Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland

GIS Methods

The below prioritization effort is intended to target locations where we should actively seek restoration or preservation opportunities, as well as recommend the list for other entities. Our intent is to predict the areas where wetland restoration, mitigation, or preservation would provide the most function and would be compatible with other Federal, State, and County programs. Due to the scale of this project, this should only be used as a preliminary assessment. More detailed analysis should be completed at the local scale. Additionally, at this scale, we were not able to take property owner interest into account.

DNR led Watershed Restoration Action Strategies for several 8-digit watersheds. In this GIS model, we included some information from the Stream Corridor Assessments (SCAs), and other stream assessment data as provided by the Counties, as GIS overlays. We chose not to include the identified potential wetland sites (as described in the WRAS Characterization document) in our GIS model, for the reason as follows. The GIS layers used to locate sites in the WRAS process were generally: hydric soils, in close proximity to other wetlands, along the stream, on agricultural land use. Since our model used similar GIS criteria plus some others, we decided it would be repetitive to include these.

Headwater streams may have higher nutrient retention capacity. However, we were not able to satisfactorily include this component in our GIS model. The available GIS layers do not allow us to identify headwater streams in an accurate way. While the USGS-NHD stream layer is the best available stream layer, it is still missing many first and second order streams, due to scale.

NRCS soil surgo data is the best available GIS soil layer for this project. Finalized, official GIS ssurgo soil data was only available for a portion of the counties (Anne Arundel, Baltimore City, Carroll, Dorchester, Frederick, Howard, Kent, Montgomery, Queen Annes, Washington, Wicomico, Worcester). Luckily, we were able to use NRCS “draft” digital data for several addition counties (Baltimore County, Cecil, Charles, Harford, Somerset, Talbot). While this “draft” data is not meant for public distribution, it is digitized from the NRCS soil surveys and is reliable for planning purposes. A handful of counties remained that did not have any reliable digitized NRCS soil data (Allegany, Calvert, Garrett, Prince Georges, St. Marys). For these counties, we used Maryland Department of Planning Natural Soil Groups GIS layer. This layer is considered to be more generalized and not as accurate as the NRCS data. Additionally, this layer did not match up well with the other GIS layers we used. For these reasons, when the GIS NRCS soil layer is completed for these remaining counties, this layer should be replaced in this model.

We did not incorporate topography data, since we felt that available State-wide GIS topography data (Digital Elevation Model – DEM) is still not detailed enough for much of Maryland (this is especially apparent in the Coastal Plain). When this layer is updated to a more detailed scale, this data can be incorporated into the model. Instead, we relied heavily upon the hydric soil layers. We feel that the hydric soil layers adequately identifies sites for wetland restoration. However, they have limitations when identifying sites for wetland creation. We included sites with drainage classification of “very

poorly drained", "poorly drained", and "somewhat poorly drained". A portion of the "somewhat poorly drained" soils are hydric, while the other portion is not hydric. These non-hydric "somewhat poorly drained" soils may provide good areas for wetland creation. Topography would be especially useful in finding locations for wetland creation.

This current GIS analysis can be used to identify more general areas that may compliment existing targeting programs. It may be desirable to complete a more detailed GIS analysis which incorporates a hydrologic model, including evaluating the contributory drainage area, on potential wetland restoration sites. As part of a FEMA effort, several Counties are in the process of acquiring much more detailed topographic data. This data would be useful in evaluating sites on a more local level.

Field evaluation of identified sites is necessary to verify potential hydrology, feasibility, and estimate cost of actual wetland restoration implementation. In order to maintain more potential wetland restoration sites, site size was not considered. However, before restoration implementation, a more detailed assessment would be necessary to evaluate cost (e.g. mobilization, design, construction) versus benefits (functions) of a small site.

We created four prioritization maps from this project: two for wetland restoration (wetland restoration for water quality benefits, wetland restoration for biodiversity) and two for wetland preservation (wetland preservation on private land, wetland preservation on protected land). Each map is discussed separately below. For each map, we included GIS layers we thought were desirable, and ranked these within the layer. For most of these layers, a certain criteria was desirable, but not required. Therefore, areas where these desirable features were present would be given a higher ranking than areas where the feature was not present. For example, it may be desirable, but not required, that the restored wetland is within the stream buffer. We also excluded certain areas (as discussed below). For example, areas mapped as existing wetlands were removed from wetland restoration consideration. Each layer was then weighted based on its perceived importance, as described in a separate document (available upon request). For example, the "land use" layer had higher weight than the "DNR farmed wetland layer", since we felt it was more important. Then we combined all these raster layers (along with their respective weights) to get a final rank value for each 15 meter grid cell.

Note: The following layers are NOT ranked in order of importance.

Restoration

Wetland restoration for water quality benefits:

Land use of potential site. We were looking for land use that contributes high pollution, has lower diversity, and is easy to convert to wetland. Forested land is not a high pollutant source like agriculture. It also provides better habitat for most plants and wildlife. For these reasons, converting upland forested land to wetland may provide fewer benefits than converting agriculture to wetland. However, projects that do convert drained forest to wetlands have resulted in beautiful wetlands with diverse ecology. Therefore, we do not exclude forest from wetland restoration, but do rank it lower. Agricultural land was ranked highest, followed by barren land, then the remaining land (including forest and urban). GIS data layer source: MDP 2002 land use data, Anne Arundel land use data.

Streams and 100 meter buffer (with higher preference given to Scenic rivers and tributaries) were ranked higher than areas outside of the buffer. Vegetated streams buffers improve water quality (through pollutant reduction and decreased water temperature) and provide a habitat corridor and food base for stream organisms. While it is desirable to have wetlands around waterways, they are especially desirable around designated Scenic Rivers. Scenic Rivers have been identified as possessing outstanding resource value. Therefore, the State recommends they be protected and the water quality enhanced. GIS data layer source: National Hydrologic Data, Anne Arundel data.

Areas with an approved TMDL for nutrients or sediments were ranked higher than areas with no approved TMDL. Wetlands can improve water quality by reducing nutrients, sediment and heavy metals entering the waterway. Areas with completed TMDLs (based on nutrients and sediments) were ranked higher. Wetland restoration/creation is one strategy that will be employed to achieve the TMDLs. Additionally, some portions within these TMDL areas were ranked higher still (e.g. above the head of tides for tidal creeks were ranked higher), based on discussions with the MDE TARSA group. GIS data layer source: MDE.

Surface water reservoirs and watersheds. Based on a request from Carroll County, watersheds of reservoirs were ranked higher than other watersheds. GIS data layer source: Carroll County.

Hydric soil. Hydric soils are one of the factors suggesting an area is currently a wetland or may have been historically (prior to a change in hydrology). In order to have the most cost-effective wetland projects, it is ideal to restore sites where little effort is required to obtain the wetland by restoring the hydrology. Major excavation is expensive and can be minimized in an area where the majority of land has an elevation near the water table or has evidence of historically having the necessary hydrology. Somewhat poorly drained soils are on the border between hydric and nonhydric, with some being classified as hydric and others not. For the somewhat poorly drained soils that are not already classified as hydric, wetland creation may not be too difficult. Therefore, we also included these soils. The site must have hydric soils (or somewhat poorly drained soil) or it was eliminated from the model. To be included in the model, at least one of the major soil components had to meet our drainage class criteria (very poorly drained/poorly drained/somewhat poorly drained). This point is important to remember in counties (e.g. Frederick) where many of the relevant soils are mapped as undifferentiated soil groups. This means that within a soil unit, one of the major soil components may be poorly drained while another major soil component is moderately well drained. NRCS Ssurgo soils were ranked based on drainage, in order of highest to lowest rank: poorly drained/very poorly drained/ somewhat poorly drained. Poorly drained was ranked higher than very poorly drained since these soils may have more hydrologic fluctuation than very poorly drained soils, and therefore high rates of denitrification. For five counties (Garrett, Allegany, Calvert, Prince Georges, St. Mary's) NRCS Ssurgo data was not available. Therefore, we had to use the Natural Soil Groups data for these counties, which is not as accurate or as detailed. Soils in this layer were classified as either hydric or not hydric. GIS data layer source: NRCS SSURGO data, MDP Natural Soil Groups, Harford County data.

Prime farmland was excluded or ranked lower than non-prime farmland. With farmland rapidly being converted to development, it is desirable to preserve the most productive farmland (classified as prime farmland on the NRCS soil survey). Soils (NRCS ssurgo data) that were not prime farmland were ranked highest, followed by prime farmland when drained. Soils with prime farmland when irrigated and prime farmland were excluded. Some Counties (Wicomico, Somerset, and Queen Annes) chose to

exclude all forms of prime farmland, including prime farmland when drained, from the model. Natural Soil Groups data was classified as either prime or not prime, with prime areas being eliminated from our model. GIS data layer source: NRCS SSURGO data, MDP Natural Soil Groups, Harford County data.

DNR classification of farmed wetlands should be higher priority than non DNR farmed wetlands. Wetlands that are currently being farmed may be good options for wetland enhancement. It is also likely that these areas are not extremely productive as farmland since they are so wet. GIS data layer source: DNR wetlands.

Existing wetlands were excluded (except the DNR classification of "farmed wetlands"). DNR and NWI wetland data was used. We did not want to focus on sites that were already wetlands. However, these sites may be good areas for enhancement. GIS data layer source: DNR wetlands and NWI wetlands, Baltimore SAMP wetlands.

Priority Funding Areas (PFAs) were ranked lower than areas outside of the PFAs for some Counties. Some Counties (Calvert, Charles, Dorchester, Somerset, Wicomico, Worcester) requested that wetland restoration within areas that are planned for development be lower priority than in areas with no planned development. For Baltimore County, rather than using Priority Funding Areas, areas zoned as Resource Conservation were ranked higher than areas not zoned as such. GIS data layer source: MDP PFAs, Worcester County data, Baltimore County.

County agricultural easements and districts were excluded in Somerset County (based on County request). GIS data layer source: Somerset agricultural easements and districts.

Overlay:

Stream "problem" sites as identified through the Stream Corridor Assessments (SCAs)
- overlay. At this point, we did not give a ranking to these locations, but only intended to bring the reader's attention to these sites as possible restoration projects. GIS data layer source: DNR (as part of WRAS Stream Corridor Assessment), Frederick County, Anne Arundel County, Howard County.

- *Stream erosion*.
- *Inadequate buffers*.
- *Fish barriers*.
- *Stream channelization*.

Restoration
<u>Wetland restoration for diversity benefits</u>:

Green Infrastructure area and a buffer were ranked higher than outside of the buffer. MDNR identified Maryland's Green Infrastructure as a network of predominantly natural undisturbed areas they consider to be important to maintaining a regional ecological network. To preserve this regional ecological network, it is important to focus efforts (where possible) on enhancing and preserving this Green Infrastructure. Therefore, it is desirable to convert open land areas and disturbed areas within or adjacent to Green Infrastructure hubs and corridors to natural vegetation (i.e., convert agriculture or barren land to natural vegetation). Sites within and up to 50 m from the Green Infrastructure were ranked highest, sites 51-200 m were ranked medium, and sites greater than 200 m were ranked lowest. Since Prince

Georges County has their own GI layer, we used their layer for that County. GIS data layer source: DNR Green Infrastructure, Prince Georges County Green Infrastructure, Anne Arundel County Greenways data.

Land use of potential site. We were looking for land use that contributes high pollution, has lower diversity, and is easy to convert to wetland. Forested land is not a high pollutant source like agriculture. It also provides better habitat for most plants and wildlife. For these reasons, converting upland forested land to wetland may provide fewer benefits than converting agriculture to wetland. However, projects that do convert drained forest to wetlands have resulted in beautiful wetlands with diverse ecology. Therefore, we do not exclude restoration of forest to wetland. Agricultural land was ranked highest, followed by barren land, then remaining land (including forest and urban land). GIS data layer source: MDP 2002 land use data. Anne Arundel land use data.

Streams and 100 meter buffer (with higher preference given to Scenic rivers and tributaries) were ranked higher than areas outside of the buffer. Vegetated streams buffers improve water quality (through pollutant reduction and decreased water temperature) and provide a habitat corridor and food base for stream organisms. While it is desirable to have wetlands around waterways, they are especially desirable around designated Scenic Rivers. Scenic Rivers have been identified as possessing outstanding resource value. Therefore, the State recommends they be protected and the water quality enhanced. GIS data layer source: National Hydrologic Data, Anne Arundel data.

Proximity to NTWSSC and other significant areas. Nontidal Wetlands of Special State Concern, potential NTWSSC, Anne Arundel Bogs, and Harford County designated Ecologically Significant Areas within the Critical Area. Wetland restoration completed near existing significant wetland areas may help to preserve the existing significant wetland and enhance the likelihood that the restored wetland will contain some of the same unique characteristics. However, when restoring around these sites, the DNR Heritage Program should be contacted to verify that no adverse impacts will occur to the existing sensitive wetland due to the wetland restoration. GIS data layer sounces: DNR NTWSSC and potential NTWSSC, Anne County Bogs, Harford County Ecologically Significant Area within the Critical Area.

Surface water reservoirs and watersheds. Based on a request from Carroll County, watersheds of reservoirs were ranked higher than other watersheds. GIS data layer source: Carroll County.

Hydric soil. Hydric soils are one of the factors suggesting an area is currently a wetland or may have been historically (prior to a change in hydrology). In order to have the most cost-effective wetland projects, it is ideal to restore sites where little effort is required to obtain the wetland by restoring the hydrology. Major excavation is expensive and can be minimized in an area where the majority of land has an elevation near the water table or has evidence of historically having the necessary hydrology. Somewhat poorly drained soils are on the border between hydric and nonhydric, with some being classified as hydric and others not. For the somewhat poorly drained soils that are not already classified as hydric, wetland creation may not be too difficult. Therefore, we also included these soils. The site must have hydric soils (or somewhat poorly drained soil) or it was eliminated from the model. To be included in the model, at least one of the major soil components had to meet our drainage class criteria (very poorly drained/poorly drained/somewhat poorly drained). This point is important to remember in counties (e.g. Frederick) where many of the relevant soils are mapped as undifferentiated soil groups. This means that within a soil unit, one of the major soil components may be poorly drained while

another major soil component is moderately well drained. NRCS Ssurgo soils were ranked based on drainage, in order of highest to lowest rank: very poorly drained/poorly drained/ somewhat poorly drained. For five counties (Garrett, Allegany, Calvert, Prince Georges, St. Mary's) NRCS Ssurgo data was not available. Therefore, we had to use the Natural Soil Groups data for these counties, which is not as accurate or as detailed. Soils in this layer were classified as either hydric or not hydric. GIS data layer source: NRCS SSURGO data, MDP Natural Soil Groups, Harford County data.

Prime farmland was excluded or ranked lower than non-prime farmland. With farmland rapidly being converted to development, it is desirable to preserve the most productive farmland (classified as prime farmland on the NRCS soil survey). Soils (NRCS ssurgo data) that were not prime farmland were ranked highest, followed by prime farmland when drained. Soils with prime farmland when irrigated and prime farmland were excluded. Some Counties (Wicomico, Somerset, and Queen Annes) chose to exclude all forms of prime farmland, including prime farmland when drained, from the model. Natural Soil Groups data was classified as either prime or not prime, with prime areas being eliminated from our model. GIS data layer source: NRCS SSURGO data, MDP Natural Soil Groups, Harford County data.

Existing wetlands were excluded (except the DNR classification of "farmed wetlands"). DNR and NWI wetland data was used. We did not want to focus on sites that were already wetlands. However, these sites may be good for enhancement. GIS data layer source: DNR wetlands and NWI wetlands, Baltimore SAMP wetlands.

Priority Funding Areas (PFAs) were ranked lower than areas outside of the PFAs. Wetland restoration may be less desirable within areas that are planned for development. Since this is not always the case, and some Counties have a large portion of land within PFAs, we did not want to exclude these areas. For Baltimore County, rather than using Priority Funding Areas, areas zoned as Resource Conservation were ranked higher than areas not zoned as such. GIS data layer source: MDP PFAs, Worcester County data, Baltimore County.

County agricultural easements and districts were excluded in Somerset County (based on County request). GIS data layer source: Somerset agricultural easements and districts.

Overlay:

Stream "problem" sites as identified through the Stream Corridor Assessments (SCAs)
- overlay. At this point, we did not give a ranking to these locations, but only intended to bring the reader's attention to these sites as possible restoration projects. GIS data layer source: DNR (as part of WRAS Stream Corridor Assessment), Frederick County, Anne Arundel County, Howard County.

- *Stream erosion*.
- *Inadequate buffers*.
- *Fish barriers*.
- *Stream channelization*.

Preservation

Wetland preservation on private land - in this case, "private" means the land is NOT Federally-owned, DNR-owned, County-owned parks, Maryland Environmental Trust easements, owned by Private Conservation, Rural Legacy Easements.

Must be:

Existing wetlands – must be. The site must be an existing mapped wetland or it was eliminated. GIS data layer source: DNR and NWI wetlands, Baltimore SAMP wetlands.

Ranked higher:

Significant wetland areas were ranked higher than non-significant wetland areas. Nontidal Wetlands of Special State Concern, potential NTWSSC, Anne Arundel Bogs, and Harford County designated Ecologically Significant Areas within the Critical Area. These areas have either unique flora or fauna, or provide unique habitat. The buffer was ranked with 0-50m being highest, 51-200m next highest, and >200m lowest. GIS data layer source: DNR NTWSSC and potential NTWSSC, Anne Arundel Bogs, Harford County Ecologically Significant Areas within Critical Area.

Ecologically Significant Areas. Ecologically significant areas were given a higher rank than non-ecologically significant areas. GIS data layer source: DNR SSPRA.

Green Infrastructure area and a buffer were ranked higher than outside of the buffer. MDNR identified Maryland's Green Infrastructure network, natural undeveloped areas they consider to be important to maintaining a regional ecological network. To preserve this regional ecological network, it is important to focus efforts (where possible) on enhancing and preserving this Green Infrastructure. Therefore, it is desirable to convert open land areas and disturbed areas within or adjacent to Green Infrastructure hubs and corridors to natural vegetation (i.e., convert agriculture or barren land to natural vegetation). Sites within and up to 50 m from the Green Infrastructure were ranked highest, sites 51-200 m were ranked medium, and sites greater than 200 m were ranked lowest. Since Prince Georges County has their own GI layer, we used their layer for that County. GIS data layer source: DNR Green Infrastructure, Prince Georges County Green Infrastructure, Anne Arundel County Greenways data.

Rural Legacy. Rural legacy areas were ranked higher than areas outside of the designated Rural Legacy. GIS data layer source: DNR Rural Legacy Areas.

Surface water reservoirs and watersheds. These were ranked higher than other watersheds. GIS data layer source: MDE data, Carroll County.

Scenic rivers (and tributaries) and 100m buffers. These were ranked higher than areas outside the buffer. Designated Scenic Rivers have been identified as possessing outstanding resource value. Therefore, the State recommends they be protected and the water quality enhanced. GIS data layer source: NHD streams, Anne Arundel data..

Development risk. MDNR conducted a cell-based model for all of Maryland to assess development risk. This model was based on several parameters, including but not limited to: level of current protection,

zoning, existing/planned sewer service, parcel size, commuting time to town centers, market value, distance from major roads, and waterfront property. To some degree, this ranking can be used to estimate how much development pressure may be put on an existing wetland. Therefore, wetlands within areas of higher development risk were ranked higher for needing preservation than wetlands within areas of lower development risk. GIS data layer source: DNR cell-based development risk.

Exclude:

Protected lands - exclude. The site should not already be permanently protected. GIS data layer source: DNR protected lands (Federal, DNR, County, METs, Private Conservation, Rural Legacy Easements), County data (Montgomery, Howard, Baltimore, Anne Arundel, Worcester, Charles).

Overlay:

Tidal wetland sites used as references by DNR Natural Heritage Program – used as an overlay. DNR completed some vegetative community surveys in tidal wetlands. Several sites were listed as reference locations for the particular vegetative communities. As these sites are relatively undisturbed and good examples of the particular vegetative community, it may be worthwhile to protect them. GIS data layer source: DNR NHP.

Preservation

Protected Land - in this case, "protected" means the land is Federally-owned, DNR-owned, County-owned parks, Maryland Environmental Trust easements, owned by Private Conservation, Rural Legacy Easements.

Must be:

Existing mapped wetlands – must be. The site must be an existing mapped wetland or it was eliminated. GIS data layer source: DNR and NWI wetlands, Baltimore SAMP wetlands.

Protected land. The site must be "protected". We feel there is a difference between "protected" land and "preserved" land. "Protected" land includes State-owned, county-owned (parks), federally-owned, Maryland Environmental Trust Holdings, Private Conservation organizations land, Rural Legacy easements, and additional permanently protected land as provided by the County. However, unless this land is managed for wetland preservation (including preservation of functions), it may be vulnerable to change. For instance, wetlands in parks may be susceptible to becoming ball fields, roads, buildings, or trails. For this reason, we felt it was important to assess which of these wetlands were most important for preservation. GIS data layer source: DNR protected lands (Federal, DNR, County, METs, Private Conservation, Rural Legacy Easements), County data (Montgomery, Howard, Baltimore, Anne Arundel, Worcester, Charles).

Ranked higher:

Significant wetland areas were ranked higher than non-significant wetland areas. Nontidal Wetlands of Special State Concern, potential NTWSSC, Anne Arundel Bogs, and Harford County designated Ecologically Significant Areas within the Critical Area. These areas have either unique flora or fauna, or

provide unique habitat. The buffer was ranked with 0-50m being highest, 51-200m next highest, and >200m lowest. GIS data layer source: DNR NTWSSC and potential NTWSSC, Anne Arundel Bogs, Harford County Ecologically Significant Areas within Critical Area.

Ecologically Significant Areas. Ecologically significant areas were given a higher rank than non-ecologically significant areas. GIS data layer source: DNR SSPRA.

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Surface water reservoirs and watersheds. These were ranked higher than other watersheds. GIS data layer source: MDE data, Carroll County.

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