently **Lat/Long:** _____ **AA size:** _____ **units** _____
**Site Description:** (general landscape setting, overview of riparian corridor, presence of braided/multithread system, topography, vegetation patterns, complexity and habitat richness; human and natural disturbance as indicated by spoil piles, beaver activity, dumping, vegetation removal, pest impacts, excessive flow; description of adjacent stream and sources/evidence of water input or alterations such as culverts, roads/trails, sediment). Representative site photographs of soil, nearest stream channel and banks, and vegetation are useful to show the features present.

## LANDSCAPE ASSESSMENT FOR PROJECT AREA (Section 3; office and field assessment)

**Field observations to assist with scoring of buffers, aquatic context, or size of AA:**

| **METRIC** | **SCORE** (use Section 3 tables to assign scores) |
|---|---|
| *Buffer Perimeter:* %Natural: ☐ >95% ☐ 85-95% ☐ 75-84% ☐ <75% | |
| *Buffer Condition:* %Natural: ☐ >90% ☐ 75-90% ☐ 50-74% ☐ <50% | |
| *Aquatic Context:* ☐ 4 or more aquatic resources ☐ 3 ☐ 2 ☐ 0-1 | |
| *Comparative Size:* ☐ Very large ☐ Large ☐ Medium to small ☐ Small to very small | |

Source(s) of size reduction, if any: ☐ Beaver dam or lodge ☐ Trail ☐ Road ☐ Railroad ☐ Development ☐ Agriculture ☐ Impoundment ☐ Human-constructed drainage (into or out of wetland) ☐ Excavation ☐ Fill ☐ Groundwater extraction ☐ Other _____

From StreamStats: Impervious Surface in project area basin: _____ Forest Cover in project area basin:_____
Additional channels in project area visible on LiDAR Hillshade image:

## WETLAND ASSESSMENT AREA ONLY:

### ENVIRONMENTAL INFORMATION (Section 4.2)

Slope (deg/%):_____ Aspect (if applicable): _____

Landscape Position: Indicate all features present

| | | | |
|---|---|---|---|
| ☐ Active floodplain (depression or terrace) | ☐ Beaver pond/Natural impoundment | ☐ Riparian-Depression (in floodplain) | ☐ Riparian terrace (outside seasonal flooding; historic floodplain or current terrace) |
| ☐ Headwater stream/spring | ☐ Seep/groundwater discharge site (toe slope) | ☐ Swale | ☐ Isolated Depression |
| ☐ Oxbow | ☐ Wetland charged by groundwater seeps (hill slope) | ☐ Streambank | ☐ Point bar |
| ☐ Flats | ☐ Braided Channels | ☐ Other- describe | |

Water Source: If more than one source is present, label as P (primary), S (Secondary), T (tertiary)

| | | | |
|---|---|---|---|
| ☐ Direct precipitation | ☐ Groundwater discharge | ☐ Natural surface flow | ☐ Urban run-off/culverts |
| ☐ Overbank flooding | ☐ High groundwater | ☐ Irrigation | ☐ Pipes/outfall (directly feeding wetland) |

Hydrological Regime: Circle the regime that best matches the conditions in the AA

| | | | | |
|---|---|---|---|---|
| H Permanently Flooded | G Intermittently Exposed | F Semipermanently Flooded | C Seasonally Flooded | E Seasonally Flooded-Saturated |
| B Seasonally Saturated | D Continuously Saturated | A Temporarily Flooded | I Intermittently Flooded | K Artificially Flooded |

**Observations/Comments:**

**CLASSIFICATION OF AA TO KEY WILDLIFE HABITAT AND HGM CLASS** (Section 4.3)
Key Wildlife Habitat: _____ HGM Class: _____
Optional: NVC Community Type/Plant Association: _____
Stream Key Wildlife Habitat Type: ☐Coastal Plain Stream ☐ Blackwater Stream ☐ Coastal Plain River

**SOIL/SUBSTRATE** (Section 4.4)
Note: if the floodplain does not naturally have hydric soils, and still does not have hydric soils under current conditions, only score Microtopography, Organic Matter Accumulation, and Soil Disturbance.

**Mapped Soil Type:**_____ **Depth to water table** _____ **Hydric soil?** ____ **Hydric Soil Indicators:** _____
**Depth of O horizon** _____ **Depth of A horizon** _____ **Extensive roots in soil?** _____ **Soil Matrix Hue Value/Chroma**_____
Note any deviations from the characteristics described for the mapped soil type for this AA and potential causes. Describe any impacts to the soil surface such as trampling/compaction from animals or machinery, ruts or other disturbances from ATV or other vehicular activity, or sedimentation.
**Observations/Comments (including for metrics below):**

**HYDROLOGY** (Section 4.5)

**Soil Biogeochemical Processing:**
**Soil Redox concentrations:** >10% surface area and ☐ start 0-6" from soil surface ☐ start >6-12" ☐ start >12-18"
<10% surface area and ☐ start 0-6" from soil surface ☐ start >6-12" ☐ None within 18" **Score:** _____
**Soil Organic Matter:** ☐ Horizon present (any thickness) ☐ Mineral surface layer(s) ≥ 4" thick with matrix value ≤3 and chroma ≤2
☐ Mineral surface layer <4" thick and ☐ Matrix value ≤3 and chroma ≤2 ☐ Matrix value >3 and ≤4 or chroma >2 and ≤3 **Score:**_____
**Microtopography:** ☐ ≥50% of Assessment Area ☐ 30-49% of AA ☐10-29% of AA ☐ <10% of AA **Score:** _____
**Organic Matter Accumulation**: Estimated ground cover of herbaceous/woody plants (living and dead residue): _____%
Estimated cover of leaf litter (loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers): _____%
% herbaceous/woody + % leaf litter: ☐ >75% ☐ >50-74% ☐>25-50% ☐ ≤25% **Score:**_____
**Soil Disturbance:** Presence of bare soil due to human activities: ☐ None/minimal ☐ Minor/small patches ☐ Moderate ☐ Substantial
Extent of impact of disturbance: ☐None ☐ Minimal ☐ Moderate ☐ Extensive
Depth of disturbance and ponding/channeling: ☐ None ☐ <2" ☐ 2-4", some ponding/channeling ☐ >4",ponding/channeling
**Score:**_____

***Water Source*–** Identify dominant water source and natural/unnatural influence for the AA by KWH type.
☐ **Natural**: ☐ Sheet flow present ☐ Natural narrow channel present ☐ Mimics natural hydrology ☐ Groundwater input ☐ Expected overbank flooding
☐ Expected plant community ☐ Other _____
☐ **Unnatural/Manipulated**: ☐ Impoundment ☐ Inflow from anthropogenic sources ☐ Fill ☐ Ditching ☐ Channelization ☐ Confined to small outlet ☐ Lost water sources due to alterations ☐ Multiple sources and some degraded ☐ Incised and no longer floods ☐Other_____
**Point Source Discharge** (into or adjacent to site): ☐ Lacking ☐ Minor ☐ Moderate ☐ Major
**Unnatural Obstructions** (to ground or surface water): ☐ None ☐ Minor (<25%) ☐ Moderate (25-75%) ☐ Major (>75%)
**Alteration to**: ☐Overland Flow ☐ Groundwater ☐ Overbank Flooding ☐ Plant Community ☐ Wetland Extent input
Timing: ☐ Recent (within 5 years) ☐ Historic ☐ Permanent hydrologic change
Negative effect: ☐ AA Flow and circulation ☐ Redirects or confines flows into/through AA ☐ Reduced water table ☐ Reduced inundation ☐ None
**Score:** _____

**Observations/Comments:**

***Stream Bank and Channel*** – Describe the stream channel in the project area, including evidence of alteration and signs of recovery/stablization.
**Evidence of bank/channel equilibrium**: ☐ Recovering to meander ☐ Low energy stream with bare banks ☐ Variety of pool depths ☐ Variety of stream velocities ☐ Visual flow of water from channel banks or wetlands (groundwater flow) ☐ Still pools with some flow and floodplain connection ☐ Embedded woody debris of size and amount consistent with what is available in riparian area ☐ Well-defined usual high water line with obvious floodplain ☐ Little or no active undercutting or burial of riparian vegetation ☐ Braided channels ☐ Other _____
**Evidence of channel instability/migration**: ☐ Riparian vegetation buried ☐ Recent sediment or gravel deposited ☐ Active incision/downcutting ☐ Braided channels have coalesced ☐ Buried hydric soil and/or gravel layer and depth _____ ☐ Other _____
**Overall channel instability**: ☐None/minimal ☐ Minor ☐ Moderate ☐ Substantial
**Sources of channel instability/migration**: ☐ Lacks vertical controls (vegetation, wood, rock, etc.) ☐ Excessive channel deposition/bar development ☐ Historic channel alteration ☐ Proximity and landscape position presents potential impact to AA hydrology ☐ Other _____
**Evidence of bank instability**: ☐ Banks undercut, slides, and/or slumps ☐ Riparian vegetation declining ☐ Shrub/trees falling into channel ☐ Bank uniformly scoured and unvegetated ☐ Other _____
**Overall bank instability**: ☐ None/minimal ☐ Minor ☐ Moderate ☐ Substantial
**Sources of bank instability**: ☐ Vertical banks ☐ Highly erodible materials ☐ Raw unvegetated banks ☐ Excessive bedload ☐ Other _____

If available: Bank Erosion Hazard Index _____ Near Bank Stress _____ **Score:** _____

**Aquatic Life:** (if available for site or use nearest, most recent Biological Stream Survey point in stream):
Benthic IBI- Value _____ Rating: ☐ Good (≥ 4) ☐ Fair (3-3.99) ☐ Poor <3 Fish IBI- Value _____ Rating: ☐ Good (≥ 4) ☐ Fair (3-3.99) ☐ Poor <3

**Observations/Comments:**

***Hydroperiod and Hydrologic Connectivity –*** Determine the natural variability and/or recent alteration of the duration, frequency, and magnitude of inundation/saturation in the AA by KWH type.

**Natural variation of hydroperiod**: ☐ Low ☐ High

Information Sources: ☐Visual indicators ☐ Monitoring Wells ☐ Hydrology/Hydraulic analysis ☐ Bank Height Ratio _____ Entrenchment Ratio _____

**Overbank flooding** (if available): ☐ 2-year storm ☐ 10-year ☐ 100-year

**Degree of connection to floodplain**: ☐ Complete **Disconnection/entrenchment**: ☐ Minimal ☐ Moderate ☐ Disconnected and/or severely entrenched

**Evidence of overbank flooding**: ☐ Recent ☐ Evidence of overbank flooding ☐ Some evidence, likely during large storm events ☐ Generally no longer occurs

**Change/Alteration of hydroperiod**: ☐None ☐ Due to natural events ☐ Due to human influences: ☐ Minor ☐ Moderate ☐ Substantial

☐ Backwater flooding or lateral movement affected by restrictions: List restrictions: _____

**Score**: _____

**Observations/Comments:**

## KEY WILDLIFE HABITAT (Section 4.6)

***Interspersion/Patch Richness –***interspersion of vegetation patches **and** number of different obvious types of physical surfaces or features that may provide habitat for aquatic, wetland, or riparian animal species.

**Interspersion of habitats/physical features** (see examples): ☐ High ☐ Moderate ☐Low or Minimal ☐ None or Few

**Features present**: ☐ Spring or upwelling groundwater ☐ Depression ☐ Vegetated pool ☐ Unvegetated pool ☐ Unvegetated flat ☐ Island ☐ Animal mound or burrow ☐ Beaver dam or lodge ☐ Beaver-chewed vegetation ☐ Oxbow, swale, secondary channel ☐ Wind-thrown tree hole ☐ Mound ☐ Bank overhang with tree roots ☐ Tip-up tree root mound ☐ Brush piles ☐ Abundant deciduous leaf litter ☐ Partially buried natural debris ☐ Debris jam ☐ Plant hummock/tussocks ☐Other wildlife habitat Wildlife species observed:_____ **Score:** _____

**Observations/Comments:**

***Vertical Structure –*** Refer to metrics for selected Key Wildlife Habitat Type for scoring.

**Forested systems: Canopy**: Heterogeneous patches of different ages or sizes: ☐ Yes ☐ Mostly ☐ Somewhat ☐ No

☐ Gaps of varying sizes ☐ Impacted by beaver activity ☐ Impacted by forest pests/pathogens

**Woody vertical layers**: ☐ Multiple layers present ☐ One layer missing or homogeneous ☐ >1 layer missing, little variation ☐ Only 1-2 layers present

**Large trees** (DBH > 60 cm or 24") present: ☐ ≥10% ☐ <10%

**Trees present** with DBH > 30 cm or 12": ☐ ≥ 20% ☐ < 20%

**Degradation** due to cutting, browsing, pests/pathogens: ☐ Minimal ☐ Moderate ☐ Extensive Source(s) of degradation: _____

**Bog and Fen systems**: **Woody layer mortality (if layer present)**: ☐ Due to natural factors ☐ Minor human-caused ☐ Moderate human-caused

☐ Extensive human- caused ☐ Impacted by forest pests/pathogens ☐ Impacted by browsing/grazing

**Expected structure**: ☐ Present ☐ Minor alteration ☐ Moderate Alteration ☐ Extensive Alteration **Score :**_____

**Observations/Comments:**

***Standing and Downed Coarse Woody Debris –*** Refer to metrics for selected Key Wildlife Habitat type for scoring.

**Forested systems: Standing snags and downed logs: Size diversity**: ☐ High ☐ Moderate ☐ Moderate-low ☐ Low

**Stage of downed log decay**: ☐ Variable including advanced stage ☐ Variable with few advanced ☐ Variable with no advanced ☐ Low variability

Source(s) of woody debris if not natural (cutting, pest/pathogens, etc.): _____

**Bog and Fen systems: Woody and/or litter**: ☐ Typical peat accumulation ☐ Human-caused alteration Minor ☐ Moderate ☐ Substantial ☐ Impacted by forest pests/pathogens

**Ground cover alterations**: ☐ None ☐ Minor ☐ Moderate ☐ Substantial **Score:** _____

**Observations/Comments:**

**VEGETATION** (Section 4.6) Additional species may be listed on a separate sheet. See Scoring Sheet for %cover examples.

**NOTE: Include native diagnostic, disturbance indicator, and state rare, threatened, and endangered species regardless of %cover.**

| Species: | Absolute % Cover | Species: | Absolute % Cover |
|---|---|---|---|
| **Tree Stratum: woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger DBH** | | | |
| 1. | | 5. | |
| 2. | | 6. | |
| 3. | | 7. | |
| 4. | | 8. | |
| **Sapling Stratum: woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH** | | | |
| 1. | | 4. | |
| 2. | | 5. | |
| 3. | | 6. | |
| **Shrub Stratum: woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height** | | | |
| 1. | | 6. | |
| 2. | | 7. | |
| 3. | | 8. | |
| 4. | | 9. | |
| 5. | | 10. | |
| **Herb Stratum: all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height** | | | |
| 1. | | 7. | |
| 2. | | 8. | |
| 3. | | 9. | |
| 4. | | 10 | |
| 5. | | 11. | |
| 6. | | 12. | |
| **Woody Vine Stratum: all woody vines, regardless of height** | | | |
| 1. | | 4. | |
| 2. | | 5. | |
| 3. | | 6. | |

**KWH VEGETATION COMPOSITION** (Use tables in Section 4.6 to assign scores).

***Invasive Species:***

**Maximum invasive species cover in any one woody layer (if present)**: ☐ <1% ☐ 1- 5% ☐ >5-10% ☐ >10%

**Absolute cover of invasive/disturbance species in herbaceous layer**: ☐ <1% ☐ 1-5% ☐ >5-30% ☐ >30% **Score:**_____

**Observations/Comments:**

***Native Species:*** *Refer to metrics for selected Key Wildlife Habitat Type for scoring.*

**Woody layer (if present):** ☐ Dominated by diagnostic native species ☐ Some diagnostic species absent/reduced ☐ Few diagnostic species ☐ Few/no diagnostic species present

**Herbaceous layer**: ☐ Dominated by diagnostic native species ☐ Some diagnostic species absent/reduced ☐ Few diagnostic species ☐ Few/no diagnostic species present

**Cover of native species indicative of disturbance**: ☐ 0-1% ☐ 2-10% ☐>10-30% ☐ >30%

**Bog and Fen/Springs: Sphagnum cover** - ☐ Continuous/abundant ☐ Absent from small areas ☐ Reduced ☐ Very low **Score:** _____

**Observations/Comments:**

***Alterations/Stressors:*** *Indicate stressors and alterations affecting the observed vegetation composition of the AA.*

☐ Recent timber harvest (clearcut or selective cut) ☐ Tree plantation ☐ Mowing or shrub cutting ☐ Herbicide use ☐ Trampling/ORV ☐ Excessive animal herbivory ☐ Pest damage ☐ Unnatural fire regime ☐ Trash/dumping

☐ Other_____

**Suggestions for improving native species cover and natural vegetation composition**_____

_____

**Observations/Comments:**

***Floristic Quality Assessment:*** *(see Excel data sheet or manual for calculation):*

**Native mean C-value** _____ : ☐>4 ☐ 3-4 ☐ <3-2 ☐ <2

**Adjusted FQI** _____

**Score:** _____

## MARYLAND WETLAND ECOLOGICAL INTEGRITY ASSESSMENT: Coastal Plain Region SCORING FORM

**Project/Site Name:**_____ **City/County:**_____ **Sampling Date:**_____

**Assessment Area Name (if >1 AA):** _____ **Observer(s):**_____

***Scoring Scale: 3.5- 4 = Excellent 2.5-3.49 = Good 1.5-2.49 = Fair 1-1.49 = Poor***

| Core Factor | Metric | Metric Score | Mean Core Factor Score | Weighting Factor | Overall Core Factor Score (Mean Core Factor Score X Weighting Factor) |
|---|---|---|---|---|---|
| Landscape (Assessment for project area) | Buffer Perimeter | | (Sum of metric scores: _____) / 4 = _____ | 0.3 | |
| | Buffer Condition | | | | |
| | Aquatic Context | | | | |
| | Comparative Size | | | | |
| Soil/Substrate* * If only Microtopography, Organic Matter Accumulation, and Soil Disturbance were scored, divide by 3 rather than 5 | Redox Concentrations | | (Sum of metric scores: _____) / 5 or /3* = _____ | 0.1 | |
| | Microtopography | | | | |
| | Soil Organic Matter | | | | |
| | Organic Matter Accumulation | | | | |
| | Soil Disturbance | | | | |
| Hydrology | Water source | | (Sum of metric scores: _____) / 3 = _____ | 0.2 | |
| | Channel | | | | |
| | Hydroperiod and Hydrologic Connectivity | | | | |
| Key Wildlife Habitat and Vegetation Composition | Interspersion/Patch Richness | | (Sum of metric scores: _____) / 6 = _____ | 0.4 | |
| | Vertical Structure | | | | |
| | Coarse Woody Debris | | | | |
| | Invasive Species | | | | |
| | Native Species Composition | | | | |
| | Floristic Quality Assessment | | | | |
| **Sum of Overall Core Factor Scores = <u>Overall KWH Ecological Integrity Assessment (EIA) Score:</u>** | | | | | |

<u>From WRR layers (see Manual Section 3.5): Mark all categories present in WRR layers. Assign the single highest score for a maximum of +0.2 for WRR layers:</u>

☐ Nontidal Wetlands of Special State Concern (+ 0.2)

☐ Biodiversity Conservation Network Tier 1, 2, or 3 (+ 0.2)

☐ Forest Interior Dwelling Species (FIDS) area: Class 1 (+ 0.1)

☐ Targeted Ecological Area (+ 0.1)

☐ Sensitive Species Project Review Area (+ 0.1)

<u>From MDE Tier II High Quality Waters (Section 3.5):</u>

☐ Upstream of, within, or adjacent to Tier II High Quality stream segment (+ 0.2)

<u>From StreamStats (see Manual Section 3.5):</u>

☐ Impervious surface area for project area basin is low (< 5%) (+ 0.2)

☐ Forest cover in project area basin is >90% (+ 0.2)

<u>From field observations (see Manual Section 5.1):</u>

☐ Maryland nontidal wetland(s) with significant plant or wildlife value (as defined by COMAR 26.23.01.01B80) but not designated as a Nontidal Wetland of Special State Concern (add + 0.2 for each wetland to the Overall EIA score)

☐ State rare, threatened, or endangered plants or state rare natural community noted during field data collection but not mapped in Biodiversity Conservation Network Tier 1, 2, or 3 (+ 0.2)

☐ Sensitive species (colonial waterbird nesting colony, native mussel bed, anadromous fish) (+ 0.1)

☐ Dominated by native trees greater than 30cm or 12" diameter at breast height (+ 0.1)

☐ Dominated by hard mast (i.e., acorns and nuts) producing native species in the tree stratum (+ 0.1)

**FINAL Key Wildlife Habitat Ecological Integrity Assessment SCORE and RATING: _____**

Comments:

# Appendix 4

# Condensed Scoring Tables

# Rapid Ecological Integrity Assessments in Wetlands of Riparian Areas in Maryland: Coastal Plain Region

## Condensed Field Guidance, Procedures, and Scoring Tables (to be used with separate Data Sheet)

**Project/Site Name: _____ Sampling Date: _____**

## GENERAL GUIDANCE

-This Ecological Integrity Assessment uses information collected in the field and from online sources/imagery. **Additional background and information can be found in the referenced sections of the "Field Manual for Rapid Ecological Integrity Assessments of Wetlands in Riparian Areas in Maryland: Coastal Plain" (Manual).**
-Refer to Section 2 in the Manual for field visit preparation and how to identify the wetland assessment area (AA) or areas on the project site. Each AA should be evaluated and scored separately.
-You will need to use online resources to prepare for the site visit, complete some of the data sheet, and to complete the Landscape Assessment. An Excel file can provide some autofill features when used with the wetland delineation Excel file (see Manual).

## PROCESS

-**Review the metrics and example photos in the Manual. In the field, use the data sheet (Excel or pdf) and this document simultaneously to score and evaluate features.** For each metric, review the guidance in this document and carry out the procedures indicated to collect data. Record your data on the data sheet, using the check boxes to indicate features present and filling in other required information where needed. Use the data that you recorded on the data sheet and the scoring tables in this document to determine a score for each metric. The scores can be entered on this document, but they need also to be recorded on the data sheet or in the Excel file. Enter all scores on the Scoring Form and follow the Manual instructions to calculate the Final Score.
-Scoring can vary due to the conditions expected for different Key Wildlife Habitats (Section 4.3). **Be sure to use the sections of the tables that correspond to the Key Wildlife Habitat being evaluated**.
-**NOTE:** All of the characteristics described for a given score category may not be present. **Assign the score to the category with the majority of features present.**

## LANDSCAPE ASSESSMENT (Section 3)

Watershed features can impact habitat quality for the organisms in the project area. Natural habitats provide the greatest benefit for wetland buffers, which play a critical role in the condition of the wetland relative to key abiotic and biotic factors. One Landscape Assessment is done for the entire project area and will apply to each AA in the project area. **Most of the landscape-level assessments will be done in the office** using mapped features and aerial imagery as described in the Manual. However, additional features noted in the field that are not visible on available imagery may affect the assessment. **In the field, as you are traveling to and assessing the AA, make note of the features described below to supplement the in-office assessment. Record these observations on the data sheet.** If access to the buffer area is limited, scoring will need to rely more on aerial imagery as described in the Manual.

| Landscape Features | Assess out to this distance from the outer edges of the proposed stream restoration project area (all AA are included in project area): | Note these features on the data sheet for use with information from aerial imagery: |
|---|---|---|
| Buffer Perimeter | 10m (33 feet) | Natural and altered habitats (see table below) |
| Buffer Condition | 100m (330 feet) | Natural and altered habitats (see table below) |
| Aquatic Context | 300m (1000 feet) | Small-scale wetlands, such as Springs or Vernal Pools, or streams that may not be evident from aerial imagery or are newly formed |
| Comparative Size | n/a- assessment occurs for each AA in the project area | Deviations from aerial imagery that could affect wetland size estimation; source(s) of size reduction of the AA such as roads, impoundment, development, etc. |

| Examples of Land Covers Included in Natural Buffers | Examples of Land Covers Excluded from Natural Buffers (Altered Habitats) |
|---|---|
| Natural plant communities; naturally vegetated rights-of-way; natural swales and ditches; natural open water features including rivers, streams, and ponds created by beaver activity; wetlands | Parking lots; commercial and private developments and structures; roads (all types); intensive agriculture; intensive plantations; orchards; vineyards; railroads; planted pastures; planted hayfields; animal pastures; lawns; sports fields; traditional golf courses; fallow farm fields; ditches; stormwater ponds; ponds formed by unnatural blockages; culverts |

## SITE DESCRIPTION AND ENVIRONMENTAL INFORMATION (Sections 4.1 and 4.2)

**Provide a detailed description of the assessment area on the data sheet**, including landscape setting, vegetation type, evidence of human or natural disturbance, and characteristics of the stream and other nearby features. **Note Landscape Position, Water Source, and Hydrological Regime** for the AA. If there is more than one water source, rank as P (primary), S (secondary), and T (tertiary). The Hydrological Regime usually matches the mapped wetland designation (see Manual for definitions).

## ASSIGNMENT OF AA TO KEY WILDLIFE HABITAT (Section 4.3) and Vegetation Indicators

**Use the key below to determine the Key Wildlife Habitat (KWH) for the AA**. Also indicate the stream type and, if possible, the community type/plant association. See the Manual for photos and complete descriptions. Lists of typical species in each stratum by KWH and indicator species by KWH are listed on the next page. These species lists may assist with KWH selection and will be used in the KWH and Vegetation Composition metrics in Section 4.6.

**1a.** Wetlands bordering streams and rivers with overland, non-tidal flooding regimes (i.e., floodplains). Distinct alluvial landforms (e.g., backswamps, levees, terraces) and indicators present (e.g., scour marks, recent sediment deposition, vegetation damaged/bent in one direction, soils with alternating deposits, channel banks with flood marks). Likely to be 3rd order and higher but may be braided systems. Structurally and compositionally diverse vegetation present ranging from closed mixed forests to floodplain pools to open, beaver-created pools with floating aquatics……**COASTAL PLAIN FLOODPLAIN** HGM Class: Riverine

**1b.** Wetlands primarily controlled via groundwater discharge often associated with depressional and slope geomorphic features as well as the margins of small stream (1st and 2nd order) floodplain wetlands.

**2a.** Wetlands associated with toe slopes and floodplains of small streams of the Coastal Plain where groundwater discharge is a major contributing input source (mixed hydrological regime: occurs in very narrow part of the groundwater driven complex that is influenced by overbank flooding) with alluvial landform a minor part of the complex; smaller order stream floodplain margins where groundwater input also contributes to overall hydrology. These areas are generally small features along streams and are usually not as well-developed as seepage swamps in larger stream systems……**COASTAL PLAIN FLOODPLAIN** HGM Class: Riverine or Slope

**2b.** Wetlands associated with distinct depressional and slope geomorphic features.

3a. Basin wetlands, depressions, or very flat areas with evidence of ponded water, unidirectional flow not evident, lacks natural outlet, maintained by high water tables and seasonal precipitation. Hydrologic regimes range from saturated to seasonally flooded.

4. Seasonally flooded to saturated forested flats and depressions of broad coastal plain terraces (i.e., "wet flatwoods") with fluctuating water levels and intermittently ponded depressions. Soils are silt, sand, and clay loams, sometimes with a thin (< 30 cm [12 in]) mantle of coarse, fibric peat.

5a. Located on flat terraces and shallow depressions with seasonally perched water tables and braided channels…**COASTAL PLAIN FLATWOOD AND DEPRESSION SWAMP** Flatwood: HGM Class- Flat; Depression Swamp: HGM Class- Depression

**5b.** Small (<0.1 ha- 2 ha) shallow pools with a well-defined, discrete basin overlying a clay hardpan or other impermeable soil or rock layer impeding drainage, may or may not have vegetation in basin……**VERNAL POOL** HGM Class: Depression

**3b.** Slope wetlands associated with groundwater discharge zones (i.e., seeps, springs) and perennial, unidirectional flow towards a natural outlet such as a stream.

**6a.** Small (usually <1m$^2$), localized area of groundwater discharge, point source, rare in Coastal Plain…..**SPRING** HGM Class: Slope

**6b.** Larger wetland systems with diffuse drainage patterns, widespread.

**7a.** Open wetlands characterized by predominately shrub and herbaceous vegetation and localized groundwater discharge zones. (*note. Lack of natural disturbances [e.g., fire, beaver activity, grazing] in these habitats often promote woody plant succession.)* Saturated "bog-like" wetlands along gently sloping headwater streams, seepage toe-slopes, and oligotrophic spring-heads with considerable accumulation of peat mosses (*Sphagnum spp*.) at varying depths, soils acidic and infertile (*note. The term "bog" applied here is a technical misnomer since none of these wetland systems in Maryland are ombrotrophic.)*…….**COASTAL PLAIN SEEPAGE BOG AND FEN** HGM Class: Organic Soil Flat; Slope

**7b.** Saturated forests of sloping stream headwaters, large spring seeps, lateral seeps in ravines and stream bottoms with diffuse drainage patterns. Braided stream channels, muck-filled depressions, and hummock-and-hollow microtopographic features evident…….**COASTAL PLAIN SEEPAGE SWAMP** HGM Class: Slope or Riverine

**Species by vegetation stratum that represent those with high constancy values (>75%) for the more common finer community types (i.e., association level) of Key Wildlife Habitats. Indicator species are those with a high diagnostic value to type, high fidelity, and high relative cover.**

| Key Wildlife Habitat | Trees | Shrubs | Herbs | Vines | Indicator |
|---|---|---|---|---|---|
| **Coastal Plain Floodplain** | *Platanus occidentalis, Liquidambar styraciflua, Liriodendron tulipifera, Quercus michauxii, Fraxinus pennsylvanica, Betula nigra, Acer rubrum*<br><br>*Additional for Blackwater Streams: Taxodium distichum, Nyssa sylvatica, Chamaecyparis thyoides (rare)* | *Lindera benzoin, Asimina triloba, Ilex opaca, Ilex verticillata, Carpinus caroliniana* | *Arauptela (Thelypteris) noveboracensis, Mitchella repens, Arisaema triphyllum, Boehmeria cylindrica, Saururus cernuus, Cinna arundinacea, Galium circaezans, Medeola virginiana, Thalictrum thalictroides, Impatiens capensis, Glyceria striata* | *Toxicodendron radicans, Parthenocissus quinquefolia, Campsis radicans* | *Platanus occidentalis, Betula nigra, Arauptela (Thelypteris) noveboracensis, Saururus cernuus, Cinna arundinacea*<br><br>*Additional for Blackwater Streams: Taxodium distichum, Nyssa sylvatica, Chamaecyparis thyoides (rare)* |
| **Coastal Plain Flatwood and Depression Swamp** | *Quercus phellos, Quercus palustris, Quercus michauxii, Quercus pagoda, Liquidambar styraciflua* | *Eubotrys racemosa, Vaccinium corymbosum, Clethra alnifolia* | *Woodwardia areolata, Osmunda cinnamomea, Mitchella repens, Osmunda regalis, Chasmanthium laxum* | *Smilax rotundifolia* | *Quercus pagoda, Quercus michauxii, Vaccinium corymbosum* |
| **Coastal Plain Seepage Bog and Fen** | *Nyssa sylvatica, Acer rubrum, Pinus rigida* | *Rhododendron viscosum, Toxicodendron vernix, Rubus hispidus, Ilex glabra, Clethra alnifolia* | *Carex atlantica, Andropogon glomeratus, Rhynchospora gracilenta, Eupatorium pilosum, Dichanthelium dichotomum var. dichotomum* | *Smilax pseudochina* | *Smilax pseudochina, Pinus rigida, Andropogon glomeratus, Rhynchospora gracilenta* |
| **Coastal Plain Seepage Swamp** | *Nyssa sylvatica, Acer rubrum, Magnolia virginiana* | *Clethra alnifolia, Viburnum nudum, Rhododendron viscosum* | *Woodwardia areolata, Osmunda cinnamomea, Osmunda regalis, Carex folliculata, Symplocarpus foetidus* | *Smilax rotundifolia* | *Magnolia virginiana, Clethra alnifolia, Viburnum nudum, Symplocarpus foetidus* |
| **Vernal Pools and Springs** have limited to sparse herbaceous and/or shrub vegetation in the wetland basin. Some Springs have *Sphagnum* species. The surrounding vegetation will represent one of the KWH listed here. Vernal Pools and Springs are most likely to be embedded in Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, or Coastal Plain Seepage Swamp. | | | | | |

## SOIL/SUBSTRATE (Section 4.4)

Healthy soil function supports plant life and biogeochemical processing for nutrient storage and transformation. Surface features such as changes in elevation over a small area (microtopography) can add to the complexity of the habitat and increase biodiversity, and organic matter accumulation and nutrient dynamics are influenced by leaf litter and ground cover. Disturbance of the surface layer increases the potential for erosion or sedimentation. Prior to fieldwork, mapped soil characteristics for the site should be reviewed. Note any deviations from these characteristics on the data sheet as well as indications of soil compaction and disturbances. Depth to water table and/or extensive roots in the soil should be noted on the data sheet. Examine a soil sample to determine all of the standard measures on the data sheet unless the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions. In that case, only score Microtopography, Organic Matter Accumulation, and Soil Disturbance. Note the presence of a gravelly substrate in the Observations/Comments section on the data sheet.

**Redox Concentrations** -Do not score if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions (e.g., relict conditions). Consider depth to groundwater and if other water sources are altered or still sufficient to contribute to reducing conditions. **Extract a sample that is 18" deep from a representative area of the AA** where the soil has not obviously been disturbed. You may need to break open the soil sample to effectively see the rusty red redox concentrations. See Manual for guidance related to scoring soils with red parent material or other problematic soils.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Biogeochemical cycling excellent, with redox concentrations starting 0 to 6" from the soil surface and covering >10% of the surface area. |
| Good = 3 | Biogeochemical cycling good, with redox concentrations starting >6" to 12" from the soil surface and covering >10% of the surface area OR redox concentrations start 0-6" from the soil surface and represent <10% of the surface area. |
| Fair = 2 | Biogeochemical cycling fair, with redox concentrations starting >12" to 18" from the soil surface and covering >10% of the surface area OR redox concentrations start >6" to 12" from the soil surface and represent <10% of the surface area. |
| Poor = 1 | Biogeochemical cycling poor, with redox concentrations starting >12" to 18" from the soil surface and covering <10% of the surface area OR no redox concentrations within 18" of the soil surface. |

**Soil Organic Matter**- Do not score if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions. Consider depth to groundwater and if other water sources are altered or still sufficient to contribute to reducing conditions. **Examine the extracted soil sample** for an organic surface horizon or determine features of the mineral surface layer(s).

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Organic surface horizon present (any thickness). |
| Good = 3 | Mineral surface layer(s) are ≥4" thick with matrix value ≤3 and chroma ≤2. |
| Fair = 2 | Mineral surface layer(s) are <4" thick with matrix value ≤3 and chroma ≤2. |
| Poor = 1 | Mineral surface layer(s) are <4" thick with matrix value >3 and ≤4 or chroma >2 and ≤3. |

**Microtopography- Estimate the percent** of the AA with an elevation change of at least 3" due to soil elevations and woody debris in an advanced stage of decomposition. Microtopography is often present as vegetated hummocks, raised areas that support tree trunks and roots, or nursery logs.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | More than 50% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |
| Good = 3 | 30-49% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |
| Fair = 2 | 10-29% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |
| Poor = 1 | <10% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |

**Organic Matter Accumulation- Organic Matter Accumulation-** Indicators will vary with season and KWH. **Estimate the percent cover** of herbaceous and woody plants, both living and dead residue. **Estimate how much of the AA is covered by >1" of loose leaf litter OR by at least 5 stacked layers of decaying or wetted leaves.** When leaf litter depth is naturally lower, pick apart decaying or wetted leaves to determine if there are 5 or more stacked layers and estimate percent coverage.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Organic matter accumulation from root turnover/leaf litter is high as herbaceous and woody plant ground cover plus leaf litter covers >75% of the surface. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Good = 3 | Organic matter accumulation from root turnover/leaf litter is moderate as herbaceous and woody ground cover plus leaf litter covers >50-74% of the surface. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Fair = 2 | Organic matter accumulation from root turnover/leaf litter is low as herbaceous and woody ground cover plus leaf litter covers >25-50%. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Poor = 1 | Organic matter accumulation from root turnover/leaf litter is minimal as herbaceous or woody ground cover plus leaf litter covers ≤25%. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |

**Soil Disturbance**- Note impacts to the soil surface as indicated by bare soil, unless caused by natural factors or the soil is naturally bare. Look at the extent of impact across the AA and the greatest depth of the impact (including ponding or channeling of water).

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Little bare soil OR bare soil and soil disturbed areas are limited to naturally caused disturbances such as flood deposition, game trails, beaver activity, etc. OR soil is naturally bare. No human-caused impacts evident. |
| Good = 3 | Minor amounts or localized, small patches of bare or disturbed soil are present from factors such as cattle trampling or heavy grazing that leads to erosion, compaction or trampling by machinery, ruts or other disturbances from ATV or other vehicular activity, sedimentation due to |

| | |
|---|---|
| | human causes, or invasive earthworms. Extent of impact is minimal and greatest depth is limited to a few centimeters (a few inches) and does not show evidence of ponding or channeling of water. |
| Fair = 2 | Moderate amounts of bare or disturbed soil are present due to human-caused activities. Extent of impact is moderate and greatest depth may extend 5–10 cm (2–4 inches), with localized deeper ruts. Shows some evidence of ponding or channeling of water. |
| Poor = 1 | Substantial amounts of bare or disturbed soil are present due to human-caused activities. Impact is extensive with long-lasting impacts. Greatest depth of impact extends > 10 cm (4 inches); deeper ruts may be widespread and show some evidence of extensively altering hydrology (e.g., ponding or channeling of water). |

## HYDROLOGY (Section 4.5)

Hydrology is a complicated ecological factor to measure during a rapid assessment, as the evaluation of one metric partly relates to another. In this section, two aspects of the hydrology of the AA are scored by indicating the presence of natural and altered features of the Water Source and Hydroperiod and Hydrologic Connectivity. The scoring for these metrics varies depending on the type of KWH, so make sure you are using the correct scoring table. The Stream Bank and Channel metric, in contrast, is assessed for the entire project area using indicators of alteration as well as stabilization and recovery. Data sheet check boxes will capture features for scoring mentioned in the following sections. Obstructions, alterations, and point source discharges may be visible on aerial photos or other available imagery. LiDAR Hillshade images may assist with identifying existing channels and other relevant features.

**Water Source (Section 4.5.1)** This metric focuses on the forms and places of direct inputs of water to the AA, as well as any unnatural diversions of water from the AA or other features that affect saturation of the wetland. **Focus on the main source of water for this evaluation and use the scoring table for the correct KWH.** Note evidence of natural and unnatural/manipulated characteristics using the check boxes on the data sheet. Consider whether alterations are recent and if they are currently having a negative effect. Beaver activity, although it may have caused changes, should be considered as a natural change for scoring.

**Coastal Plain Floodplain:** Groundwater discharge not a major input. For scoring, note stream bank alterations that will affect the riparian water source.

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. No unnatural obstructions to water source or impact on overland flow and overbank flooding. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Up to 25% of stream banks are affected due to dikes, rip rap and/or elevated culverts, or there is increased discharge due to other causes. Little change in plant community resulting from unnatural alterations. |
| Fair = 2 | Water sources are moderately impacted by anthropogenic sources but are still a mix of natural and non-natural sources. Between 25-75% of stream banks are affected (e.g., dikes, rip rap, concrete, and elevated culverts) or increased discharge due to other causes. Wetlands still present due to groundwater or other water inputs, but potentially reduced in extent and showing some plant community changes; or plant community changes due to increased unnatural water inputs. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. > 75% of stream banks are affected (for example due to dikes, rip rap, concrete, and elevated culverts) or increased discharge due to other causes. Wetlands are reduced in extent unless high groundwater or other surface water inputs maintain them. Plant community changes are observed due to unnatural water inputs. |

**Coastal Plain Floodplain:** Mixed hydrologic regime with some input from groundwater and from precipitation or limited flooding

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. No unnatural obstructions to lateral or vertical movement of ground or surface water. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Little change in plant community resulting from unnatural alterations. |
| Fair = 2 | Water sources are moderately impacted by anthropogenic sources, but are still a mix of natural and non-natural sources. Wetland is still connected to its natural water source (e.g., modified ponds on a floodplain that are still connected to alluvial aquifers, natural stream channels that now receive substantial irrigation return flows, many small/few large storm drains), but moderately disconnected from floodplain due to multiple geomorphic modifications. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to increased unnatural water inputs. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. Wetland has reduced connection to natural water source (e.g., loss of overbank flow). Wetlands are potentially reduced in extent if no other surface water inputs maintain them. Plant community changes are observed due to unnatural water inputs. |

| **All other KWH:** Predominantly groundwater or precipitation water source, with potential limited flooding from small stream in relation to wetlands in riparian system | |
|---|---|
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. Groundwater or precipitation dominant or only water source; otherwise, no unnatural obstructions to lateral or vertical movement of ground or surface water, or, if perched water table, impermeable soil layer is intact. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features, such as levees or excessively high banks (less than 25% of the site). If perched, impermeable soil layer partly disturbed. Little change in plant community resulting from water source alterations. |
| Fair = 2 | Water source is moderately impacted by anthropogenic sources, but still a mix of natural and non-natural sources. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features or alteration. Between 25-75% of the site is restricted by barriers to drainage. If perched, impermeable soil layer moderately disturbed. Drainage back to the wetland is incomplete due to impoundment. Wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to water source alterations. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. Most or all water stages are contained within artificial banks, levees, or comparable features. Greater than 75% of wetland is restricted by barriers to drainage. If perched, impermeable soil layer strongly disturbed. Wetlands reduced in extent and show plant community changes due to water source alterations. |

**Stream Bank and Channel (Section 4.5.2)** Indicate the characteristics of the stream bank and channel for the project area using the check boxes on the data sheet and additional lines as needed, including evidence of equilibrium, signs of recovery, channel and bank instability and their sources. **This score will apply to all AA in the project area.** Examples of field indicators of equilibrium, degradation, and aggradation are presented in the table on the next page. If available, indicate the Bank Erosion Hazard Index (BEHI) score, Near Bank Stress (NBS) score, and modeled inundation from storm events and use them in your scoring process. Use online resources (Section 3.1) to fill in the Benthic Index of Biotic Integrity (IBI) and Fish IBI Values and Ratings if available.

| **Stream Bank and Channel in Project Area (score applies to all AA in project area)** | |
|---|---|
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Indicators of channel equilibrium present. Minimal or no evidence of degradation or aggradation leading to channel instability or migration. Bank instability none or minimal. Channel is not unnaturally entrenched. If calculated, BEHI/NBS scores low. |
| Good = 3 | Minor channel incision. Channel is somewhat entrenched (overbank flow occurs during most floods). Some evidence of degradation or aggradation leading to a minimal level of channel instability or migration. Minor bank instability. If calculated, BEHI/NBS scores low. |
| Fair = 2 | Channel is incised. Channel is moderately entrenched (overbank flow only occurs during moderate to severe floods, functioning at risk). Uncharacteristic aggradation or degradation is present leading to a moderate level of channel instability or migration. Bank instability moderate. BEHI/NBS scores moderate. |
| Poor = 1 | Channel is incised. Channel is substantially entrenched (overbank flow never occurs or only during severe floods-not functioning). Channel entirely or extensively disconnected from the floodplain. Bank instability substantial. BEHI/NBS scores high, very high, or extreme. |

**Hydroperiod and Hydrologic Connectivity (Section 4.5.3)** This metric examines the characteristic frequency, level, and duration of wetland inundation or saturation, regardless of the source, and the ability of water to flow into or out of the wetland. **Use the scoring table for the correct KWH and check off what you observe on the data sheet.** Estimate the hydroperiod variation based on visual indicators and soil redox. Indicators of changes in extent and duration of inundation or saturation are presented on the next page. If available, add information for storm interval flooding, Bank Height Ratio, and Entrenchment Ratio.

| **Coastal Plain Floodplain** Note: Recent beaver activity may lead to deviations from rating descriptions. This should be noted on the data sheet.<br><br>Low natural variation of hydroperiod _____ High natural variation of hydroperiod_____ | |
|---|---|
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Evidence of recent overbank flooding. Completely connected to floodplain (backwater sloughs and channels, may be still pools with flow). No major hydrologic stressors present that impact natural hydroperiod or impact due to natural events (e.g., beaver dams). No unnatural obstructions to lateral or vertical movement of ground or surface water. |
| Good = 3 | Evidence of overbank flooding. Minimally disconnected from floodplain. Minor alterations in frequency, levels, or duration of hydroperiod. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Flooding at 2-year storm interval. |
| Fair = 2 | Some evidence of overbank flooding, likely during larger storm events. Moderately disconnected from floodplain due to multiple geomorphic modifications. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Moderate flooding at 10-year storm interval. |
| Poor = 1 | Overbank flooding generally no longer occurs. Disconnected from floodplain, likely causing some drainage of groundwater. Flooding may or may not occur at 100-year or greater storm interval. |

**Other KWH**
Low natural variation of hydroperiod _____ High natural variation of hydroperiod_____

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Overbank flooding present and recent but not predominant water source to wetland. No unnatural obstructions to lateral or vertical movement of ground or surface water. |
| Good = 3 | Evidence of overbank flooding but not predominant water source to wetland. Hydroperiod with minor alterations in frequency, levels, or duration due to groundwater and other inputs. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. |
| Fair = 2 | Some evidence of overbank flooding, likely during larger storm events. Hydroperiod with moderate alterations in frequency, levels, or duration due to groundwater and other inputs. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. |
| Poor = 1 | Overbank flooding generally no longer occurs. Hydroperiod with substantial alterations in frequency, levels, or duration due to groundwater and other inputs. Substantial restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. |

| Condition | Field Indicators for Stream Bank and Channel and Hydroperiod for Coastal Plain Floodplain |
|---|---|
| Indicators of Channel Equilibrium | ● The channel (or multiple channels in braided systems) has a well-defined usual high water line, or bankfull stage, that is clearly indicated by an obvious floodplain. A topographic bench represents an abrupt change in the cross-sectional profile of the channel throughout most of the site.<br>● The usual high water line (consistent with ACOE ordinary high water mark) or bankfull stage corresponds to the lower limit of riparian vascular vegetation.<br>● The channel contains embedded woody debris of the size and amount consistent with what is available in the riparian area.<br>● There is little or no active undercutting or burial of riparian vegetation. |
| Indicators of Active Degradation (Erosion) | ● Portions of the channel are characterized by deeply undercut banks with exposed living roots of trees or shrubs. There are abundant bank slides or slumps, or the banks are uniformly scoured and unvegetated.<br>● Riparian vegetation may be declining in stature or vigor, and/or riparian trees and shrubs may be falling into the channel.<br>● The channel bed lacks any fine-grained sediment (unless it is the dominant bank material).<br>● Recently active flow pathways appear to have coalesced into one channel (i.e., a previously braided system is no longer braided). |
| Indicators of Excessive Aggradation (Sedimentation) | ● The channel through the site lacks a well-defined usual high water line.<br>● There is an active floodplain with fresh splays of excessive sediment covering older soils or recent vegetation.<br>● There are partially buried tree trunks or shrubs.<br>● Excessive cobbles and/or coarse gravels have recently been deposited on the floodplain.<br>● There are partially buried, or sediment-choked, culverts. |
| **Condition** | **Hydroperiod Field Indicators for Other KWH Types** |
| Reduced Extent and Duration of Inundation or Saturation | ● Upstream diversions, impoundments, pumps, ditching, or draining from the wetland.<br>● Water withdrawal (wells).<br>● Evidence of aquatic wildlife mortality.<br>● Encroachment of terrestrial vegetation.<br>● Encroachment of young, tall, vigorous trees if not usually present, shading of underlying mosses.<br>● Stress or mortality of hydrophytes or sphagnum.<br>● Compressed or reduced plant zonation.<br>● Organic soils occur well above contemporary water tables.<br>● Increased discharges resulting in channel downcutting. |
| Increased Extent and Duration of Saturation | ● Berms, dikes, or other water control features that increase duration of ponding (e.g., pumps).<br>● Diversions, ditching, or draining into the wetland.<br>● Late-season vitality of annual vegetation.<br>● Recently drowned riparian or terrestrial vegetation (e.g., beaver-created impoundment).<br>● Extensive fine-grained deposits on the wetland margins. |

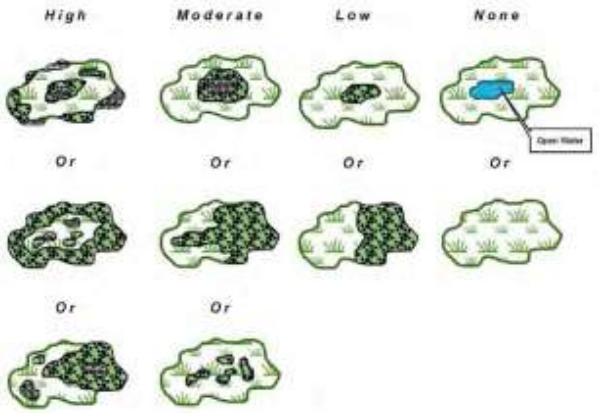
## KEY WILDLIFE HABITAT AND VEGETATION COMPOSITION (Section 4.6)

Vegetation structure and composition are of particular interest for assessing the condition of Key Wildlife Habitats because they directly support the ecological needs of animal and plant species of concern. In this section, metrics provide information on the interspersion of vegetation patches, habitat features/evidence of animal use, vertical structure, and standing and downed woody debris (standing tree snags and downed trees and branches). Vegetation data collected previously or simultaneously using standard wetland delineation methods are used to document vegetation composition and can be used to assess most metrics. Scores are assigned to reflect the presence and extent of invasive and native plant species in herbaceous and woody layers, including the presence of native species that are diagnostic (Section 4.3) and indicative of disturbance. Additionally, any plant species listed as rare, threatened, or endangered in Maryland should be identified (see Manual for source of current list). **These species should be noted on the data sheet even if they are not dominant**. A Floristic Quality Assessment will be calculated using the Excel data sheet or as otherwise described in the Manual. **Expected conditions vary by Key Wildlife Habitat for some metrics- use the correct scoring tables.**

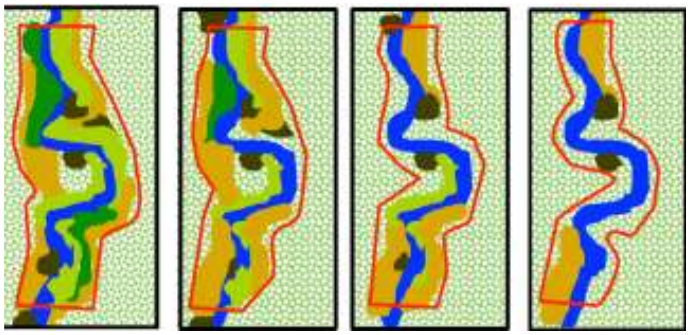
**Interspersion and Patch Richness (Section 4.6.1)** For this metric, interspersion and patch richness will be scored separately and then averaged for a final score. Interspersion is assessed within the AA but patch richness is assessed within the AA and out to 10m around the AA on each side.

**Interspersion:** The figures below show a range of patterns for the interspersion of vegetation patches for different Key Wildlife Habitats. Different vegetation types, such as hummocks, sphagnum, shrub areas, patches of herbaceous vegetation, and patches or lines of trees of different heights or ages, should be noted for the AA. **Select the diagram below for the appropriate KWH** to determine a score for this metric. To be considered, vegetative patches should represent at least 5% of the AA in single or multiple locations. This metric is often reflective of the topographic complexity metric in many wetland types. Record the score on the next page.

**Coastal Plain Seepage Swamp, Coastal Plain Seepage Bog and Fen, Coastal Plain Flatwood and Depression Swamp, Vernal Pool, Spring**. (Source: USACE 2015 Texas Rapid Assessment Method)
***Scoring*: High = 4** Vegetation patches are large and intertwined or numerous and scattered
**Moderate = 3** At least two types of vegetation patches are present but patches are slightly smaller or less scattered/intertwined than "High" category
**Low = 2** Two types of vegetation patches are present but in smaller, very localized, and/or isolated patches
**None = 1** Only one type of vegetation patch is present




**Coastal Plain Floodplain**: The red box represents the boundary of the AA and each color represents a unique plant zone such as shrub areas, patches of herbaceous vegetation, or tree clumps of different ages or heights. The speckled background represents the background matrix of vegetation and the blue line represents the stream. For multithread stream systems, evaluate the channel with the highest complexity of plant zones for scoring. (Source: California Rapid Assessment Methods for Wetlands Riverine Wetlands Field Book 2013)
**Scoring: A = 4** High complexity of scattered and intertwined plant zones
**B = 3** Moderate complexity of intertwined plant zones
**C = 2** Minimal complexity of plant zones with little interspersion
**D = 1** Few plant zones with localized, isolated patches



**A** **B** **C** **D**

**Patch Richness:** Patch richness provides a measure of components that represent potential wildlife habitat. **Check the following features off on the data sheet if they are present in the AA or within 10 m (33 feet) of the AA boundary**. Count the number of features present. Also indicate the presence of any observed wetland- or stream-associated animals such as frogs, waterbirds, crayfish, fish, mussels, etc. on the data sheet. Record the score on the next page.
Features: Spring or upwelling groundwater; Depression; Vegetated pool; Unvegetated pool; Unvegetated flat; Island; Animal mound or burrow; Beaver dam or lodge; Beaver-chewed vegetation; Oxbow, swale, secondary channel; Wind-thrown tree hole; Mound;

Bank overhang with tree roots; Tip-up tree root mound; Brush piles; Abundant deciduous leaf litter; Partially buried natural debris; Debris jam; Plant hummock/tussocks; Other wildlife habitat

| Score | Coastal Plain Floodplain, Coastal Plain Seepage Bog and Fen, Coastal Plain Seepage Swamp | Coastal Plain Flatwood and Depression Swamp | Vernal Pool/Spring |
|---|---|---|---|
| **4** | ≥ 6 | ≥ 7 | ≥ 4 |
| **3** | 5 - 6 | 6 - 7 | 3 - 4 |
| **2** | 3 - 4 | 4 - 5 | 2 |
| **1** | < 3 | < 4 | <2 |

**Interspersion and Patch Richness Score:** Calculate the mean of the Interspersion and Patch Richness metrics below. Use the table to assign an overall score for this metric**.**

| Score | Mean of Interspersion and Patch Richness Metric Scores |
|---|---|
| Excellent = 4 | 3.5 – 4 |
| Good = 3 | 2.6 - 3.4 |
| Fair = 2 | 1.6- – 2.5 |
| Poor = 1 | 1 – 1.5 |

**Interspersion Score: _____**

**Patch Richness Score: _____**

**Mean of Interspersion and Patch Richness Scores:_____**

**Overall Score for Metric (see table at left): _____**

**Vertical Structure (Section 4.6.2)** This metric provides an assessment of the overall structural complexity of vegetation layers, including presence of multiple strata, age and structural complexity of canopy layer, and effects of disease or mortality on structure. **Assess within the AA and out to 10m (33 feet) of the AA boundary.** Forested KWH are assessed differently than non-forested KWH (Coastal Plain Seepage Bog and Fen). As **beaver activity** can impact vertical structure, the vertical structure in the surrounding area and previous structure as indicated by snags and downed trees should be considered when assigning a score. Note the presence of these changes on the data sheet. **Vernal Pools and Springs** are expected to have only sparse woody and/or herbaceous vegetation in the basin area, if any. For these KWH, assess the vertical structure in the surrounding area. For **Coastal Plain Seepage Bog and Fen**, an evaluation of the integrity of dominant growth forms is made (e.g., whether shrubs have been removed, killed, or increased or if the herbaceous layer has been reduced or homogenized by stressors). Reference to the description for this KWH can be useful. **Use the correct KWH table and assign the rating to the category with the majority of features present.**

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp**
**Vernal Pool and Spring:** only assess structure in area surrounding basin- limited to sparse herbaceous vegetation is usually present in the basin area.
Note: Recent beaver activity may lead to deviations from rating descriptions for Coastal Plain Floodplain. This should be noted on the data sheet.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Tree canopy or highest woody level present is a heterogeneous mosaic of patches of different ages or sizes. Gaps of varying size. Multiple layers are created through the presence of trees of varying ages and heights and the shrub layer. Large trees (> 60 cm or 24" dbh) expected to be present (≥ 10% of trees present). If large trees are absent, few or no large stumps are present and there is evidence of a natural disturbance event (e.g., large downed wood from wind storms, fire scars, beaver activity, tree senescence). Little impact from deer browse. |
| Good = 3 | Tree canopy or highest woody level present is largely heterogeneous in age or size. Multiple layers are present, but one layer missing or little variation in ages and heights of woody vegetation in at least one layer. Less than 10% of trees present are large trees (>60 cm or 24" dbh) due to human activities. At least 20% of trees present are >30 cm or 12" dbh. Minor presence of cutting, browsing, grazing and other degradation such as forest pest/pathogens. If large trees are absent, few or no large stumps are present and there is evidence of a natural disturbance event (e.g., large downed wood from wind storms, fire scars, beaver activity, tree senescence). Little impact from deer browse. |
| Fair = 2 | Tree canopy or highest woody level present is somewhat homogeneous in age or size. More than one layer present, but one or more layers missing. Little variation in ages and heights of woody vegetation in layers. Less than 20% of trees present are >30 cm or 12" dbh are present. Moderate levels of cutting, browsing, or grazing, or other degradation such as forest pest/pathogens has caused the loss of larger trees rather than a natural disturbance event. |
| Poor = 1 | Tree canopy or highest woody level present is very homogeneous in age or size. Only one or two layers present due to human activities. Most, if not all, larger trees (dbh 30-60 cm or 12-24") have been removed. Major cutting, heavy browsing, grazing, or other degradation such as forest pest/pathogens. |

**Coastal Plain Seepage Bog and Fen**

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Mortality of woody vegetation, if present, is due to natural factors such as wind storms or senescence. Excellent potential for site recovery given structure present and lack of degradation (past or present).<br>Bogs/acidic fens: Peatland structure includes shrub and herb strata (some tall and some short). When present (peatland not too wet), trees are relatively short and stunted with rounded tops and furrowed bark. Shrubs are < 50 cm and open enough to allow for a nearly continuous ground cover of *Sphagnum* and other expected vegetation around tree/shrub bases AND in low hummocks, hollows, or other low areas. |

| | |
|---|---|
| | Circumneutral/rich fens: Primarily short-statured vegetation and nearly continuous cover of mosses (except in tall sedge fens - which are naturally more vigorous, homogenous, and often with little bryophyte cover). Shrubs may be present as a mosaic with open areas. Tree species, when present, do not form a closed canopy. *Sphagnum* and other mosses actively growing. Never more than local, small patches of degenerating *Sphagnum*. |
| Good = 3 | Minor negative anthropogenic influences present, or the site is still recovering from major past human disturbances. Mortality or degradation due to grazing, peat mining, limited timber harvesting, or other anthropogenic factors may be present, though not widespread. The site can be expected to meet minimally disturbed conditions in the near future if negative influences do not continue.<br>Bogs/acidic fens: Shrubs and herbs show minor alterations from expected conditions. A few areas of dense and tall shrubs (> 1 m) may occur (dense enough to eliminate *Sphagnum*/moss growth). Some trees may have been or killed due to anthropogenic stressors.<br>Circumneutral/rich fens: Shrubs and herbs show minor alterations from expected conditions. |
| Fair = 2 | Expected structural classes are not present. Shrubs and herbs moderately altered from expected conditions. The site will recover to minimally disturbed conditions only with the removal of degrading influences and moderate recovery times.<br>Bogs/acidic fens: Shrub cover averages > 1 m tall and is beginning to reduce *Sphagnum* cover. Many trees have been cut or killed due to anthropogenic stressors.<br>Circumneutral/rich fens: Trampling or other physical disturbance has moderately reduced moss cover where expected. Overall, evidence of degradation includes moderate levels of cutting, mowing, browsing, fire or grazing. *Sphagnum* still regenerating in open areas. |
| Poor = 1 | Expected peatland structure is absent or much degraded due to anthropogenic factors, such as peat mining. Overall, evidence of degradation includes major cutting, mowing, browsing, fire or grazing. Woody regeneration is minimal and existing structure is in poor condition, unnaturally sparse, or depauperate. Shrubs and herbs substantially altered from expected conditions. Recovery to minimally disturbed condition is questionable without restoration, or will take many decades.<br>Bogs/acidic fens: Most if not all *Sphagnum* cover has been eliminated due to extremely dense and tall (> 1 m) shrubs. Trees have all been cut or killed by anthropogenic stressors.<br>Circumneutral/rich fens: Trampling or other physical disturbance has eliminated moss cover where it is expected. *Sphagnum* not regenerating, even in open areas. |

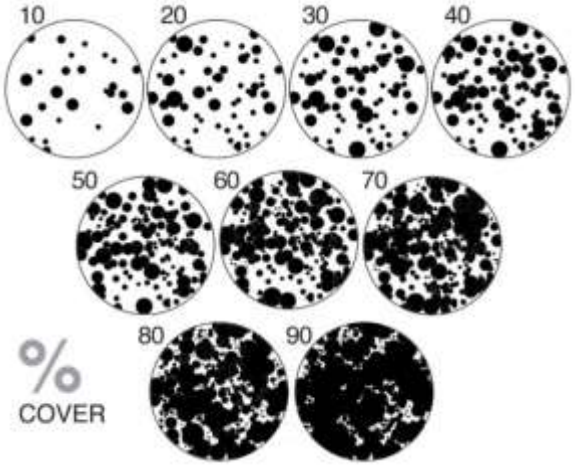
**Standing and Downed Woody Debris (Section 4.6.3)** Standing or fallen woody debris (snags and downed branches and trees) plays a critical role in riparian systems. Estimation of coarse woody debris should be based on a walkthrough of the entire AA if possible. For large AA, estimation along transects may be preferred. Use the check boxes in the data sheet to indicate features present for the correct KWH. In forested KWH, pay special attention to the amount of coarse woody debris when surveying the AA and note the creation of woody debris from cutting, pests/pathogens, or other factors. Riverine wetlands that have incised banks, no longer experience flooding, experience overgrazing, or are no longer at a dynamic equilibrium may lack coarse woody debris. For wetlands dominated by shrub and herb layers, note the quantity and distribution of litter compared with the baseline that may be expected in the landscape. Active floodplain systems are typically low in litter. As **Vernal Pools and Springs** may have only scattered woody debris, evaluate both the basin and the surrounding area. Peatlands are dominated by peat-forming species which contribute enough litter and debris to maintain carbon dynamics, playing a critical role in these systems that may naturally include little coarse woody debris.

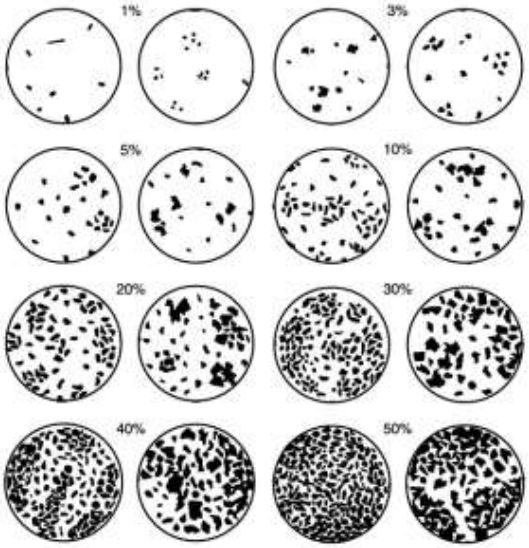
| **Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp**<br>**Vernal Pool and Spring:** assess presence in immediate surrounding area as well as the basin.<br>If non-natural sources have created standing and/or downed woody debris, indicate this on the data sheet. | |
|---|---|
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Wide diversity of sizes for both standing and downed logs, including larger sizes [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] present with 5 or more snags per ha (2.5 ac), but not excessive numbers (suggesting disease or other problems). Downed logs are in various stages of decay, from sound and intact to soft pieces that no longer maintain their shape. |
| Good = 3 | Moderate diversity of sizes for both standing and downed logs, but larger sizes [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] are rare. Larger size class present with 2-4 snags per ha, or an increased but not excessive number of snags (suggesting disease or other problems). Downed logs are in various stages of decay, with few soft pieces that no longer maintain their shape. |
| Fair = 2 | Moderate-low diversity of sizes for both standing and downed logs, but larger sizes [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] very rare or not present. Larger size class present with 1-2 snags per ha, or moderately excessive numbers (suggesting disease or other problems). Downed logs are in various stages of decay, but few to no soft pieces that no longer maintain their shape. |
| Poor = 1 | Low diversity of sizes for both standing and downed logs. Larger size class [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] present with < 1 snag per ha, or very excessive numbers (suggesting disease or other problems). Downed logs are mostly in early stages of decay. |
| **Coastal Plain Seepage Bog and Fen** | |
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Typical of the system. Woody vegetation mortality is due to natural factors. Peat accumulation appears to be stable or actively growing.<br>Bogs/acidic fens: *Sphagnum* is nearly continuous and growing around tree/shrub bases AND in low hummocks, hollows, or other low areas.<br>Circumneutral/rich fens: Dominant species are active peat-formers. |
| Good = 3 | Minor alterations to system present.<br>Bogs/acidic fens: Mortality or degradation of peat surface due to grazing, limited timber harvesting, anthropogenic fire or other anthropogenic factors may be present, but not widespread.<br>Circumneutral/rich fens: Mortality or degradation of peat surface due to grazing, limited timber harvesting, anthropogenic fire or other anthropogenic factors may be present, but not widespread. |

| | |
|---|---|
| Fair = 2 | Moderate alterations to system present.<br>Bogs/acidic fens: Ground cover has as much bare peat as *Sphagnum* cover, or nearly so.<br>Circumneutral/rich fens: Dominance of active peat-formers is being reduced in favor of non-peat-forming grasses and forbs. |
| Poor = 1 | Substantial alterations to system present.<br>Bogs/acidic fens: Ground cover is almost all bare peat with very little *Sphagnum* cover.<br>Circumneutral/rich fens: Cover of active peat-formers dramatically reduced and site is now dominated by non-peat-forming grasses and forbs. |

**Vegetation Composition (Section 4.6.4)** Vegetation of the AA is characterized using the five strata version of the wetland delineation determination (USACE 2010). The species composition is assessed relative to the species expected in each stratum for the KWH. **The coverage of invasive species and native species (both diagnostic and those indicative of disturbance) should be noted regardless of percent cover.** These species are listed with Section 4.3 above. State rare species should be noted. In addition, the sources of stressors or alterations to the native plant community should be noted on the data sheet as well as suggestions for improving native species cover. The diagrams below may be useful to assist with the estimation of percent cover.

**% Cover Estimation Diagrams** *(johnmuirlaws.com and Terry and Chilingar 1955)*




**Invasive Species (Section 4.6.5)** Invasive species are non-native species that can spread into natural ecosystems, where they can displace native species and cause major alterations to KWH. The most common plant invasive species in Coastal Plain stream-associated wetlands are *Microstegium vimineum, Glechoma hederacea, Rosa multiflora, Ligustrum sinense, Lonicera japonica, Phalaris arundinacea,* and *Phragmites australis.* Identification references and additional species can be found in the Manual. Scoring for Vernal Pools and Springs should use observations from the basin and surrounding area, as only limited sparse vegetation may be present in the basin.

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp, Coastal Plain Seepage Bog and Fen**

**Vernal Pool and Spring**: assess vegetation structure in area surrounding basin, as only limited to sparse vegetation may be present in the basin area.

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Invasive species are absent from all layers or absolute cover in any one woody layer (if present) and herbaceous layer is <1%. |
| Good = 3 | Invasive species are sporadic (no more than 1-5% absolute cover in any layer). |
| Fair = 2 | Absolute cover of Invasive species is >5-10% in any one woody layer (if present) and/or present with moderate absolute cover (>5-30%) in the herbaceous layer. Patches of native vegetation are reduced in size and complexity due to the presence of invasive species. |
| Poor = 1 | Absolute cover of Invasive species is over 10% in any one woody layer (if present) and/or is very abundant (over 30%) in the herbaceous layer. Vegetation reduced in size and complexity due to human disturbance. Patches of native vegetation are reduced in size and complexity due to the presence of invasive species. |

**Native Species (Section 4.6.6)** The presence and composition of native plant species provides an indication of KWH ecological integrity and how well the AA supports a diversity of native animal species. This metric uses the presence of indicator species and characteristic native species for the KWH in the AA (Section 4.3) as well as the presence of native species that indicate human disturbance. Metrics are adjusted for Coastal Plain Seepage Bog and Fen systems and some Spring KWH due to the importance of *Sphagnum*. Indicate the stressors present in the AA on the data sheet and provide suggestions for improvement.

**Native Species Indicative of Disturbance:** These species are those that seem to be more or less weedy and not picky about habitat, or they occur in young, often heavily altered wetland communities. Note the presence of these species to help assess the site and to assist with scoring.

| | |
|---|---|
| *Phalaris arundinacea* | *Dichanthelium boscii* |
| *Typha latifolia* | *Dichanthelium sphaerocarpon* |
| *Elymus glabriflorus* | *Paspalum floridanum* |
| *Muhlenbergia schreberi* | *Echinochloa muricata* |
| *Carex blanda, C. frankii* | *Coleataenia anceps* |
| *Dichanthelium scoparium* | *Panicum dichtomiflorum* |

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp, Coastal Plain Seepage Bog and Fen** (see information on second and third pages for diagnostic native species and those that indicate disturbance)
**Vernal Pool and Spring**: assess vegetation structure in area surrounding basin, as only limited to sparse vegetation is usually present in the basin area.
**Note:** Recent beaver activity may lead to deviations from rating descriptions for Coastal Plain Floodplain. This should be noted on the data sheet and considered in assignment of the score.

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Herbaceous and woody layers (if present) dominated by diagnostic native species. Layers may be sparse and patchy in areas with deeper flooding, with patches of vegetation confined to hummocks. In other areas, diverse native vegetation present unless there has been a recent natural disturbance.<br><br>Bog and Fen, some Springs: *Sphagnum* is nearly continuous and growing around tree/shrub bases AND in low hummocks, hollows, or other low areas. |
| Good = 3 | Some diagnostic native species absent or substantially reduced in abundance OR low cover (<10%) of native species indicative of human disturbance. Layer may be sparse and patchy in areas with deeper flooding.<br><br>Bog and Fen, some Springs: *Sphagnum* and other mosses actively growing, but may be eliminated from some areas due to disturbance or invasive species. |
| Fair = 2 | Few diagnostic species are present. Native species indicative of human disturbance are present with moderate cover (10-30%). Patches of native vegetation are reduced in size and complexity due to human disturbance.<br><br>Bog and Fen, some Springs: *Sphagnum* cover reduced but still regenerating in open areas. Dominance of active peat-formers is being reduced in favor of non-peat-forming grasses and forbs. |
| Poor = 1 | Few to no diagnostic species are present. Native species indicative of human disturbance are present with >30% cover. Patches of native vegetation are reduced in size and complexity due to human disturbance.<br><br>Bog and Fen, some Springs: Very little *Sphagnum* cover. Cover of active peat-formers dramatically reduced and site is now dominated by non-peat-forming grasses and forbs: |

## Floristic Quality Assessment (Section 4.6.7)

This method derives an estimate of nativity or habitat quality based on a combination of the tolerance to disturbance or environmental stress and the fidelity of individual plant species to specific habitats. These values will be calculated according to the procedure in the Manual using the list of plant species identified on the AA.

## Calculation of Final Key Wildlife Habitat Ecological Integrity Assessment Score (Section 5)

The major components of the EIA include four core factors: landscape, soil/substrate, hydrology, and KWH and vegetation composition. The previously scored metrics that pertain to these core factors should be entered into the Scoring Form. Use these values to calculate the Overall KWH Ecological Integrity Assessment Score using the scale on the Scoring Form.

**Use the check boxes on the Scoring Form to note if any of the additional features are present** from the sources indicated as described in the Manual (Sections 3.5 and 5.1)**. If the EIA score is not "Excellent",** add additional points for unique resources present at the project area according to the instructions on the Scoring Form to calculate the Final Key Wildlife Habitat Ecological Integrity Assessment Score and Rating for the AA.

# Appendix 5

## Data Sheet, Field Guidance, and Scoring Tables

# Rapid Ecological Integrity Assessments of Wetlands in Riparian Areas in Maryland: Coastal Plain Region

## Data Sheet, Field Guidance, and Scoring Tables

**Project/Site Name:**_____ **City/County:**_____ **Sampling Date:**_____
**Assessment Area Name (if >1 AA):** _____ **Observer(s):**_____
Delineation performed: ☐previously ☐ concurrently **Lat/Long:** _____ **AA size:** _____ **units** _____

## GENERAL GUIDANCE AND PROCESS

-This Ecological Integrity Assessment uses information collected in the field and from online sources/imagery. **Additional background and information can be found in the referenced sections of the "Field Manual for Rapid Ecological Integrity Assessments of Wetlands in Riparian Areas in Maryland: Coastal Plain" (Manual).**
-**Review** the metrics, guidance, and example photos in the Manual. **Prepare for the site visit** by reviewing aerial imagery (recent and historical if available), mapped soil characteristics for the site, mapped wetlands, and topography, including LiDAR Hillshade imagery, using the Maryland Watershed Resources Registry or other sources (Section 2). Carry out the Landscape Assessment (Section 3) before you go into the field if the project area boundary is known.
**-Use this packet** carry out the procedures indicated to collect data. Record your data where indicated, using the check boxes to indicate features present and filling in other required information where needed. Use the data that you record and the scoring tables in this document to determine a score for each metric. Enter all scores on the final Scoring Form and follow the Manual instructions to calculate the Final Score.
-An Excel sheet is also available for data entry. Some fields will automatically fill in if the wetland delineation Excel sheet and the AA assessment data sheet are both open. Further instructions can be found in the Manual.
-Scoring can vary due to the conditions expected for different Key Wildlife Habitats (Section 4.3). **Be sure to use the sections of the tables that correspond to the Key Wildlife Habitat being evaluated**.
-**NOTE:** All of the characteristics described for a given score category may not be present. **Assign the score to the category with the majority of features present.**

## ASSESSMENT AREA DETERMINATION (Section 2)

The first step is to identify the wetland assessment area (AA) or areas on the project site. AA(s) are located within or adjacent to the proposed stream restoration project footprint. Each AA should be evaluated and scored separately. Refer to Section 2 in the Manual for further information on how to determine AA boundaries. Use imagery in addition to field observations. An AA should be composed of only one Key Wildlife Habitat, consistent with guidance for wetland determinations to sample a single vegetation community or major landscape unit. Field data collection in the AA is carried out using a site walkthrough approach.

## LANDSCAPE ASSESSMENT (Section 3)

Watershed features can impact habitat quality for the organisms in the project area. Natural habitats provide the greatest benefit for wetland buffers, which play a critical role in the condition of the wetland relative to key abiotic and biotic factors. One Landscape Assessment is done for the entire project area and will apply to each AA in the project area. **Most of the landscape-level assessments will be done in the office** using mapped features and aerial imagery as described in the Manual. However, additional features noted in the field that are not visible on available imagery may affect the assessment. **In the field, as you are traveling to and assessing the AA, make note of the features described below to supplement the in-office assessment related to the buffer, presence of other wetlands, and size of the AA. Record these observations in the space on the next page.** If access to the buffer area is limited, scoring will need to rely more on aerial imagery as described in the Manual. Using in-office evaluations and any modifications or additions noted in the field, fill in the check boxes and values on the next page and on the Scoring Form (Sections 3.5 and 5.1) to capture the information and to assign scores. In the next section (Section 4.1), you will describe the full AA.

| Landscape Features | Assess out to this distance from the outer edges of the proposed stream restoration project area (all AA are included in project area): | Note these features below for use with information from aerial imagery: |
|---|---|---|
| Buffer Perimeter | 10m (33 feet) | Natural and altered habitats (see table) |
| Buffer Condition | 100m (330 feet) | Natural and altered habitats (see table) |
| Aquatic Context | 300m (1000 feet) | Small-scale wetlands, such as Springs or Vernal Pools, or streams that may not be evident from aerial imagery or are newly formed |
| Comparative Size | n/a- assessment occurs for each AA in the project area | Deviations from aerial imagery that could affect wetland size estimation; source(s) of size reduction of the AA such as roads, impoundment, development, etc. |

| Examples of Land Covers Included in Natural Buffers | Examples of Land Covers Excluded from Natural Buffers (Altered Habitats) |
|---|---|
| Natural plant communities; naturally vegetated rights-of-way; natural swales and ditches; natural open water features including rivers, streams, and ponds created by beaver activity; wetlands | Parking lots; commercial and private developments and structures; roads (all types); intensive agriculture; intensive plantations; orchards; vineyards; railroads; planted pastures; planted hayfields; animal pastures; lawns; sports fields; traditional golf courses; fallow farm fields; ditches; stormwater ponds; ponds formed by unnatural blockages; culverts |

**Field observations to assist with scoring of buffers, aquatic context, or size of AA:**

| **METRIC** | **SCORE** (applies to all AA in project area) |
|---|---|
| *Buffer Perimeter:* **%Natural:** _____<br>4 = Excellent: >95%  3 = Good: 85-95%  2 = Fair: 75-84%  1 = Poor: <75% | |
| *Buffer Condition:* **%Natural:** _____<br>4 = Excellent: >90%  3 = Good: 75-90%  2 = Fair: 50-74%  1 = Poor: <50% | |
| *Aquatic Context:* **Number of aquatic resources**: _____<br>4 = Excellent: 4 or more aquatic resources  3 = Good: 3 resources  2 = Fair: 2 resources  1 = Poor: 0-1 | |
| *Comparative Size (*see Manual for scoring*):*<br>☐ Very large ☐ Large ☐ Medium to small ☐ Small to very small | |

Source(s) of size reduction, if any: ☐ Beaver dam or lodge ☐ Trail ☐ Road ☐ Railroad ☐ Development ☐ Agriculture ☐ Impoundment ☐ Human-constructed drainage (into or out of wetland) ☐ Excavation ☐ Fill ☐ Groundwater extraction ☐ Other _____

From StreamStats: Impervious Surface in project area basin: _____ Forest Cover in project area basin:_____
Additional channels in project area visible on LiDAR Hillshade image:

## SITE DESCRIPTION AND ENVIRONMENTAL INFORMATION (Section 4.1)

**Provide a detailed description of the assessment area**, including the features listed below. A sketch may be helpful.

**Site Description:** (general landscape setting, overview of riparian corridor, presence of braided/multithread system, topography, vegetation patterns, complexity and habitat richness; human and natural disturbance as indicated by spoil piles, beaver activity, dumping, vegetation removal, pest impacts, excessive flow; description of adjacent stream and sources/evidence of water input or alterations such as culverts, roads/trails, sediment). Representative site photographs of soil, nearest stream channel and banks, and vegetation are useful to show the features present.

## ENVIRONMENTAL INFORMATION (Section 4.2)

**Note Landscape Position, Water Source, and Hydrological Regime** for the AA. If there is more than one water source, rank as P (primary), S (secondary), and T (tertiary). The Hydrological Regime usually matches the mapped wetland type. Definitions for Hydrological Regime are provided in the Manual (Table 11).

Landscape Position: Indicate all features present.

| | | | |
|---|---|---|---|
| ☐ Active floodplain (depression or terrace) | ☐ Beaver pond/Natural impoundment | ☐ Riparian-Depression (in floodplain) | ☐ Riparian terrace (outside seasonal flooding; historic floodplain or current terrace) |
| ☐ Headwater stream/spring | ☐ Seep/groundwater discharge site (toe slope) | ☐ Swale | ☐ Isolated Depression |
| ☐ Oxbow | ☐ Wetland charged by groundwater seeps (hill slope) | ☐ Streambank | ☐ Point bar |
| ☐ Flats | ☐ Braided Channels | ☐ Other- describe | |

Water Source: If more than one source is present, label as P (primary), S (Secondary), T (tertiary)

| | | | |
|---|---|---|---|
| ☐ Direct precipitation | ☐ Groundwater discharge | ☐ Natural surface flow | ☐ Urban run-off/culverts |
| ☐ Overbank flooding | ☐ High groundwater | ☐ Irrigation | ☐ Pipes/outfall (directly feeding wetland) |

Hydrological Regime: Circle the regime that best matches the conditions in the AA (see Manual for definitions)

| | | | | |
|---|---|---|---|---|
| H Permanently Flooded | G Intermittently Exposed | F Semipermanently Flooded | C Seasonally Flooded | E Seasonally Flooded-Saturated |
| B Seasonally Saturated | D Continuously Saturated | A Temporarily Flooded | I Intermittently Flooded | K Artificially Flooded |

**Observations/Comments:**

## ASSIGNMENT OF AA TO KEY WILDLIFE HABITAT (Section 4.3) and Vegetation Indicators

**Use the key below to determine the Key Wildlife Habitat (KWH) and HGM class for the AA**. Also indicate the stream type and, if possible, the community type/plant association. See the Manual for photos and complete descriptions. Lists of typical species in each stratum by KWH, indicator species by KWH, and general native wetland species that usually indicate disturbance are also listed below. These species lists may assist with KWH selection and will be used in the KWH and Vegetation Composition metrics in Section 4.6.

Key Wildlife Habitat: _____ HGM Class: _____
Optional: NVC Community Type/Plant Association: _____
Stream Key Wildlife Habitat Type: ☐Coastal Plain Stream ☐ Blackwater Stream ☐ Coastal Plain River

**1a.** Wetlands bordering streams and rivers with overland, non-tidal flooding regimes (i.e., floodplains). Distinct alluvial landforms (e.g., backswamps, levees, terraces) and indicators present (e.g., scour marks, recent sediment deposition, vegetation damaged/bent in one direction, soils with alternating deposits, channel banks with flood marks). Likely to be 3rd order and higher but may be braided systems. Structurally and compositionally diverse vegetation present ranging from closed mixed forests to floodplain pools to open, beaver-created pools with floating aquatics**……COASTAL PLAIN FLOODPLAIN** HGM Class: Riverine

**1b.** Wetlands primarily controlled via groundwater discharge often associated with depressional and slope geomorphic features as well as the margins of small stream (1st and 2nd order) floodplain wetlands.

**2a.** Wetlands associated with toe slopes and floodplains of small streams of the Coastal Plain where groundwater discharge is a major contributing input source (mixed hydrological regime: occurs in very narrow part of the groundwater driven complex that is influenced by overbank flooding) with alluvial landform a minor part of the complex; smaller order stream floodplain margins where groundwater input also contributes to overall hydrology. These areas are generally small features along streams and are usually not as well-developed as seepage swamps in larger stream systems……**COASTAL PLAIN FLOODPLAIN** HGM Class: Riverine or Slope

**2b.** Wetlands associated with distinct depressional and slope geomorphic features.

**3a.** Basin wetlands, depressions, or very flat areas with evidence of ponded water, unidirectional flow not evident, lacks natural outlet, maintained by high water tables and seasonal precipitation. Hydrologic regimes range from saturated to seasonally flooded.

**4.** Seasonally flooded to saturated forested flats and depressions of broad coastal plain terraces (i.e., "wet flatwoods") with fluctuating water levels and intermittently ponded depressions. Soils are silt, sand, and clay loams, sometimes with a thin (< 30 cm [12 in]) mantle of coarse, fibric peat.

5a. Located on flat terraces and shallow depressions with seasonally perched water tables and braided channels……**COASTAL PLAIN FLATWOOD AND DEPRESSION SWAMP** Flatwood: HGM Class- Flat; Depression Swamp: HGM Class- Depression

**5b.** Small (<0.1 ha- 2 ha) shallow pools with a well-defined, discrete basin overlying a clay hardpan or other impermeable soil or rock layer impeding drainage, may or may not have vegetation in basin……**VERNAL POOL** HGM Class: Depression

**3b.** Slope wetlands associated with groundwater discharge zones (i.e., seeps, springs) and perennial, unidirectional flow towards a natural outlet such as a stream.

6a. Small (usually <1m$^2$), localized area of groundwater discharge, point source, rare in Coastal Plain…..**SPRING** HGM Class: Slope

**6b.** Larger wetland systems with diffuse drainage patterns, widespread.

7a. Open wetlands characterized by predominately shrub and herbaceous vegetation and localized groundwater discharge zones. (*note. Lack of natural disturbances [e.g., fire, beaver activity, grazing] in these habitats often promote woody plant succession.)* Saturated "bog-like" wetlands along gently sloping headwater streams, seepage toe-slopes, and oligotrophic spring-heads with considerable accumulation of peat mosses (*Sphagnum spp*.) at varying depths, soils acidic and infertile (*note. The term "bog" applied here is a technical misnomer since none of these wetland systems in Maryland are ombrotrophic.)*…….**COASTAL PLAIN SEEPAGE BOG AND FEN** HGM Class: Organic Soil Flat; Slope

**7b.** Saturated forests of sloping stream headwaters, large spring seeps, lateral seeps in ravines and stream bottoms with diffuse drainage patterns. Braided stream channels, muck-filled depressions, and hummock-and-hollow microtopographic features evident……**COASTAL PLAIN SEEPAGE SWAMP** HGM Class: Slope or Riverine

**Species by vegetation stratum that represent those with high constancy values (>75%) for the more common finer community types (i.e., association level) of Key Wildlife Habitats. Indicator species are those with a high diagnostic value to type, high fidelity, and high relative cover.**

| Key Wildlife Habitat | Trees | Shrubs | Herbs | Vines | Indicator |
|---|---|---|---|---|---|
| **Coastal Plain Floodplain** | *Platanus occidentalis, Liquidambar styraciflua, Liriodendron tulipifera, Quercus michauxii, Fraxinus pennsylvanica, Betula nigra, Acer rubrum Additional for Blackwater Streams: Taxodium distichum, Nyssa sylvatica, Chamaecyparis thyoides (rare)* | *Lindera benzoin, Asimina triloba, Ilex opaca, Ilex verticillata, Carpinus caroliniana* | *Amauropelta (Thelypteris) noveboracensis, Mitchella repens, Arisaema triphyllum, Boehmeria cylindrica, Saururus cernuus, Cinna arundinacea, Galium circaezans, Medeola virginiana, Thalictrum thalictroides, Impatiens capensis, Glyceria striata* | *Toxicodendron radicans, Parthenocissus quinquefolia, Campsis radicans* | *Platanus occidentalis, Betula nigra, Amauropelta (Thelypteris) noveboracensis, Saururus cernuus, Cinna arundinacea Additional for Blackwater Streams: Taxodium distichum, Nyssa sylvatica, Chamaecyparis thyoides (rare)* |
| **Coastal Plain Flatwood and Depression Swamp** | *Quercus phellos, Quercus palustris, Quercus michauxii, Quercus pagoda, Liquidambar styraciflua* | *Eubotrys racemosa, Vaccinium corymbosum, Clethra alnifolia* | *Woodwardia areolata, Osmunda cinnamomea, Mitchella repens, Osmunda regalis, Chasmanthium laxum* | *Smilax rotundifolia* | *Quercus pagoda, Quercus michauxii, Vaccinium corymbosum* |
| **Coastal Plain Seepage Bog and Fen** | *Nyssa sylvatica, Acer rubrum, Pinus rigida* | *Rhododendron viscosum, Toxicodendron vernix, Rubus hispidus, Ilex glabra, Clethra alnifolia* | *Carex atlantica, Andropogon glomeratus, Rhynchospora gracilenta, Eupatorium pilosum, Dichanthelium dichotomum var. dichotomum* | *Smilax pseudochina* | *Smilax pseudochina, Pinus rigida, Andropogon glomeratus, Rhynchospora gracilenta* |
| **Coastal Plain Seepage Swamp** | *Nyssa sylvatica, Acer rubrum, Magnolia virginiana* | *Clethra alnifolia, Viburnum nudum, Rhododendron viscosum* | *Woodwardia areolata, Osmunda cinnamomea, Osmunda regalis, Carex folliculate, Symplocarpus foetidus* | *Smilax rotundifolia* | *Magnolia virginiana, Clethra alnifolia, Viburnum nudum, Symplocarpus foetidus* |
| **Vernal Pools and Springs** have limited to sparse herbaceous and/or shrub vegetation in the wetland basin. Some Springs have *Sphagnum* species. The surrounding vegetation will represent one of the KWH listed here. Vernal Pools and Springs are most likely to be embedded in Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, or Coastal Plain Seepage Swamp. | | | | | |

## SOIL/SUBSTRATE (Section 4.4)

Healthy soil function supports plant life and biogeochemical processing for nutrient storage and transformation. Surface features such as changes in elevation over a small area (microtopography) can add to the complexity of the habitat and increase biodiversity,

and organic matter accumulation and nutrient dynamics are influenced by leaf litter and ground cover. Disturbance of the surface layer increases the potential for erosion or sedimentation. Prior to fieldwork, mapped soil characteristics for the site should be reviewed. Note any deviations from these characteristics below as well as indications of soil compaction and disturbances. Depth to water table and/or extensive roots in the soil should be noted. Examine a soil sample to determine all of the standard measures below unless the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions. Check off the features present and use them to assign a score for each metric below. Note the presence of a gravelly substrate in the Observations/Comments section.

**Note:** if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions, only score Microtopography, Organic Matter Accumulation, and Soil Disturbance.

**Mapped Soil Type:**_____ **Depth to water table** _____ **Hydric soil?**_____ **Hydric soil indicators**_____
**Depth of O horizon** _____ **Depth of A horizon** _____ **Extensive roots in soil?** _____ **Soil Matrix Hue Value/Chroma**_____
Note any deviations from the characteristics described for the mapped soil type for this AA and potential causes. Is soil compaction evident? Describe any impacts to the soil surface such as trampling/compaction from animals or machinery, ruts or other disturbances from ATV or other vehicular activity, or sedimentation.
**Observations/Comments (including for metrics below):**

**Soil Biogeochemical Processing:**
**Redox concentrations:** >10% surface area and ☐ start 0-6" from soil surface ☐ start >6-12" ☐ start >12-18"
<10% surface area and ☐ start 0-6" from soil surface ☐ start >6-12" ☐ None within 18"
**Soil Organic Matter:** ☐ Horizon present (any thickness) ☐ Mineral surface layer(s) ≥ 4" thick with matrix value ≤3 and chroma ≤2
☐ Mineral surface layer <4" thick and ☐ Matrix value ≤3 and chroma ≤2 ☐ Matrix value >3 and ≤4 or chroma >2 and ≤3
**Microtopography:** ☐ ≥50% of Assessment Area ☐ 30-49% of AA ☐10-29% of AA ☐ <10% of AA
**Organic Matter Accumulation**: **Organic Matter Accumulation**: Estimated ground cover of herbaceous/woody plants (living and dead residue): _____%
Estimated cover of leaf litter (loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers): _____%
% herbaceous/woody + % leaf litter: ☐ >75% ☐ >50-74% ☐>25-50% ☐ ≤25%
**Soil Disturbance:** Presence of bare soil due to human activities: ☐ None/minimal ☐ Minor/small patches ☐ Moderate ☐ Substantial
Extent of impact of disturbance: ☐None ☐ Minimal ☐ Moderate ☐ Extensive
Depth of disturbance and ponding/channeling: ☐ None ☐ <2" ☐ 2-4", some ponding/channeling ☐ >4" and ponding/channeling

**Redox Concentrations** - Do not score if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions (e.g., relict conditions). Consider depth to groundwater and if other water sources are altered or still sufficient to contribute to reducing conditions. **Extract a sample that is 18" deep from a representative area of the AA** where the soil has not obviously been disturbed. You may need to break open the soil sample to effectively see the rusty red redox concentrations. See Manual for guidance related to scoring soils with red parent material or other problematic soils.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Biogeochemical cycling excellent, with redox concentrations starting 0 to 6" from the soil surface and covering >10% of the surface area. |
| Good = 3 | Biogeochemical cycling good, with redox concentrations starting >6" to 12" from the soil surface and covering >10% of the surface area OR redox concentrations start 0-6" from the soil surface and represent <10% of the surface area. |
| Fair = 2 | Biogeochemical cycling fair, with redox concentrations starting >12" to 18" from the soil surface and covering >10% of the surface area OR redox concentrations start >6" to 12" from the soil surface and represent <10% of the surface area. |
| Poor = 1 | Biogeochemical cycling poor, with redox concentrations starting >12" to 18" from the soil surface and covering <10% of the surface area OR no redox concentrations within 18" of the soil surface. |

**Soil Organic Matter**- Do not score if the floodplain does not naturally have hydric soils and/or does not have functioning hydric soils under current conditions. Consider depth to groundwater and if other water sources are altered or still sufficient to contribute to reducing conditions. **Examine the extracted soil sample** for an organic surface horizon or determine features of the mineral surface layer(s).

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Organic surface horizon present (any thickness). |
| Good = 3 | Mineral surface layer(s) are ≥4" thick with matrix value ≤3 and chroma ≤2. |
| Fair = 2 | Mineral surface layer(s) are <4" thick with matrix value ≤3 and chroma ≤2. |
| Poor = 1 | Mineral surface layer(s) are <4" thick with matrix value >3 and ≤4 or chroma >2 and ≤3. |

**Microtopography- Estimate the percent** of the AA with an elevation change of at least 3" due to soil elevations and woody debris in an advanced stage of decomposition. Microtopography is often present as vegetated hummocks, raised areas that support tree trunks and roots, or nursery logs.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | More than 50% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |
| Good = 3 | 30-49% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |
| Fair = 2 | 10-29% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |
| Poor = 1 | <10% of the AA shows at least a 3" increase in elevation over the base elevation of the AA. |

**Organic Matter Accumulation**- Indicators will vary with season and KWH. **Estimate the percent cover** of herbaceous and woody plants, both living and dead residue **Estimate how much of the AA is covered by >1" of loose leaf litter OR by at least 5 stacked layers of decaying or wetted leaves.** When leaf litter depth is naturally lower, pick apart decaying or wetted leaves to determine if there are 5 or more stacked layers and estimate percent coverage.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Organic matter accumulation from root turnover/leaf litter is high as herbaceous and woody plant ground cover plus leaf litter covers >75% of the surface. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Good = 3 | Organic matter accumulation from root turnover/leaf litter is moderate as herbaceous and woody ground cover plus leaf litter covers >50-74% of the surface. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Fair = 2 | Organic matter accumulation from root turnover/leaf litter is low as herbaceous and woody ground cover plus leaf litter covers >25-50%. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |
| Poor = 1 | Organic matter accumulation from root turnover/leaf litter is minimal as herbaceous or woody ground cover plus leaf litter covers ≤25%. To count towards coverage, loose leaves must be at least 1" thick or decaying leaves must have at least 5 stacked layers. |

**Soil Disturbance**- Note impacts to the soil surface as indicated by bare soil, unless caused by natural factors or the soil is naturally bare. Look at the extent of impact across the AA and the greatest depth of the impact (including ponding or channeling of water).

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Little bare soil OR bare soil and soil disturbed areas are limited to naturally caused disturbances such as flood deposition, game trails, beaver activity, etc. OR soil is naturally bare. No human-caused impacts evident. |
| Good = 3 | Minor amounts or localized, small patches of bare or disturbed soil are present from factors such as cattle trampling or heavy grazing that leads to erosion, compaction or trampling by machinery, ruts or other disturbances from ATV or other vehicular activity, sedimentation due to human causes, or invasive earthworms. Extent of impact is minimal and greatest depth is limited to a few centimeters (a few inches) and does not show evidence of ponding or channeling of water. |
| Fair = 2 | Moderate amounts of bare or disturbed soil are present due to human-caused activities. Extent of impact is moderate and greatest depth may extend 5–10 cm (2–4 inches), with localized deeper ruts. Shows some evidence of ponding or channeling of water. |
| Poor = 1 | Substantial amounts of bare or disturbed soil are present due to human-caused activities. Impact is extensive with long-lasting impacts. Greatest depth of impact extends > 10 cm (4 inches); deeper ruts may be widespread and show some evidence of extensively altering hydrology (e.g., ponding or channeling of water). |

## HYDROLOGY (Section 4.5)

Hydrology is a complicated ecological factor to measure during a rapid assessment, as the evaluation of one metric partly relates to another. In this section, two aspects of the hydrology of the AA are scored by indicating the presence of natural and altered features of the Water Source and Hydroperiod and Hydrologic Connectivity. The scoring for these metrics varies depending on the type of KWH, so make sure you are using the correct scoring table. The Stream Bank and Channel metric, in contrast, is assessed for the entire project area using indicators of alteration as well as stabilization and recovery. Use the check boxes to capture features for scoring mentioned in the sections below. Obstructions, alterations, and point source discharges may be visible on aerial photos or other available imagery. LiDAR Hillshade images may assist with identifying existing channels and other relevant features.

**Water Source (Section 4.5.1)** This metric focuses on the forms and places of direct inputs of water to the AA, as well as any unnatural diversions of water from the AA or other features that affect saturation of the wetland. **Focus on the main source of water for this evaluation and use the scoring table for the correct KWH.** Note evidence of natural and unnatural/manipulated characteristics using the check boxes. Consider whether alterations are recent and if they are currently having a negative effect. Beaver activity, although it may have caused changes, should be considered as a natural change for scoring.

***Water Source***

☐ **Natural**: ☐ Sheet flow present ☐ Natural narrow channel present ☐ Mimics natural hydrology ☐ Coldwater spring flow ☐ Groundwater input ☐ Expected overbank flooding ☐ Expected plant community ☐ Other _____

☐ **Unnatural/Manipulated**: ☐ Impoundment ☐ Inflow from anthropogenic sources ☐ Fill ☐ Ditching ☐ Channelization ☐ Confined to small outlet ☐ Lost water sources due to alterations ☐ Multiple sources and some degraded ☐ Incised and no longer floods ☐Other_____

**Point Source Discharge** (into or adjacent to site): ☐ Lacking ☐ Minor ☐ Moderate ☐ Major

**Unnatural Obstructions** (to ground or surface water): ☐ None ☐ Minor (<25%) ☐ Moderate (25-75%) ☐ Major (>75%)

**Alteration to**: ☐Overland Flow ☐ Groundwater ☐ Overbank Flooding ☐ Plant Community ☐ Wetland Extent input

Timing: ☐ Recent (within 5 years) ☐ Historic ☐ Permanent hydrologic change

Negative effect: ☐ AA Flow and circulation ☐ Redirects or confines flows into/through AA ☐ Reduced water table ☐ Reduced inundation ☐ None

| **Observations/Comments:** | |
|---|---|
| **Coastal Plain Floodplain:** Groundwater discharge not a major input. For scoring, note stream bank alterations that will affect the riparian water source. | |
| **Score** | **Assign rating to category with majority of features present: SCORE _____** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. No unnatural obstructions to water source or impact on overland flow and overbank flooding. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Up to 25% of stream banks are affected due to dikes, rip rap and/or elevated culverts, or there is increased discharge due to other causes. Little change in plant community resulting from unnatural alterations. |
| Fair = 2 | Water sources are moderately impacted by anthropogenic sources but are still a mix of natural and non-natural sources. Between 25-75% of stream banks are affected (e.g., dikes, rip rap, concrete, and elevated culverts) or increased discharge due to other causes. Wetlands still present due to groundwater or other water inputs, but potentially reduced in extent and showing some plant community changes; or plant community changes due to increased unnatural water inputs. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. > 75% of stream banks are affected (for example due to dikes, rip rap, concrete, and elevated culverts) or increased discharge due to other causes. Wetlands are reduced in extent unless high groundwater or other surface water inputs maintain them. Plant community changes are observed due to unnatural water inputs. |
| **Coastal Plain Floodplain:** Mixed hydrologic regime with some input from groundwater and from precipitation or limited flooding | |
| **Score** | **Assign rating to category with majority of features present: SCORE _____** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. No unnatural obstructions to lateral or vertical movement of ground or surface water. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Little change in plant community resulting from unnatural alterations. |
| Fair = 2 | Water sources are moderately impacted by anthropogenic sources, but are still a mix of natural and non-natural sources. Wetland is still connected to its natural water source (e.g., modified ponds on a floodplain that are still connected to alluvial aquifers, natural stream channels that now receive substantial irrigation return flows, many small/few large storm drains), but moderately disconnected from floodplain due to multiple geomorphic modifications. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to increased unnatural water inputs. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. Wetland has reduced connection to natural water source (e.g., loss of overbank flow). Wetlands are potentially reduced in extent if no other surface water inputs maintain them. Plant community changes are observed due to unnatural water inputs. |
| **All other KWH:** Predominantly groundwater or precipitation water source, with potential limited flooding from small stream in relation to wetlands in riparian system | |
| **Score** | **Assign rating to category with majority of features present: SCORE _____** |
| Excellent = 4 | Water source is natural. Lacks point charge discharges into or adjacent to the site. Groundwater or precipitation dominant or only water source; otherwise, no unnatural obstructions to lateral or vertical movement of ground or surface water, or, if perched water table, impermeable soil layer is intact. Plant community reflective of characteristic KWH or not altered by natural changes to water source. |
| Good = 3 | Water source is mostly natural, but wetland directly receives occasional or small amounts of inflow from anthropogenic sources such as some road runoff, small storm drains, or other minor point source discharges emptying into the wetland. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features, such as levees or excessively high banks (less than 25% of the site). If perched, impermeable soil layer partly disturbed. Little change in plant community resulting from water source alterations. |
| Fair = 2 | Water source is moderately impacted by anthropogenic sources, but still a mix of natural and non-natural sources. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features or alteration. Between 25-75% of the site is restricted by barriers to drainage. If perched, impermeable soil layer moderately disturbed. Drainage back to the wetland is incomplete due to impoundment. Wetlands still present due to groundwater or other water inputs, but limited reduction in extent and showing some plant community changes; or some limited plant community changes due to water source alterations. |
| Poor = 1 | Water source contains a substantial amount of inflow from anthropogenic sources, such as major point source discharges into or adjacent to the wetland. Most or all water stages are contained within artificial banks, levees, or comparable features. Greater than 75% of wetland is restricted by barriers to drainage. If perched, impermeable soil layer strongly disturbed. Wetlands reduced in extent and show plant community changes due to water source alterations. |

**Stream Bank and Channel (Section 4.5.2)** Indicate the characteristics of the stream bank and channel for the project area using the check boxes below and additional lines as needed, including evidence of equilibrium, signs of recovery, channel and bank instability and their sources. **This score will apply to all AA in the project area.** Examples of field indicators of equilibrium, degradation, and aggradation are presented in the table at the end of this section. If available, indicate the Bank Erosion Hazard Index (BEHI) score, Near Bank Stress (NBS) score, and modeled inundation from storm events and use them in your scoring process. Use online resources (Section 3.1) to fill in the Benthic Index of Biotic Integrity (IBI) and Fish IBI Values and Ratings if available.

***Stream Bank and Channel***

**Evidence of bank/channel equilibrium**: ☐ Recovering to meander ☐ Low energy stream with bare banks ☐ Variety of pool depths ☐ Variety of stream velocities ☐ Visual flow of water from channel banks or wetlands (groundwater flow) ☐ Embedded woody debris of size and amount consistent with what is available in riparian area ☐ Well-defined usual high water line with obvious floodplain ☐ Little or no active undercutting or burial of riparian vegetation ☐ Braided channels ☐ Other _____

**Evidence of channel instability/migration**: ☐ Riparian vegetation buried ☐ Recent sediment or gravel deposited ☐ Active incision/downcutting ☐ Buried hydric soil and/or gravel layer and depth _____ ☐ Other _____

**Overall channel instability**: ☐None/minimal ☐ Minor ☐ Moderate ☐ Substantial

**Sources of channel instability/migration**: ☐ Lacks vertical controls (vegetation, wood, rock, etc.) ☐ Excessive channel deposition/bar development ☐Historic channel alteration ☐Proximity and landscape position presents potential impact to AA hydrology ☐ Other _____

**Evidence of bank instability**: ☐ Banks undercut, slides, and/or slumps ☐ Riparian vegetation declining ☐ Shrub/trees falling into channel ☐ Bank uniformly scoured and unvegetated ☐ Other _____

**Overall bank instability**: ☐ None ☐ Minimal ☐ Minor ☐ Moderate ☐ Substantial

**Sources of bank instability**: ☐ Vertical banks ☐ Highly erodible materials ☐ Raw unvegetated banks ☐ Excessive bedload ☐ Other _____

If available: Bank Erosion Hazard Index _____ Near Bank Stress _____

**Aquatic Life:** (if available for site or use nearest, most recent Biological Stream Survey point in stream):

Benthic IBI- Value _____ Rating: ☐ Good (≥ 4) ☐ Fair (3-3.99) ☐ Poor <3 Fish IBI- Value _____ Rating: ☐ Good (≥ 4) ☐ Fair (3-3.99) ☐ Poor <3

**Observations/Comments:**

**Stream Bank and Channel in Project Area (score applies to all AA in project area)**

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Indicators of channel equilibrium present. Minimal or no evidence of degradation or aggradation leading to channel instability or migration. Bank instability none or minimal. Channel is not unnaturally entrenched. If calculated, BEHI/NBS scores low. |
| Good = 3 | Minor channel incision. Channel is somewhat entrenched (overbank flow occurs during most floods). Some evidence of degradation or aggradation leading to a minimal level of channel instability or migration. Minor bank instability. If calculated, BEHI/NBS scores low. |
| Fair = 2 | Channel is incised. Channel is moderately entrenched (overbank flow only occurs during moderate to severe floods, functioning at risk). Uncharacteristic aggradation or degradation is present leading to a moderate level of channel instability or migration. Bank instability moderate. BEHI/NBS scores moderate. |
| Poor = 1 | Channel is incised. Channel is substantially entrenched (overbank flow never occurs or only during severe floods-not functioning). Channel entirely or extensively disconnected from the floodplain. Bank instability substantial. BEHI/NBS scores high, very high, or extreme. |

**Hydroperiod and Hydrologic Connectivity (Section 4.5.3)** This metric examines the characteristic frequency, level, and duration of wetland inundation or saturation, regardless of the source, and the ability of water to flow into or out of the wetland. **Use the scoring table for the correct KWH and check off what you observe below.** Estimate the hydroperiod variation based on visual indicators and soil redox. Indicators of changes in extent and duration of inundation or saturation are presented in the following table. If available, add information may for storm interval flooding, Bank Height Ratio, and Entrenchment Ratio.

***Hydroperiod and Hydrologic Connectivity***

**Natural variation of hydroperiod**: ☐ Low ☐ High

Information Sources: ☐Visual indicators ☐ Monitoring Wells ☐ Hydrology/Hydraulic analysis ☐ Bank Height Ratio _____ Entrenchment Ratio _____

**Overbank flooding** (if available): ☐ 2-year storm ☐ 10-year ☐ 100-year

**Degree of connection to floodplain**: ☐ Complete **Disconnection/entrenchment**: ☐ Minimal ☐ Moderate ☐ Disconnected and/or severely entrenched

**Evidence of overbank flooding**: ☐ Recent ☐ Evidence of overbank flooding ☐ Some evidence, likely during large storm events ☐ Generally no longer occurs

**Change/Alteration of hydroperiod**: ☐None ☐ Due to natural events ☐ Due to human influences: ☐ Minor ☐ Moderate ☐ Substantial

☐ Backwater flooding or lateral movement affected by restrictions: List restrictions: _____

**Observations/Comments:**

**Coastal Plain Floodplain** Note: Recent beaver activity may lead to deviations from rating descriptions. This should be noted in the comments.

Low natural variation of hydroperiod _____ High natural variation of hydroperiod_____

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Evidence of recent overbank flooding. Completely connected to floodplain (backwater sloughs and channels). No major hydrologic stressors present that impact natural hydroperiod or impact due to natural events (e.g., beaver dams). No unnatural obstructions to lateral or vertical movement of ground or surface water. |

| | |
|---|---|
| Good = 3 | Evidence of overbank flooding. Minimally disconnected from floodplain. Minor alterations in frequency, levels, or duration of hydroperiod. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Flooding at 2-year storm interval. |
| Fair = 2 | Some evidence of overbank flooding, likely during larger storm events. Moderately disconnected from floodplain due to multiple geomorphic modifications. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. Moderate flooding at 10-year storm interval. |
| Poor = 1 | Overbank flooding generally no longer occurs. Disconnected from floodplain, likely causing some drainage of groundwater. Flooding may or may not occur at 100-year or greater storm interval. |

**Other KWH**
Low natural variation of hydroperiod _____ High natural variation of hydroperiod_____

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Overbank flooding present and recent but not predominant water source to wetland. No unnatural obstructions to lateral or vertical movement of ground or surface water. |
| Good = 3 | Evidence of overbank flooding but not predominant water source to wetland. Hydroperiod with minor alterations in frequency, levels, or duration due to groundwater and other inputs. Minor restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. |
| Fair = 2 | Some evidence of overbank flooding, likely during larger storm events. Hydroperiod with moderate alterations in frequency, levels, or duration due to groundwater and other inputs. Moderate restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. |
| Poor = 1 | Overbank flooding generally no longer occurs. Hydroperiod with substantial alterations in frequency, levels, or duration due to groundwater and other inputs. Substantial restrictions to the lateral or vertical movement of ground or surface waters by unnatural features. |

| **Condition** | **Field Indicators for Stream Bank and Channel and Hydroperiod for Coastal Plain Floodplain** |
|---|---|
| Indicators of Channel Equilibrium | ● The channel (or multiple channels in braided systems) has a well-defined usual high water line, or bankfull stage, that is clearly indicated by an obvious floodplain. A topographic bench represents an abrupt change in the cross-sectional profile of the channel throughout most of the site.<br>● The usual high water line (consistent with ACOE ordinary high water mark) or bankfull stage corresponds to the lower limit of riparian vascular vegetation.<br>● The channel contains embedded woody debris of the size and amount consistent with what is available in the riparian area.<br>● There is little or no active undercutting or burial of riparian vegetation. |
| Indicators of Active Degradation (Erosion) | ● Portions of the channel are characterized by deeply undercut banks with exposed living roots of trees or shrubs. There are abundant bank slides or slumps, or the banks are uniformly scoured and unvegetated.<br>● Riparian vegetation may be declining in stature or vigor, and/or riparian trees and shrubs may be falling into the channel.<br>● The channel bed lacks any fine-grained sediment (unless it is the dominant bank material).<br>● Recently active flow pathways appear to have coalesced into one channel (i.e., a previously braided system is no longer braided). |
| Indicators of Excessive Aggradation (Sedimentation) | ● The channel through the site lacks a well-defined usual high water line.<br>● There is an active floodplain with fresh splays of excessive sediment covering older soils or recent vegetation.<br>● There are partially buried tree trunks or shrubs.<br>● Excessive cobbles and/or coarse gravels have recently been deposited on the floodplain.<br>● There are partially buried, or sediment-choked, culverts. |
| **Condition** | **Hydroperiod Field Indicators for Other KWH Types** |
| Reduced Extent and Duration of Inundation or Saturation | ● Upstream diversions, impoundments, pumps, ditching, or draining from the wetland.<br>● Water withdrawal (wells).<br>● Evidence of aquatic wildlife mortality.<br>● Encroachment of terrestrial vegetation.<br>● Encroachment of young, tall, vigorous trees if not usually present, shading of underlying mosses.<br>● Stress or mortality of hydrophytes or sphagnum.<br>● Compressed or reduced plant zonation.<br>● Organic soils occur well above contemporary water tables.<br>● Increased discharges resulting in channel downcutting. |
| Increased Extent and Duration of Saturation | ● Berms, dikes, or other water control features that increase duration of ponding (e.g., pumps).<br>● Diversions, ditching, or draining into the wetland.<br>● Late-season vitality of annual vegetation. |

| | |
|---|---|
| | • Recently drowned riparian or terrestrial vegetation (e.g., beaver-created impoundment).<br>• Extensive fine-grained deposits on the wetland margins. |

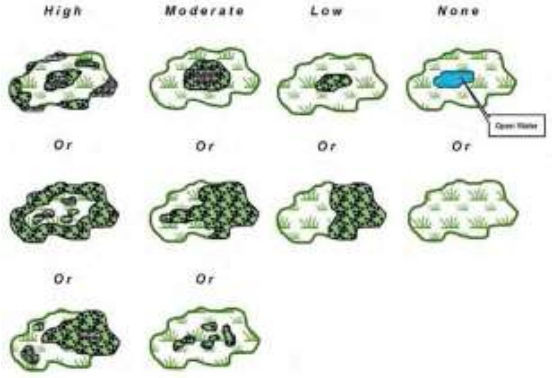
## KEY WILDLIFE HABITAT AND VEGETATION COMPOSITION (Section 4.6)

Vegetation structure and composition are of particular interest for assessing the condition of Key Wildlife Habitats because they directly support the ecological needs of animal and plant species of concern. In this section, metrics provide information on the interspersion of vegetation patches, habitat features/evidence of animal use, vertical structure, and standing and downed woody debris (standing tree snags and downed trees and branches). Vegetation data collected previously or simultaneously using standard wetland delineation methods are used to document vegetation composition and can be used to assess most metrics. Scores are assigned to reflect the presence and extent of invasive and native plant species in herbaceous and woody layers, including the presence of native species that are diagnostic (Section 4.3) and indicative of disturbance. Additionally, any plant species listed as rare, threatened, or endangered in Maryland should be identified (see Manual for source of current list). **These species should be noted on the data sheet even if they are not dominant**. A Floristic Quality Assessment will be calculated using the Excel data sheet or as otherwise described in the Manual. **Expected conditions vary by Key Wildlife Habitat for some metrics- use the correct scoring tables.**

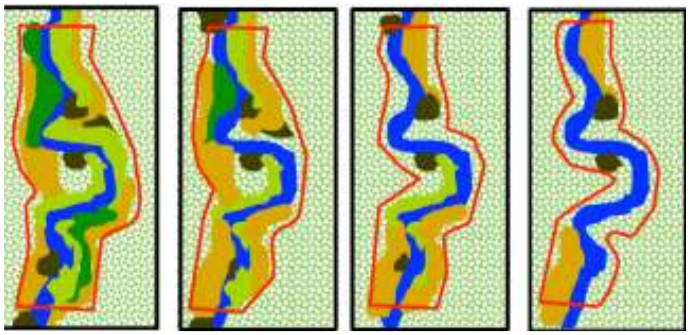
**Interspersion and Patch Richness (Section 4.6.1)** For this metric, interspersion and patch richness will be scored separately and then averaged for a final score. Interspersion is assessed within the AA but patch richness is assessed within the AA and out to 10m around the AA on each side.

**Interspersion:** The figures below show a range of patterns for the interspersion of vegetation patches for different Key Wildlife Habitats. Different vegetation types, such as hummocks, sphagnum, shrub areas, patches of herbaceous vegetation, and patches or lines of trees of different heights or ages, should be noted. **Select the diagram below for the appropriate KWH** to determine a score for this metric. To be considered, vegetative patches should represent at least 5% of the AA in single or multiple locations. This metric is often reflective of the topographic complexity metric in many wetland types. Record the score on the next page.

**Coastal Plain Seepage Swamp, Coastal Plain Seepage Bog and Fen, Coastal Plain Flatwood and Depression Swamp, Vernal Pool, Spring**. (Source: USACE 2015 Texas Rapid Assessment Method)
***Scoring*: High = 4** Vegetation patches are large and intertwined or numerous and scattered
**Moderate = 3** At least two types of vegetation patches are present but patches are slightly smaller or less scattered/intertwined than "High" category
**Low = 2** Two types of vegetation patches are present but in smaller, very localized, and/or isolated patches
**None = 1** Only one type of vegetation patch is present




**Coastal Plain Floodplain**: The red box represents the boundary of the AA and each color represents a unique plant zone such as shrub areas, patches of herbaceous vegetation, or tree clumps of different ages or heights. The speckled background represents the background matrix of vegetation and the blue line represents the stream. For multithread stream systems, evaluate the channel with the highest complexity of plant zones for scoring. (Source: California Rapid Assessment Methods for Wetlands Riverine Wetlands Field Book 2013)
**Scoring: A = 4** High complexity of scattered and intertwined plant zones
**B = 3** Moderate complexity of intertwined plant zones
**C = 2** Minimal complexity of plant zones with little interspersion
**D = 1** Few plant zones with localized, isolated patches



**A** **B** **C** **D**

**Patch Richness:** Patch richness provides a measure of components that represent potential wildlife habitat. **Check the following features off below if they are present in the AA or within 10 m (33 feet) of the AA boundary**. Count the number of features present. Also indicate the presence of any observed wetland- or stream-associated animals such as frogs, waterbirds, crayfish, fish, mussels, etc. using the check boxes. Record the score on the next page.

**Features present**: ☐ Spring or upwelling groundwater ☐ Depression ☐ Vegetated pool ☐ Unvegetated pool ☐ Unvegetated flat ☐ Island ☐ Animal mound or burrow ☐ Beaver dam or lodge ☐ Beaver-chewed vegetation ☐ Oxbow, swale, secondary channel ☐ Wind-thrown tree hole ☐ Mound ☐ Bank overhang with tree roots ☐ Tip-up tree root mound ☐ Brush piles ☐ Abundant deciduous leaf litter ☐ Partially buried natural debris ☐ Debris jam ☐ Plant hummock/tussocks ☐Other wildlife habitat Wildlife species observed:_____

| Score | Coastal Plain Floodplain, Coastal Plain Seepage Bog and Fen, Coastal Plain Seepage Swamp | Coastal Plain Flatwood and Depression Swamp | Vernal Pool/Spring |
|---|---|---|---|
| **4** | ≥ 6 | ≥ 7 | ≥ 4 |
| **3** | 5 - 6 | 6 - 7 | 3 - 4 |
| **2** | 3 - 4 | 4 - 5 | 2 |
| **1** | < 3 | < 4 | <2 |

**Interspersion and Patch Richness Score:** Calculate the mean of the Interspersion and Patch Richness metrics below. Use the table to assign an overall score for this metric**.**

| Score | Mean of Interspersion and Patch Richness Metric Scores |
|---|---|
| Excellent = 4 | 3.5 – 4 |
| Good = 3 | 2.6 - 3.4 |
| Fair = 2 | 1.6- – 2.5 |
| Poor = 1 | 1 – 1.5 |

**Interspersion Score: _____**

**Patch Richness Score: _____**

**Mean of Interspersion and Patch Richness Scores:_____**

**Overall Score for Metric (see table at left): _____**

**Observations/Comments:**

**Vertical Structure (Section 4.6.2)** This metric provides an assessment of the overall structural complexity of vegetation layers, including presence of multiple strata, age and structural complexity of canopy layer, and effects of disease or mortality on structure. **Assess within the AA and out to 10m (33 feet) of the AA boundary.** Forested KWH are assessed differently than non-forested KWH (Coastal Plain Seepage Bog and Fen). As **beaver activity** can impact vertical structure, the vertical structure in the surrounding area and previous structure as indicated by snags and downed trees should be considered when assigning a score. Note the presence of these changes below. **Vernal Pools and Springs** are expected to have only sparse woody and/or herbaceous vegetation in the basin area, if any. For these KWH, assess the vertical structure in the surrounding area. For **Coastal Plain Seepage Bog and Fen**, an evaluation of the integrity of dominant growth forms is made (e.g., whether shrubs have been removed, killed, or increased or if the herbaceous layer has been reduced or homogenized by stressors). **Check off the features present and use the correct KWH table.**

**Forested systems: Canopy**: Heterogeneous patches of different ages or sizes: ☐ Yes ☐ Mostly ☐ Somewhat ☐ No
☐ Gaps of varying sizes ☐ Impacted by beaver activity ☐ Impacted by forest pests/pathogens
**Woody vertical layers**: ☐ Multiple layers present ☐ One layer missing or homogeneous ☐ >1 layer missing, little variation ☐ Only 1-2 layers present
**Large trees** (DBH > 60 cm or 24") present: ☐ ≥10% ☐ <10%
**Trees present** with DBH > 30 cm or 12": ☐ ≥ 20% ☐ < 20%
**Degradation** due to cutting, browsing, pests/pathogens: ☐ Minimal ☐ Moderate ☐ Extensive Source(s) of degradation: _____
**Bog and Fen systems**: **Woody layer mortality (if layer present)**: ☐ Due to natural factors ☐ Minor human-caused ☐ Moderate human-caused
☐ Extensive human- caused ☐ Impacted by forest pests/pathogens ☐ Impacted by browsing/grazing
**Expected structure**: ☐ Present ☐ Minor alteration ☐ Moderate Alteration ☐ Extensive Alteration

**Observations/Comments:**

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp**
**Vernal Pool and Spring:** only assess structure in area surrounding basin- limited to sparse herbaceous vegetation is usually present in the basin area.
Note: Recent beaver activity may lead to deviations from rating descriptions for Coastal Plain Floodplain. This should be noted in the comments.

| Score | Assign rating to category with majority of features present: SCORE _____ |
|---|---|
| Excellent = 4 | Tree canopy or highest woody level present is a heterogeneous mosaic of patches of different ages or sizes. Gaps of varying size. Multiple layers are created through the presence of trees of varying ages and heights and the shrub layer. Large trees (> 60 cm or 24" dbh) expected to be present (≥ 10% of trees present). If large trees are absent, few or no large stumps are present and there is evidence of a natural disturbance event (e.g., large downed wood from wind storms, fire scars, beaver activity, tree senescence). Little impact from deer browse. |
| Good = 3 | Tree canopy or highest woody level present is largely heterogeneous in age or size. Multiple layers are present, but one layer missing or little variation in ages and heights of woody vegetation in at least one layer. Less than 10% of trees present are large trees (>60 cm or 24" dbh) due to human activities. At least 20% of trees present are >30 cm or 12" dbh. Minor presence of cutting, browsing, grazing and other degradation |

| | |
|---|---|
| | such as forest pest/pathogens. If large trees are absent, few or no large stumps are present and there is evidence of a natural disturbance event (e.g., large downed wood from wind storms, fire scars, beaver activity, tree senescence). Little impact from deer browse. |
| Fair = 2 | Tree canopy or highest woody level present is somewhat homogeneous in age or size. More than one layer present, but one or more layers missing. Little variation in ages and heights of woody vegetation in layers. Less than 20% of trees present are >30 cm or 12" dbh are present. Moderate levels of cutting, browsing, or grazing, or other degradation such as forest pest/pathogens has caused the loss of larger trees rather than a natural disturbance event. |
| Poor = 1 | Tree canopy or highest woody level present is very homogeneous in age or size. Only one or two layers present due to human activities. Most, if not all, larger trees (dbh 30-60 cm or 12-24") have been removed. Major cutting, heavy browsing, grazing, or other degradation such as forest pest/pathogens. |

**Coastal Plain Seepage Bog and Fen**

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Mortality of woody vegetation, if present, is due to natural factors such as wind storms or senescence. Excellent potential for site recovery given structure present and lack of degradation (past or present).<br>Bogs/acidic fens: Peatland structure includes shrub and herb strata (some tall and some short). When present (peatland not too wet), trees are relatively short and stunted with rounded tops and furrowed bark. Shrubs are < 50 cm and open enough to allow for a nearly continuous ground cover of *Sphagnum* and other expected vegetation around tree/shrub bases AND in low hummocks, hollows, or other low areas.<br>Circumneutral/rich fens: Primarily short-statured vegetation and nearly continuous cover of mosses (except in tall sedge fens - which are naturally more vigorous, homogenous, and often with little bryophyte cover). Shrubs may be present as a mosaic with open areas. Tree species, when present, do not form a closed canopy. *Sphagnum* and other mosses actively growing. Never more than local, small patches of degenerating *Sphagnum*. |
| Good = 3 | Minor negative anthropogenic influences present, or the site is still recovering from major past human disturbances. Mortality or degradation due to grazing, peat mining, limited timber harvesting, or other anthropogenic factors may be present, though not widespread. The site can be expected to meet minimally disturbed conditions in the near future if negative influences do not continue.<br>Bogs/acidic fens: Shrubs and herbs show minor alterations from expected conditions. A few areas of dense and tall shrubs (> 1 m) may occur (dense enough to eliminate *Sphagnum*/moss growth). Some trees may have been or killed due to anthropogenic stressors.<br>Circumneutral/rich fens: Shrubs and herbs show minor alterations from expected conditions. |
| Fair = 2 | Expected structural classes are not present. Shrubs and herbs moderately altered from expected conditions. The site will recover to minimally disturbed conditions only with the removal of degrading influences and moderate recovery times.<br>Bogs/acidic fens: Shrub cover averages > 1 m tall and is beginning to reduce *Sphagnum* cover. Many trees have been cut or killed due to anthropogenic stressors.<br>Circumneutral/rich fens: Trampling or other physical disturbance has moderately reduced moss cover where expected. Overall, evidence of degradation includes moderate levels of cutting, mowing, browsing, fire or grazing. *Sphagnum* still regenerating in open areas. |
| Poor = 1 | Expected peatland structure is absent or much degraded due to anthropogenic factors, such as peat mining. Overall, evidence of degradation includes major cutting, mowing, browsing, fire or grazing. Woody regeneration is minimal and existing structure is in poor condition, unnaturally sparse, or depauperate. Shrubs and herbs substantially altered from expected conditions. Recovery to minimally disturbed condition is questionable without restoration, or will take many decades.<br>Bogs/acidic fens: Most if not all *Sphagnum* cover has been eliminated due to extremely dense and tall (> 1 m) shrubs. Trees have all been cut or killed by anthropogenic stressors.<br>Circumneutral/rich fens: Trampling or other physical disturbance has eliminated moss cover where it is expected. *Sphagnum* not regenerating, even in open areas. |

**Standing and Downed Coarse Woody Debris (Section 4.6.3)** Standing or fallen woody debris (snags and downed branches and trees) plays a critical role in riparian systems. Estimation of coarse woody debris should be based on a walkthrough of the entire AA if possible. For large AA, estimation along transects may be preferred. Use the check boxes below to indicate features present for the correct KWH. In forested KWH, pay special attention to the amount of coarse woody debris when surveying the AA and note the creation of woody debris from cutting, pests/pathogens, or other factors. Riverine wetlands that have incised banks, no longer experience flooding, experience overgrazing, or are no longer at a dynamic equilibrium may lack coarse woody debris. For wetlands dominated by shrub and herb layers, note the quantity and distribution of litter compared with the baseline that may be expected in the landscape. Active floodplain systems are typically low in litter. As **Vernal Pools and Springs** may have only scattered woody debris, evaluate both the basin and the surrounding area. Peatlands are dominated by peat-forming species which contribute enough litter and debris to maintain carbon dynamics, playing a critical role in these systems that may naturally include little coarse woody debris.

**Forested systems: Standing snags and downed logs: Size diversity**: ☐ High ☐ Moderate ☐ Moderate-low ☐ Low

**Stage of downed log decay**: ☐ Variable including advanced stage ☐ Variable with few advanced ☐ Variable with no advanced ☐ Low variability

Source(s) of woody debris if not natural (cutting, pest/pathogens, etc.): _____

**Bog and Fen systems: Woody and/or litter**: ☐ Typical peat accumulation ☐ Human-caused alteration Minor ☐ Moderate ☐ Substantial ☐ Impacted by forest pests/pathogens

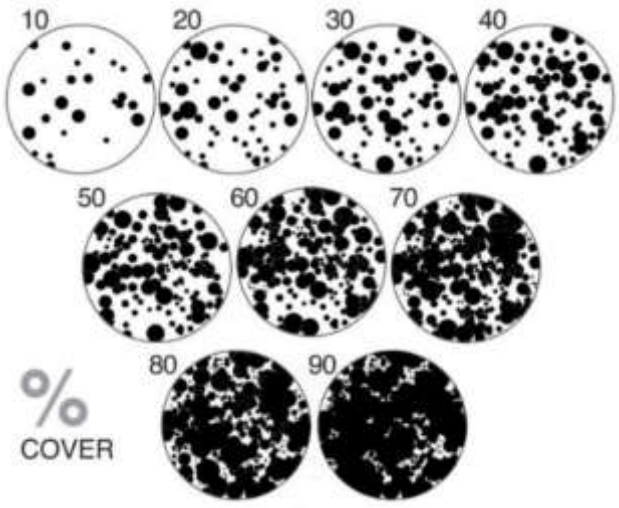
**Ground cover alterations**: ☐ None ☐ Minor ☐ Moderate ☐ Substantial

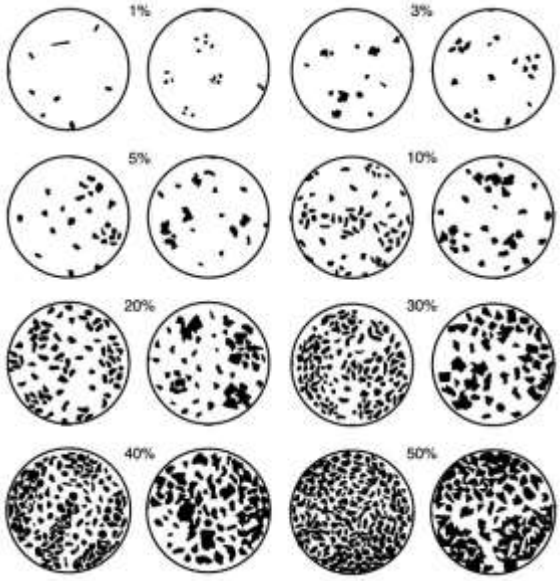
**Observations/Comments:**

| **Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp**<br>**Vernal Pool and Spring:** assess presence in immediate surrounding area as well as the basin. | |
|---|---|
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Wide diversity of sizes for both standing and downed logs, including larger sizes [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] present with 5 or more snags per ha (2.5 ac), but not excessive numbers (suggesting disease or other problems). Downed logs are in various stages of decay, from sound and intact to soft pieces that no longer maintain their shape. |
| Good = 3 | Moderate diversity of sizes for both standing and downed logs, but larger sizes [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] are rare. Larger size class present with 2-4 snags per ha, or an increased but not excessive number of snags (suggesting disease or other problems). Downed logs are in various stages of decay, with few soft pieces that no longer maintain their shape. |
| Fair = 2 | Moderate-low diversity of sizes for both standing and downed logs, but larger sizes [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] very rare or not present. Larger size class present with 1-2 snags per ha, or moderately excessive numbers (suggesting disease or other problems). Downed logs are in various stages of decay, but few to no soft pieces that no longer maintain their shape. |
| Poor = 1 | Low diversity of sizes for both standing and downed logs. Larger size class [> 30 cm (12 in) diameter and > 2 m (6 ft) long)] present with < 1 snag per ha, or very excessive numbers (suggesting disease or other problems). Downed logs are mostly in early stages of decay. |

| **Coastal Plain Seepage Bog and Fen** | |
|---|---|
| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
| Excellent = 4 | Typical of the system. Woody vegetation mortality is due to natural factors. Peat accumulation appears to be stable or actively growing.<br>Bogs/acidic fens: *Sphagnum* is nearly continuous and growing around tree/shrub bases AND in low hummocks, hollows, or other low areas.<br>Circumneutral/rich fens: Dominant species are active peat-formers. |
| Good = 3 | Minor alterations to system present.<br>Bogs/acidic fens: Mortality or degradation of peat surface due to grazing, limited timber harvesting, anthropogenic fire or other anthropogenic factors may be present, but not widespread.<br>Circumneutral/rich fens: Mortality or degradation of peat surface due to grazing, limited timber harvesting, anthropogenic fire or other anthropogenic factors may be present, but not widespread. |
| Fair = 2 | Moderate alterations to system present.<br>Bogs/acidic fens: Ground cover has as much bare peat as *Sphagnum* cover, or nearly so.<br>Circumneutral/rich fens: Dominance of active peat-formers is being reduced in favor of non-peat-forming grasses and forbs. |
| Poor = 1 | Substantial alterations to system present.<br>Bogs/acidic fens: Ground cover is almost all bare peat with very little *Sphagnum* cover.<br>Circumneutral/rich fens: Cover of active peat-formers dramatically reduced and site is now dominated by non-peat-forming grasses and forbs. |

**Vegetation Composition (Section 4.6.4)** Vegetation of the AA is characterized using the five strata version of the wetland delineation determination (USACE 2010). The species composition is assessed relative to the species expected in each stratum for the KWH. **The coverage of invasive species and native species (both diagnostic and those indicative of disturbance) should be noted even if they are not dominant species in the AA.** These species are listed in Section 4.3. State rare species should be noted. In addition, the sources of stressors or alterations to the native plant community should be noted on the data sheet as well as suggestions for improving native species cover. The diagrams below may be useful to assist with the estimation of percent cover.




**% Cover Estimation Diagrams** *(johnmuirlaws.com and Terry and Chilingar 1955)*

**VEGETATION** Additional species may be listed on a separate sheet. See cover examples above.

**NOTE: Include all invasive (Section 4.6.5), native indicator (Section 4.3), disturbance indicator (Section 4.6.5), and state rare, threatened, and endangered species regardless of % cover.**

| Species: | Absolute % Cover | Species: | Absolute % Cover |
|---|---|---|---|
| **Tree Stratum: woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger DBH** | | | |
| 1. | | 6. | |
| 2. | | 7. | |
| 3. | | 8. | |
| 4. | | 9. | |
| 5. | | 10. | |
| **Sapling Stratum: woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH** | | | |
| 1. | | 4. | |
| 2. | | 5. | |
| 3. | | 6. | |
| **Shrub Stratum: woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height** | | | |
| 1. | | 6. | |
| 2. | | 7. | |
| 3. | | 8. | |
| 4. | | 9. | |
| 5. | | 10. | |
| **Herb Stratum: all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height** | | | |
| 1. | | 8. | |
| 2. | | 9. | |
| 3. | | 10. | |
| 4. | | 11. | |
| 5. | | 12 | |
| 6. | | 13. | |
| 7. | | 14. | |
| **Woody Vine Stratum: all woody vines, regardless of height** | | | |
| 1. | | 4. | |
| 2. | | 5. | |
| 3. | | 6. | |

**Invasive Species (Section 4.6.5)** Invasive species are non-native species that can spread into natural ecosystems, where they can displace native species and cause major alterations to KWH. The most common plant invasive species in Coastal Plain stream-associated wetlands are *Microstegium vimineum, Glechoma hederacea, Rosa multiflora, Lonicera japonica, Ligustrum sinense, Phalaris arundinacea,* and *Phragmites australis*. *Murdannia keisak* may also be present. Identification references and additional species can be found in the Manual. Note the cover of invasive species below. Scoring for Vernal Pools and Springs should use observations from the basin and surrounding area, as only limited sparse vegetation may be present in the basin.

**Maximum invasive species cover in any one woody layer (if present)**: ☐ <1% ☐ 1- 5% ☐ >5-10% ☐ >10%
**Absolute cover of invasive/disturbance species in herbaceous layer**: ☐ <1% ☐ 1-5% ☐ >5-30% ☐ >30%

**Observations/Comments:**

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp, Coastal Plain Seepage Bog and Fen**

**Vernal Pool and Spring**: assess vegetation structure in area surrounding basin, as only limited to sparse vegetation may be present in the basin area.

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Invasive species are absent from all layers or absolute cover in any one woody layer (if present) and herbaceous layer is <1%. |
| Good = 3 | Invasive species are sporadic (no more than 1-5% absolute cover in any layer). |
| Fair = 2 | Absolute cover of Invasive species is >5-10% in any one woody layer (if present) and/or present with moderate absolute cover (>5-30%) in the herbaceous layer. Patches of native vegetation are reduced in size and complexity due to the presence of invasive species. |
| Poor = 1 | Absolute cover of Invasive species is over 10% in any one woody layer (if present) and/or is very abundant (over 30%) in the herbaceous layer. Vegetation reduced in size and complexity due to human disturbance. Patches of native vegetation are reduced in size and complexity due to the presence of invasive species. |

**Native Species (Section 4.6.6)** The presence and composition of native plant species provides an indication of KWH ecological integrity and how well the AA supports a diversity of native animal species. This metric uses the presence of indicator species and characteristic native species for the KWH in the AA (see table below) as well as the presence of native species that indicate human disturbance. Metrics are adjusted for Coastal Plain Seepage Bog and Fen systems and some Spring KWH due to the importance of *Sphagnum*. Indicate the species and stressors present in the AA using the check boxes below and provide suggestions for improvement.

**Native Species Indicative of Disturbance:** These species are those that seem to be more or less weedy and not picky about habitat, or they occur in young, often heavily altered wetland communities. Note the percent cover of these species to help assess the site and to assist with scoring.

| | |
|---|---|
| *Phalaris arundinacea* | *Dichanthelium boscii* |
| *Typha latifolia* | *Dichanthelium sphaerocarpon* |
| *Elymus glabriflorus* | *Paspalum floridanum* |
| *Muhlenbergia schreberi* | *Echinochloa muricata* |
| *Carex blanda, C. frankii* | *Coleataenia anceps* |
| *Dichanthelium scoparium* | *Panicum dichtomiflorum* |

**Woody layer (if present):** ☐ Dominated by diagnostic native species ☐ Some diagnostic species absent/reduced ☐ Few diagnostic species ☐ Few/no diagnostic species present

**Herbaceous layer**: ☐ Dominated by diagnostic native species ☐ Some diagnostic species absent/reduced ☐ Few diagnostic species ☐ Few/no diagnostic species present

**Cover of native species indicative of disturbance**: ☐ 0-1% ☐ 2-10% ☐>10-30% ☐ >30%

**Bog and Fen/Springs: Sphagnum cover** - ☐ Continuous/abundant ☐ Absent from small areas ☐ Reduced ☐ Very low

**Alterations/Stressors: Indicate stressors and alterations affecting the observed vegetation composition of the AA.**

☐ Recent timber harvest (clearcut or selective cut) ☐ Tree plantation ☐ Mowing or shrub cutting ☐ Herbicide use ☐ Trampling/ORV ☐ Excessive animal herbivory ☐ Pest damage ☐ Unnatural fire regime ☐ Trash/dumping

☐ Other_____

**Suggestions for improving native species cover and natural vegetation composition**_____

_____

**Observations/Comments:**

**Coastal Plain Floodplain, Coastal Plain Flatwood and Depression Swamp, Coastal Plain Seepage Swamp, Coastal Plain Seepage Bog and Fen** (see information on second and third pages for diagnostic native species and those that indicate disturbance)

**Vernal Pool and Spring**: assess vegetation structure in area surrounding basin, as only limited to sparse vegetation is usually present in the basin area.

**Note:** Recent beaver activity may lead to deviations from rating descriptions for Coastal Plain Floodplain. This should be noted in the comments and considered in assignment of the score.

| **Score** | **Assign rating to category with majority of features present:** **SCORE _____** |
|---|---|
| Excellent = 4 | Herbaceous and woody layers (if present) dominated by diagnostic native species. Layers may be sparse and patchy in areas with deeper flooding, with patches of vegetation confined to hummocks. In other areas, diverse native vegetation present unless there has been a recent natural disturbance.<br><br>Bog and Fen, some Springs: *Sphagnum* is nearly continuous and growing around tree/shrub bases AND in low hummocks, hollows, or other low areas. |
| Good = 3 | Some diagnostic native species absent or substantially reduced in abundance OR low cover (<10%) of native species indicative of human disturbance. Layer may be sparse and patchy in areas with deeper flooding.<br><br>Bog and Fen, some Springs: *Sphagnum* and other mosses actively growing, but may be eliminated from some areas due to disturbance or invasive species. |
| Fair = 2 | Few diagnostic species are present. Native species indicative of human disturbance are present with moderate cover (10-30%). Patches of native vegetation are reduced in size and complexity due to human disturbance.<br><br>Bog and Fen, some Springs: *Sphagnum* cover reduced but still regenerating in open areas. Dominance of active peat-formers is being reduced in favor of non-peat-forming grasses and forbs. |
| Poor = 1 | Few to no diagnostic species are present. Native species indicative of human disturbance are present with >30% cover. Patches of native vegetation are reduced in size and complexity due to human disturbance. |

| | |
|---|---|
| | Bog and Fen, some Springs: Very little *Sphagnum* cover. Cover of active peat-formers dramatically reduced and site is now dominated by non-peat-forming grasses and forbs: |

**Floristic Quality Assessment (Section 4.6.7)** This method derives an estimate of nativity or habitat quality based on a combination of the tolerance to disturbance or environmental stress and the fidelity of individual plant species to specific habitats (coefficient of conservatism or C-value). These values will be calculated according to the procedure in the Manual using the list of plant species identified on the AA. The Excel data sheet file will calculate the required values if the plant species are entered into the Excel file. Note the calculated values and score below. The Adjusted FQI is not scored but provides information on the influence of disturbance on the quality of the habitat being evaluated.

**Native mean C-value** _____
4 = Excellent: Value >4 3 = Good: Value of 3-4 2 = Fair: Value of <3-2 1 = Poor: Value of <2

**Adjusted FQI** _____

**SCORE** _____

## Calculation of Final Key Wildlife Habitat Ecological Integrity Assessment Score (Section 5)

The major components of the EIA include four core factors: landscape, soil/substrate, hydrology, and KWH and vegetation composition. The previously scored metrics that pertain to these core factors should be entered into the Scoring Form on the next page. To calculate Mean Core Factor Scores, add up the Metric Scores for that Core Factor and divide by the number of Metrics. Note that if only Microtopography, Organic Matter Accumulation, and Soil Disturbance were scored for the Soil/Substrate Core Factor, you will divide by 3 rather than 5. The Core Factors are weighted for the calculation of overall scores for the AA to reflect their relative importance to the ecological integrity and function of Key Wildlife Habitats and the species that they support. Multiply the Weighting Factor and the Mean Core Factor Score to get the Overall Core Factor Scores. Sum these values to calculate the Overall KWH Ecological Integrity Assessment Score. To rate the AA in terms of its overall ecological integrity, use the table below.

| Numerical Score | Rating |
|---|---|
| 3.5 – 4 | Excellent |
| 2.5 – 3.49 | Good |
| 1.5 – 2.49 | Fair |
| 1 – 1.49 | Poor |

**Use the check boxes on the Scoring Form to note if any of the additional features are present** from the sources indicated as described in the Manual (Sections 3.5 and 5.1)**. If the EIA score is not "Excellent",** add additional points for unique resources present at the project area according to the instructions on the Scoring Form to calculate the Final Key Wildlife Habitat Ecological Integrity Assessment Score and Rating for the AA.

### Additional remarks and scoring rationales or challenges:

## MARYLAND WETLAND ECOLOGICAL INTEGRITY ASSESSMENT: Coastal Plain Region SCORING FORM

**Project/Site Name:**_____ **City/County:**_____ **Sampling Date:**_____

**Assessment Area Name (if >1 AA):** _____ **Observer(s):**_____

***Scoring Scale: 3.5- 4 = Excellent 2.5-3.49 = Good 1.5-2.49 = Fair 1-1.49 = Poor***

| Core Factor | Metric | Metric Score | Mean Core Factor Score | Weighting Factor | Overall Core Factor Score (Mean Core Factor Score X Weighting Factor) |
|---|---|---|---|---|---|
| Landscape (Assessment for project area) | Buffer Perimeter | | (Sum of metric scores: _____) / 4 = _____ | 0.3 | |
| | Buffer Condition | | | | |
| | Aquatic Context | | | | |
| | Comparative Size | | | | |
| Soil/Substrate* * If only Microtopography, Organic Matter Accumulation, and Soil Disturbance were scored, divide by 3 rather than 5 | Redox Concentrations | | (Sum of metric scores: _____) / 5 or /3* = _____ | 0.1 | |
| | Microtopography | | | | |
| | Soil Organic Matter | | | | |
| | Organic Matter Accumulation | | | | |
| | Soil Disturbance | | | | |
| Hydrology | Water source | | (Sum of metric scores: _____) / 3 = _____ | 0.2 | |
| | Channel | | | | |
| | Hydroperiod and Hydrologic Connectivity | | | | |
| Key Wildlife Habitat and Vegetation Composition | Interspersion/Patch Richness | | (Sum of metric scores: _____) / 6 = _____ | 0.4 | |
| | Vertical Structure | | | | |
| | Coarse Woody Debris | | | | |
| | Invasive Species | | | | |
| | Native Species Composition | | | | |
| | Floristic Quality Assessment | | | | |
| **Sum of Overall Core Factor Scores = <u>Overall KWH Ecological Integrity Assessment (EIA) Score:</u>** | | | | | |

**Note the presence of these features in the project area using the check boxes.**
**Add additional points <u>IF</u> the Overall EIA score is not "Excellent"** for each of the following:

<u>From WRR layers (see Manual Section 3.5): Mark all categories present in WRR layers. Assign the single highest score for a maximum of +0.2 for WRR layers:</u>

☐ Nontidal Wetlands of Special State Concern (+ 0.2)
☐ Biodiversity Conservation Network Tier 1, 2, or 3 (+ 0.2)
☐ Forest Interior Dwelling Species (FIDS) area: Class 1 (+ 0.1)
☐ Targeted Ecological Area (+ 0.1)
☐ Sensitive Species Project Review Area (+ 0.1)

<u>From MDE Tier II High Quality Waters (Section 3.5):</u>

☐ Upstream of, within, or adjacent to Tier II High Quality stream segment (+ 0.2)

<u>From StreamStats (see Manual Section 3.5):</u>

☐ Impervious surface area for project area basin is low (< 5%) (+ 0.2)
☐ Forest cover in project area basin is >90% (+ 0.2)

<u>From field observations (see Manual Section 5.1):</u>

☐ Maryland nontidal wetland(s) with significant plant or wildlife value (as defined by COMAR 26.23.01.01B80) but not designated as a Nontidal Wetland of Special State Concern (add + 0.2 for each wetland to the Overall EIA score)
☐ State rare, threatened, or endangered plants or state rare natural community noted during field data collection but not mapped in Biodiversity Conservation Network Tier 1, 2, or 3 (+ 0.2)
☐ Sensitive species (colonial waterbird nesting colony, native mussel bed, anadromous fish) (+ 0.1)
☐ Dominated by native trees greater than 30cm or 12" diameter at breast height (+ 0.1)
☐ Dominated by hard mast (i.e., acorns and nuts) producing native species in the tree stratum (+ 0.1)

**FINAL Key Wildlife Habitat Ecological Integrity Assessment SCORE and RATING:** _____

Comments: