CARROLL COUNTY

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Background

Based on MDP 2002 GIS land use data, Carroll County has 2,496 acres of open water and 287,142 acres of land. The land acres are divided as follows: urban 60,734 acres (21%), agriculture 157,853 acres (55%), forest 68,070 acres (24%), wetlands 315 acres (<1%) and barren land 170 acres (<1%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in the watershed sections of this document, is a better estimate.

There are four State-designated 6-digit watersheds and nine 8-digit watersheds in this County. The Middle Potomac River (021403) includes Lower Monocacy River (02140302), Upper Monocacy River (02140303), and Double Pipe Creek (02140304); Patapsco River (021309) includes Liberty Reservoir (02130907), South Branch Patapsco (02130908), and a small amount of Patapsco River Lower North Branch (02130906); Gunpowder River (021308) includes Prettyboy Reservoir (02130806) and a small amount of Loch Raven Reservoir (02130805); Conewago Creek (020503) includes Conewago Creek (02050301).

Streams

The following information is based on the Maryland Tributary Strategies 2004 document entitled *Maryland Upper Potomac River Final Version for 1985-2002 Data*. Maryland's Upper Potomac River basin includes all of Allegany and Washington Counties, and part of Frederick, Carroll, Montgomery, and Garrett Counties. It reports that water quality in the Upper Potomac River Basin is variable, with some waterways being healthy trout streams and others being nearly lifeless due to acid mine drainage. The eastern portion of the basin (Piedmont and Great Valley areas east of Allegany County) contribute high amounts of nutrients and sediment from development and agriculture. The middle portion of the basin is largely forested, so does not contribute excessive pollutants. The western portion of the basin (the Appalachian Plateau) contributes pollution from agriculture and development, but also contributes acid mine drainage. In 2002, the main nitrogen, phosphorus, and sediment sources within the Upper Potomac River basin were agriculture (56%, 59%, and 80% respectively). There are two major wastewater treatment plants in this County (Taneytown and Westminster) contributing roughly 7% of the total nitrogen and 6% of the total phosphorus load in the Upper Potomac River basin. The tributary station sampled within Carroll County (Big Pipe Creek (MD Rte. 194) had total nitrogen status of poor and had improved in the period between 1985 and 2002. Total phosphorus was ranked fair but had improved. Total suspended solids were ranked good and had improved. This document describes the success of BMPs in the Upper Potomac River Watershed like this:

> A series of Best Management Practices (BMPs) have been planned in the basin to help reduce non-point source pollution. As of 1998, the implementation of these practices varies from having exceeded the goal to

> not having made any progress. Implementation of BMPs for animal waste management, conservation tillage, cover crops, and stream buffers have made good progress towards Tributary Strategy goals. Unfortunately, there has been no progress in forest harvesting BMPs, which consist of regulatory and voluntary measures applied to timber harvests, including erosion and sediment control and streamside management. Others, such as nutrient management and stream protections have exceeded the goals.

The Maryland Tributary Strategies document *Maryland Upper Western Shore Final Version for 1985-2002 Data* describes the success of BMPs in the Upper Western Shore Watershed (an area containing all of Harford, and part of Carroll, Baltimore, and Cecil) like this:

> BMP implementation for animal waste management, nutrient management plans, conservation tillage and cover crops, forest conservation and buffers, shore erosion control, marine pumpouts, and stormwater management retrofits and conversion are making good progress toward Tributary Strategy Goals. For other issues, such as treatment and retirement of highly erodible land, runoff control, stream protection, erosion and sediment control, septic connections and pumping, and urban nutrient management, progress toward Tributary Strategy Goals has been slower.

Land use for the entire basin is dominated by agriculture and forest/wetlands (38% each), followed by urban (25%). Roughly 70% of the houses are on public water and 75% are on municipal sewer. In 2002, the main nitrogen, phosphorus, and sediment sources within the Upper Western Shore basin was agriculture (39%, 33%, and 69% respectively). Other sources included point sources (21% N and 16% P), urban sources (18% N, 30% P, and 14% sediment), mixed open land (18% P and 7% sediment), and forest (10% sediment). Tributary stations sampled had total nitrogen ranked generally good. Two sites were ranked poor (Upper Gunpowder River – Prettyboy and Deer Creek) and one was ranked fair (Middle Gunpowder River - Glencoe). Levels were decreasing in some areas during the period 1985-2002. Total phosphorus was ranked fair or good, with some stations improving. Total suspended solids were generally good, but one site was ranked poor (Lower Gunpowder River – Cromwell) and two were ranked fair (Susquehanna River and Bush River). Of the three sites sampled for SAV abundance between 1984 and 2000, two of the sites exceeded SAV goals during portions of that period (Bush River and Gunpowder River Oligohaline). The Middle River Oligohaline did not meet the SAV goal but was close in 2000. In 1995-2000, benthic communities were generally good.

The Maryland Tributary Strategies document *Patapsco/Back River Final Version for 1985-2002 Data* describes the success of BMPs in the Patapsco/Back River Watershed (an area containing Baltimore City and parts of Anne Arundel, Baltimore, Carroll, and Howard Counties) like this:

> BMP implementation for shore and soil erosion control, agricultural nutrient management plans, for buffers, marine pumpout installation, septic connections, and stormwater management are all making progress toward Tributary Strategy goals. Progress has been slower for other issues,

> such as stream protection, forest conservation and tree plantings, grassed buffers, animal waste management, runoff control, septic pumping, and urban nutrient management.

Land use for the entire watershed is dominated by urban (55%), followed by forest (24%) and agriculture (21%). About 95% of the houses are on public water and 93% are on municipal sewage. There are six municipal sewage plants in this basin. Of these, three have Biological Nutrient Removal (BNR) and two others are planned to get BNR installed by 2010. The main nitrogen, phosphorus, and sediment sources within the Lower Western Shore basin were point sources (75%, 51%, and 0%, respectively), urban sources (19%, 41% and 53%, respectively) and agriculture (4%, 4%, and 32%, respectively). Tributary stations sampled had total nitrogen generally ranked as poor to fair. Poor sites were located at North Branch Patapsco River (MD Rte. 91), Patapsco River, and Back River. Levels had improved at most stations during the period 1985-2002. Total phosphorus was ranked poor to good. Sites ranked poor were Patapsco River (mouth) and Back River. Most stations had improved during the period 1985-2002. Total suspended solids were ranked good except at Patapsco River (near the mouth) and Back River. Abundance of algae was ranked poor at the two sites sampled. Dissolved oxygen was ranked as poor at Patapsco River (near the mouth). SAV abundance was way below the SAV goals. In 1995-2000, benthic communities were severely degraded along Patapsco River and moderately degraded along Back River.

Based on the Carroll County Comprehensive Plan, Carroll County contains roughly 1,380 stream miles, all flowing into the Chesapeake Bay. Streams in the north and west drain into the Monocacy River and streams in the south and east flow into Patapsco and Gunpowder Rivers. As Stated in this comprehensive plan:

> At least half of the County drains into drinking water reservoirs for various jurisdictions. Liberty Reservoir, fed by the North Branch of the Patapsco River, supplies water to Carroll County residents as well as Baltimore City, Anne Arundel, Baltimore, and Howard County residents. Cranberry Reservoir, which is part of Westminster's community water supply system, is fed by water pumped from the West Branch of the Patapsco River. Piney Run Reservoir, created by the impoundment of Piney Run, is a future water source for South Carroll. Two other reservoirs are undeveloped but planned for future water supply: Union Mills Reservoir, on Big Pipe Creek; and Gillis Falls Reservoir, on Gillis Falls. Portions of eastern Carroll County also drain to Loch Raven and Pretty Boy Reservoirs, located in Baltimore County, which supply public water to Baltimore City and Anne Arundel, Baltimore, and Harford County. It should be noted that Little Pipe Creek and Big Pipe Creek drain into the Monocacy River, which supplies water to the City of Frederick. In addition, the Monocacy flows into the Potomac, which provides water to Washington, D.C. There is also a small portion of Carroll County that drains to Hanover's water supply.

The areas east of Parr's Ridge, the eastern half of the County, is within a reservoir watershed, but is a designated growth area. With this said, the majority of Carroll County's residents still depend on groundwater for their water supply. These aquifers are

susceptible to contamination, especially ones within carbonate rock areas. Roughly two percent of the County is carbonate rock. These carbonate rock aquifers contribute water to Union Bridge, New Windsor, and partially to Westminster (Carroll County, 2000).

Wetlands

Wetland classifications

According to Tiner and Burke (1995), in 1981-1982 there were 4,791 acres of wetlands (0.8% of the State's total). The wetland types were Palustrine (4,229 acres), Riverine (4 acres), and Lacustrine (558 acres). Comparisons of this 1981-1982 wetland acreage with historic wetland acreage (based on hydric soils) represents a 64%, or 8,373 acre, loss (MDE, 2002).

The following wetland plant community descriptions are based on Tiner and Burke (1995).

- Palustrine wetlands can be classified into four major groups depending on the dominant vegetation type: forested, scrub-shrub, emergent, and aquatic. These wetlands were described for the Piedmont Province.
    - Palustrine forested wetlands are often found in stream floodplains. They can be categorized into two main types.
        - Seasonally flooded palustrine forested wetlands: These wetlands are flooded for some period (e.g. greater than two weeks) during the spring. Common tree species include Red maple, Black willow, and Green ash. There is often a dense understory of shrubs (e.g. Spicebush and Southern arrowwood) and herbaceous species (e.g. Skunk cabbage). Tiner and Burke gave an example of a seasonally flooded forested wetland community within Frederick County. The example was a Silver maple-Black willow dominated community. Associate tree species were Red maple, shrub species were Alder and Dogwood, and herbaceous species were Jewelweed, Joe-Pye weed, Blue vervain, Lurid sedge, and Big arrowhead.
        - Temporarily flooded palustrine forested wetlands: These wetlands are flooded for some period (e.g. a week or less) during the spring, less than that in the seasonally flooded forested wetlands. These systems may contain Red maple, Sycamore, Green ash, Silver maple, Pin oak, Tulip poplar, Black walnut, Black locust, or Box elder. The shrub layer may be less dense than in the seasonally flooded system. Temporarily flooded forested wetlands along the Potomac River floodplain are often dominated by Eastern cottonwood and Silver maple, with some Sycamore and Black willow. Tiner and Burke give two examples of wetland communities found within Frederick County. The first system, a Green ash-Sycamore-Box elder dominance, was found along Bennett Branch. Associate tree species were Pawpaw, Ironwood, Beech, Hackberry, and Tulip poplar. Associate shrubs species were spicebush and elderberry, herbaceous species were wood nettle,

garlic mustard, wood sorrel, Lady's thumb, False nettle, and clearweed. Other associate vine-like species were Virginia creeper and poison ivy. The second example was a Red Maple dominance. Associates tree species were Sycamore, Box elder, and Silver maple. Shrub species were Multiflora rose, herbaceous species were Jewelweed and Goldenrod, and other species were Japanese honeysuckle and Blackberry.

  - Palustrine shrub wetlands contain shrubs and tree saplings. The wetter systems are often dominated by Bottonbush, while the drier seasonally flooded systems may be dominated by a number of different species. Herbaceous species may form an understory.
  - Palustrine emergent wetlands:
    - Semipermanently flooded marsh
    - Seasonally flooded marsh: These systems may be dominated by cattail, rice cutgrass, arrow arum, and rush.
    - Seasonally flooded meadow: This is the most common wetland type in the region. These systems would naturally be forested wetlands, but were cleared. Many have high plant diversity.
    - Temporarily flooded wet meadow: These systems may be adjacent to the seasonally flooded meadows, but they are flooded less often and for shorter durations.
  - Palustrine aquatic beds are small ponds with partial or total vegetative cover.
- Riverine wetlands are found within the channel and include nonpersistent vegetation.
- Lacustrine wetlands are associated with deepwater habitat (e.g. freshwater lakes, deep ponds, and reservoirs). They can be classified into lacustrine aquatic beds (wetlands are located in the shallow water) and lacustrine emergent wetlands (wetlands are located along the shoreline).

Wetlands in Carroll County occur in floodplains of streams, at the heads of drainageways, and in isolated depressions. The supporting hydrology of nontidal wetlands is primarily through groundwater or a combination of groundwater and overbank flooding. Wetlands may also occur at the bases of slopes, where they are supported by seepage from the hillside. Wetlands have also developed at mined sites.

Wetland functions

Stormwater and Flood Control
Wetlands are often credited with providing natural stormwater and flood control benefits. Inland wetlands adjacent to rivers, streams and creeks hold excess discharge and runoff during periods of increased precipitation such as tropical storms and hurricanes and during periods of rapid snow-melt in mountainous regions.

Several factors influence the effectiveness of a wetland in reducing adverse effects of stormwater and floods. Factors include the characteristics of the wetland, local land

conditions, and landscape features in the surrounding larger watershed, as well as the type of storm itself. The physical structure of many wetlands, with dense vegetation, fallen trees, topography (hummocks, depressions), and complexity of stream channel systems serve as resistance features to slow flow of surface water from floods and surface runoff, the height of peak floods, and delay the timing of the flood crest. Wetlands are typically in topographically low position, which provides a natural basin for water storage. The depth of the basin and soil characteristics affect the wetland's storage capacity at surface and subsurface levels. Water is released more slowly from the wetlands, thereby reducing both erosion and damage to property and structures farther downstream. In the surrounding areas, the ability of the land to also reduce runoff may aid the wetland in its flow retention/reduction function. At the landscape level, the position of the wetland in the watershed and the ratio of size of the wetland to the size of the watershed also affect the function. Wetlands higher in the landscape and of large in size in relation to the watershed are most effective. While wetlands retain surface flows that enter the wetlands at a gradual rate, they are considered to be more effective at reducing damages from short duration storms.

Also, some water will be removed from the wetland through ground water recharge, soil retention and evapotranspiration.

Land use changes have likely caused some alteration in Carroll County wetlands' capacity and opportunity for providing some flood attenuation. Development and increases in impervious surfaces have resulted in stream channel erosion and downcutting of stream channels. This has in some instances resulted in less out of bank flooding for low intensity storm events, thus less opportunity for adjacent wetlands to provide the flood attenuation function. The downcutting of the stream also results in a lower elevation of the base flow, which is often paralleled by a lowering of groundwater levels in adjacent wetlands. In other instances, increased development that caused additional flashiness and higher peak flows may result in additional flooding and more opportunity for adjacent wetlands to reduce flood damages to property. Some floodplain wetlands are also found in pasture land with little natural vegetation. Lack of dense vegetation reduces the ability of a wetland to slow velocities of floodwaters, further reducing the flood attenuation function. Floodplains are relatively narrow, which is another limitation to the storage capacity of wetlands in the floodplain. In areas of less development, headwater streams still may provide some flood attenuation functions.

Groundwater Recharge and Discharge

Functions

Wetlands facilitate the flow of water between the ground water system and surface water system. Wetlands periodically perform different functions, depending on the gradient of the groundwater table and the topography of the land surface. The relationship of the groundwater table and the land surface dictates which function - groundwater recharge or discharge - a wetland performs.

Nearly all of Maryland's wetlands are ground water discharge areas, at least for some portion of the year (Fugro East, Inc., 1995). Variations in the depth of the ground water table, resulting from seasonal changes in climate, dictate which of these functions -

discharge or recharge - a wetland will perform at a given time.

Values

Ground water discharge helps maintain a wetland's water balance and water chemistry. This wetland function is also critical to the formation of hydric soils and the maintenance of ecosystem habitats in different types of wetlands.
Ground water recharge is the primary mechanism for aquifer replenishment which ensures future sources of groundwater for commercial and residential use.

Many Carroll County wetlands exist in association with springs that provide baseflow to streams or are developed in water sources for livestock.

Modification of Water Quality

Water Quality Improvement

Wetlands are valued for their ability to maintain or improve quality of adjacent surface waters. This ability is primarily accomplished by the following processes:

- Nutrient removal, transformation, and retention
- Retention of toxic materials
- Storage of the sediment transported by runoff or floods.

Hydrophytic vegetation (adapted to live in water) and microbial activity in soils help remove toxic substances and excess nutrients from surface water. Dissolved solids and other constituents may be removed or degraded, such that they become inactive, or incorporated into biomass. This occurs through adsorption and absorption by soil particles, uptake by vegetation and loss to the atmosphere through decomposition and exchange between atmosphere and water.

Nutrient Cycling: Addition, Removal and Transformation

Nutrients are carried into wetlands by hydrologic pathways of precipitation, river flooding, tides, and surface and ground water inflows. Outflows of nutrients are controlled primarily by outflow pathways of waters. The inflow and outflow of water and nutrients are important processes that effect wetland productivity.

Wetland biological and chemical processes remove suspended and dissolved solids and nutrients from surface and ground water and convert them into other forms, such as plant or animal biomass or gases. Debris and suspended solids (fine sediment or organic matter) may be removed by physical processes, such as filtering and sedimentation.

Soil characteristics, landscape position, and hydrology all contribute to the relative ability of a wetland to perform nutrient removal and transformation. Sufficient organic matter must be present for microorganisms in the soil to consume or transform the nutrients. Wetlands are often depressions in the landscape that hold water, transported sediment, and attached or dissolved nutrients for a longer period of time than a sloping area or areas with relatively higher elevations. A longer retention time allows for chemical interactions and plant uptake to occur.

Nitrogen undergoes some chemical transformations and may be taken up in soluble form, absorbed by plants through their roots, or consumed by anaerobic microorganisms that

convert the nitrogen to organic matter (Mitsch and Gosselink, 2000). Anaerobic microbes may also convert the nitrogen from a nitrate form to nitrogen gas. Phosphorus is often bound to clay particles, and these fine sediments are transported into wetlands by riparian flooding and tidal action. Phosphorus may be stored in a wetland attached to the clay particles, however, phosphorus becomes available for plant uptake in its soluble form after flooding, saturation and anaerobic conditions typical of a wetland occur. Nutrient processes vary seasonally. Cooler temperatures slow microbial activity and plant uptake while higher flows of water transport more materials out of non-isolated wetland systems. The transported organic material is critical for downstream food chain support.

Wetlands are most effective at nutrient transformation and uptake when there are seasonal fluctuations in water levels (Tiner and Burke, 1995). Wetlands that are temporarily flooded (saturated or inundated for brief periods early in the growing season) and those that are permanently inundated would generally be less effective than seasonally wet areas (saturated or inundated for longer periods during the early-mid growing season but are drier by the end of the growing season).

Toxics Retention

Retention of heavy metals has been reported most often in studies of tidal wetlands, though most wetlands are believed to serve as sinks for heavy metals. Accumulation is primarily in soils, with plants playing a more limited role (Mitsch and Gosselink, 2000). Plants such as cattails, bulrushes, and *Phragmites* are among the more effective and commonly used plants for uptake of toxic materials such as metals. As is the case for nutrient transformation and sediment retention, soil characteristics, landscape position, vegetation, and hydrology all contribute the relative ability of a wetland to retain toxic materials. The longer the duration that water and transported materials remain in the wetland, the greater the likelihood that the materials will be retained. Many wetlands have been constructed as part of stormwater management facilities to treat surface runoff.

Sediment Reduction

Wetlands along rivers, streams and coastal areas are important for removing sediment from surface and tidal waters. During large flood events, rivers frequently overtop their banks and water flows through adjacent floodplains and wetlands. Flood waters carry large volumes of suspended sediment, mostly fine sand, silt and clay. Because floodplains and wetlands provide resistance to flow - from dense vegetation, microtopography, and woody debris - the flow of water is slowed and sediment is deposited and stored in these areas. Similarly, coastal marshes and estuaries retain sediment brought in by tides and residual suspended sediment from rivers.

Lack of dense vegetation in some floodplains, and narrow width of floodplains, would reduce the ability of wetlands to slow velocities of floodwaters and allow settling of transported sediments.

Wildlife Habitat/Biodiversity

Wetlands provide important habitat for fish, wildlife, and plant species, including rare species. Wetlands adjacent to coldwater streams in Carroll County also aid in providing shade to maintain cool temperatures for aquatic species such as trout. The County

contains a number of wetlands in pasture land that support the State and federally threatened bog turtle.

Nontidal Wetlands of Special State Concern

There are State-designated Nontidal Wetlands of Special State Concern in this County, described in the watershed sections for Prettyboy Reservoir and South Branch Patapsco. There are numerous other wetlands that may qualify for designation as nontidal Wetlands of Special State Concern, primarily due to their habitat for the endangered bog turtle.

Wetland Restoration Considerations

Hydric soils suggest where wetlands are currently or were historically. There are many "poorly drained" hydric soils, throughout the County, that are not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). Most are located along waterways. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration. There are also many soils that are "somewhat poorly drained". While not always classified as hydric, it is often relatively easy to create wetlands in these areas. These "somewhate poorly drained" soils are located mostly in the northwestern portion of the County.

Vegetated stream buffers have the potential to intercept and remove nutrients, sediments, and other pollutants. Peterson et al. (2001) found that the smallest headwater streams, which are often found in association with springs and groundwater discharge wetlands, have the most rapid uptake and transformation of inorganic nitrogen (ammonium and nitrate) in comparison with other surface waters. The authors believed that the large surface to volume ratio in small streams resulted in rapid nitrogen uptake and processing. An excess of discharges to overload these systems would result in nitrogen being transported farther down the drainage systems to rivers and estuaries. Forested stream buffers can also improve down steam biodiversity by contributing organic matter to the food web, providing woody debris which increases diversity of physical habitat, and reducing stream temperature. Headwater streams are thought to be the most beneficial at these processes. Therefore, wetlands adjacent to streams should be high priority for restoration/preservation, with emphasis on headwater stream systems. Wetlands adjacent to Scenic Rivers and around all tributaries of waterways used for drinking water (COMAR Use P) should also be ranked higher.

DNR assessed the development risk for all land within Maryland. Wetlands within areas of high development risk should be higher priority for preservation.

In order to maintain water quality of surface water reservoirs, wetlands within the watersheds of surface water reservoirs should be higher priority for preservation.

Wetland restoration may be more desirable in land uses that contribute high pollution, currently provide relatively low amounts of biodiversity, and are easy to convert to wetlands. As a general rule, agriculture fits these criteria more than other land use types.

Forested land is generally not as high of a pollutant source and it also provides better habitat for plants and wildlife. For these reasons, converting upland forest to wetland may provide fewer benefits than converting agriculture to wetlands. However, projects that have converted artificially drained forest to wetland have resulted in beautiful wetlands with diverse ecology. Additionally, wetlands may be built in urban land use, but they are generally much smaller and sometimes more costly. Urban areas may provide good potential for wetlands designed for storm water management.

MDE has designated some areas as Wellhead Protection Areas (WPAs). In some WPAs, the water table is near the surface, with only a few feet of soil to filter any water entering the ground. Excavation of a few feet would significantly reduce the filtering capacity of the soil, allowing the wetland to act as a direct pathway for nutrients and other pollutants to enter the groundwater. Therefore, wetland creation designs within WPAs should consider the impact to groundwater quality.

Sensitive Resources

Source water assessments were completed for numerous water systems within this County. They are discussed in the watershed section in which they are located.

Based on the 2004 document entitled *Water Resource Management Manual Carroll County, Maryland*, management areas that may need special management have been delineated as the following:

- Carbonate rock. There are roughly 7,601 acres of carbonate rock in this County. While these areas can produce high volumes of groundwater, they are very susceptible to groundwater contamination and structural instability (sinkhole formation). Designs for wetland restoration/creation within these areas should take this into account. These areas include Wakefield Marble, Silver Run Limestone, and unnamed calcareous zones within schist or phyllite areas. Watersheds with this carbonate rock are: Double Pipe Creek, Prettyboy Reservoir, and Liberty Reservoir.
- Wellhead protection. These areas contribute groundwater to existing water supply source.
- Aquifer protection. These potential groundwater resource areas are near Community Planning Areas.
- Surface watershed. This area is the watershed of all existing and proposed surface water reservoirs and stream intakes for Carroll County and Baltimore City (reservoirs within Carroll County).
- Stream buffer. All stream buffers should be at least 50 feet on each side, with areas of slopes >25% or wetlands not being counted as stream buffer. The minimum stream buffer width should be based on the slope, with each one percent increase in average slope equaling the addition of two feet steam buffer (to the original 50 feet). For instance, a stream valley with a 20% slope should have a 90 foot stream buffer.

In addition to the above identified sensitive areas, the Environmental Resources Element of the Master Plan and the Carroll County Comprehensive Plan identified several sensitive resources, including:

- Streams
- Steep slopes (>25%)
- 100-year floodplains
- Habitats of threatened and endangered species
- Wetlands
- Use III waters

Other goals mentioned in the Comprehensive Plan include:

- Protect agricultural land, putting 100,000 acres of tillable agricultural land into agricultural land preservation easements.
- Focusing growth in designated growth areas to reduce sprawl and preserve rural character
- Encourage creation of greenbelts around the growth areas
- Develop a Countywide trail system
- Seek non-County funds for construction of greenway corridor trails

A Watershed Restoration Action Strategy was completed for Liberty Reservoir. This included a watershed characterization, stream corridor assessment, nutrient synoptic survey, and WRAS strategies. Additionally, a Piney Run Reservoir stream corridor assessment should be completed in 2006 and a Piney Run Reservoir comprehensive watershed management plan may be completed in 2007. These are discussed in the specific 8-digit watershed sections.

The County's main environmental focus is to protect the drinking water reservoirs. County regulations require a 50 foot steam buffer, plus additional width for slopes, around new development (Nelson, 2006 pers. comm.).

Other Relevant Programs

Green Infrastructure and Greenways

There is a relatively small amount of State-designated Green Infrastructure within this County. The largest hub is around Liberty Reservoir and Patapsco Valley State Park. Areas within the Green Infrastructure network that are currently unprotected should be protected. There are also sections of Green Infrastructure considered to be "gaps," currently in development, agriculture, or barren land. It is desirable to restore these areas back to natural vegetation, as they can provide a wildlife corridor, a protective buffer, and may be especially important along the waterways. For more detailed information, refer to section on the individual watershed.

Ecologically Significant Areas

DNR designates areas that contain habitat for rare, threatened and endangered species and rare natural community types. These areas are buffered to create the "sensitive species project review areas" GIS layer, intented to assist in assessing environmental

impacts and reviewing potential development changes. This layer generally includes designated Natural Heritage Areas, Wetlands of Special State Concern, Colonial Waterbird Colonies, and Habitat Protection Areas.

Natural Heritage Areas
There are no State-designated Natural Heritage Areas (NHA) located in this County.

Rural Legacy
Designated Rural Legacy land is located west of Westminster (encompassing Union Bridge and New Windsor) and east of Westminster. For detailed information about the program, refer to the Double Pipe Creek and Liberty Reservoir watershed sections.

Priority Funding Areas
There are several relatively large Priority Funding Areas within this County, including around Westminster, Eldersburg, Mt. Airy, Union Bridge, Taneytown, and Manchester/Hampstead.

Stakeholders in wetland management may have conflicting goals for wetlands in Priority Funding Areas. Some may advocate preserving wetlands in these areas as greenways, for aesthetics, or as unique communities in a developing area. Other interests may seek flexibility and expedited review of proposals to impact wetlands due to other goals for growth and economic development in a designated area. There may be benefits to protecting and restoring wetlands for water quality in a growth area, particularly as an offset against future or existing TMDLs. Preservation of biodiversity may be more of a challenge due to possible increases in nonpoint source pollution and fragmentation. Stormwater management associated with growth may also reduce certain nonpoint source impacts to wetlands in PFAs.

Agricultural Easements
Some properties are within agricultural easements. Some are permanent and some are shorter-term. There is some controversy about conducting wetland restoration within agricultural easements. Most would agree that it is desirable to preserve good farmland. However, properties within these easements may also contain spots of soil with lower productivity due to wetness. These low productivity spots may be a hassle to the farmer and may be good areas for wetland restoration. First, the property owner may be able to benefit from an additional program for that low productivity area, resulting in the owner getting more money for the land and utilizing the land to its full extent. Since these property owners are already involved in a preservation program, they may be more likely to consider additional programs. Second, since some of these agricultural easements are temporary, after the agricultural easement expires, the land owner may decide to get out of agriculture, and a wetland program could help to preserve some of the land from development.

Watershed Information

Information on the individual 8-digit watershed basins is as follows:

Lower Monocacy River (02140302)

Background

While the majority of this watershed is located within Frederick County, a smaller amount if also located in Carroll and Montgomery Counties. Based on MDP 2002 GIS land use data, the Carroll County portion of the Lower Monocacy River watershed has 1 acre of open water and 5,476 acres of land. The land acres are divided as follows: urban 2,014 acres (37%), agriculture 2,007 acres (37%), forest 1,441 acres (26%), and wetlands 14 acres (<1%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, are better estimates.

Some of the Carroll County portion of this watershed is classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

Scenic Rivers
The Monocacy River was designated a State Scenic River in order to restore the water quality. In this watershed, three tributaries to the Monocacy were also listed as candidates for State Scenic Rivers, including: Friends Creek (in Frederick County), Owens Creek (in Frederick County), and Piney Creek (in Carroll County).

The Monocacy River Study and Management Plan
The following information was summarized from the *Monocacy River Study and Management Plan* (1990). Since much of the land adjacent to the Monocacy and its tributaries had fairly low topographic gradients, development and agricultural were possible next to the water. As discussed later, this proximity increases pollutant entry into the waterways.

There are many springs and seeps, often being wetlands. The majority of these areas produce little water, with the exception of Fountain Rock Spring. Since these springs and seeps may provide important conditions required for certain species (e.g. brook trout and pearl dace), these sites may provide good opportunities for protection. The wetlands located in the mountain region, often getting water from seeps, contain rare plant species.

Trout streams include the following: Furnace, Glade, and Bear Branches, Friends, Ballenger, Owens, Hunting, Tuscarora, and Fishing Creeks. Trout populations are higher in the northern waterways, suggesting that water quality in general is better in the north. Waterfowl densities are highest on the Monocacy near Michael's Dam, through the Monocacy Natural Resource Management Area to the Potomac. There are some wetlands in this area that could be protected to maintain wildlife habitat.

During the period of this study, the most dominant land use along the river was agriculture and old fields, with some residential development and light industry. The forest buffer width along the Monocacy River was generally poor, with only about half of the streambanks having adequate buffers (with good buffers being found within park property).

Water impacts include: three major developed areas withdrawing water from the Monocacy River (Frederick, Westminster, and Gettysburg), sewage disposal, and agricultural and residential land use. An important issue in this waterway is suspended sediment, which inhibits aquatic species. This watershed discharges over two times the amount of sediment per acre than any other Potomac River watershed upstream of Point of Rocks. Other pollutants of concern in the Monocacy are nutrients and pathogens. Conversion of the natural buffers and creation of structures within the floodplain increases pollution entering the waterways and increases flash flooding.

This plan proposed developing a Monocacy River overlay extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is wider or in areas where there are sensitive resources outside the existing conservation buffer. The following streams should be protected: Furnace Branch, Rocky Fountain Run, Tuscarora Creek, Ballenger Creek, Bennett Creek, Glade Creek, Bush Creek, Toms Creek, Carroll Creek, Owens Creek, Fishing Creek, Friends Creek, and Hunting Creek. Streams that should be developed into stream valley parks include: Glade Creek, Ballenger Creek, Linganore Creek, and Tuscarora Creek. The City of Frederick has already established parts of Carroll Creek as a stream valley park and intends to develop a Monocacy River linear park.

A Watershed Restoration Action Strategy (WRAS) was completed for the Frederick County portion of this watershed. The WRAS process included a watershed characterization, stream corridor assessment, nutrient synoptic survey, and final strategy. More information on this process can be found in the description within the Frederick County section.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways. Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine unconsolidated shore: 1 acre
- Palustrine
    - Aquatic bed: 1 acres
    - Emergent: 1,009 acres
    - Scrub shrub: 639 acres
    - Forested: 2,483 acres
    - Unconsolidated bottom: 757 acres
    - Unconsolidated shore: 2 acres
    - Farmed: 219 acres
- Riverine unconsolidated shore: 2 acres

- Total: 5,114 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140302	-6.06	5.91	37.50	0.11	37.46

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. For the Carroll County portion they are as follows:

- Use IV-P: recreational trout waters and public water supply; Monocacy River and all tributaries above Rte. 40.

Water Quality

The source water assessment for the Town of Mt. Airy found that wells withdrawing from the unconfined aquifer were susceptible to nitrates, VOCs, SOCs, naturally occurring radionuclides, and bacteria/viruses (in two wells).

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high levels of the nutrients phosphorus and nitrogen, poor benthic index of biotic integrity (BIBI), high percent unforested stream buffer (63%), and high soil erodibility (0.28). Wetland loss was estimated to be 11,799 acres. This watershed was ranked among the worst 25% of the State watersheds for having high levels of total nitrogen and total phosphorus. Indicators for Category 3 include high fish index of biotic integrity (FIBI), high imperiled aquatic species indicator, and the presence of five drinking water intakes.

According to the *2002 Maryland Section 305(b) Water Quality Report*, some portions of the Lower Monocacy River and larger tributaries do not support all designated uses due to bacteria. The majority of wadeable streams fail to fully support all designated uses due to siltation from hydromodification and habitat alteration. Lake Linganore fails to support all designated uses due to siltation and nutrients from sources including upstream, natural, and unknown.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Lower Monocacy River*; fecal coliform. While this watershed is also impaired by nutrients and sediments, a TMDL has been completed for these contaminant.
- *Lake Linganore*; While this waterway is impaired by nutrients and suspended sediments, a TMDL has been completed for these pollutants.
- *Bear Creek* (021403020224 in Frederick); poor biological community.
- *Bennett Creek* (021403020224 in Frederick); poor biological community.
- *Horsehead Run* (021403020227 in Frederick); poor biological community.
- *Carroll Creek* (021403020233 in Frederick); poor biological community.
- *Ballenger Creek* (021403020230 in Frederick); poor biological community.
- *Unnamed tributary to Ballenger Creek* (021403020230 in Frederick); poor biological community.
- *Unnamed tributary to Carroll Creek* (021403020233 in Frederick); poor biological community.
- *Addison Run* (021403020233 in Frederick); sedimentation.
- *Rock Creek* (021403020233 in Frederick); poor biological community.
- *Laurel Run* (021403020237 in Frederick); poor biological community.
- *Laurel Run Unnamed Tributary* (021403020237 in Frederick); poor biological community.
- *Dollyhide Creek Unnamed Tributary* (021403020236 in Frederick); poor biological community.
- *Unnamed tributary to the Monocacy River* (021403020233 in Frederick); sedimentation.
- *Cabbage Run* (021403020237 in Frederick); poor biological community.
- *Unnamed tributary to Israel Creek* (021403020237 in Frederick); poor biological community.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There are some hydric soils that are not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). These include some of the waterways around Harrisville and Franklinville. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

There is a small Green Infrastructure corridor within the Carroll County portion of this watershed. Much of this corridor is in agriculture, so may be a potential site for restoration to natural vegetation (DNR, 2000-2003).

There are no State-designated Nontidal Wetlands of Special State Concern within the Carroll County portion of this watershed.

Specific recommendations for restoration:

- Scenic River: Monocacy River. Including development of a Monocacy River buffer extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is wider or in areas where there are sensitive resources outside the existing conservation buffer (The Monocacy Scenic River Local Advisory Board, 1990).
- Candidates for scenic river status: Friends Creek (in Frederick County), Owens Creek (in Frederick County), and Piney Creek (in Carroll County) (The Monocacy Scenic River Local Advisory Board, 1990).
- Restore "gaps" in the Green Infrastructure network to natural vegetation.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Scenic River: Monocacy River. Including development of a Monocacy River buffer extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is wider or in areas where there are sensitive resources outside the existing conservation buffer (The Monocacy Scenic River Local Advisory Board, 1990).
- Candidates for scenic river status: Friends Creek (in Frederick County), Owens Creek (in Frederick County), and Piney Creek (in Carroll County) (The Monocacy Scenic River Local Advisory Board, 1990).
- Springs and seeps along the Monocacy River and tributaries (The Monocacy Scenic River Local Advisory Board, 1990).
- Protect these trout streams and their associated wetlands: Furnace, Glade, and Bear Branches, Friends, Ballenger, Owens, Hunting, Tuscarora, and Fishing Creeks (The Monocacy Scenic River Local Advisory Board, 1990).
- Protect these streams: Rocky Fountain Run, Bennett Creek, Bush Creek, Toms Creek, and Carroll Creek (The Monocacy Scenic River Local Advisory Board, 1990).
- Protect areas within the Green Infrastructure network.
- Protect wetlands and streams within the headwaters.

<u>Upper Monocacy River (02140303)</u>

Background

This watershed is located within Carroll and Frederick Counties and Pennsylvania. Based on MDP 2002 GIS land use data, the Carroll County portion of the Upper Monocacy River watershed has 2 acres of open water and 27,171 acres of land. The land acres are divided as follows: urban 2,223 acres (8%), agriculture 20,457 acres (75%), forest 4,449 acres (16%), and wetlands 41 acres (<1%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate.

The majority of the Carroll County portion of this watershed is classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime

farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

The Monocacy River was designated a State Scenic River in order to restore the water quality. In this watershed, three tributaries to the Monocacy were also listed as candidates for State Scenic Rivers: Friends Creek (in Frederick County), Owens Creek (in Frederick County), and Piney Creek (in Carroll County).

The Monocacy River Study and Management Plan
The following information was summarized from the Monocacy River Study and Management Plan (1990). Since much of the land adjacent to the Monocacy and its tributaries had fairly low topographic gradients, development and agriculture were possible next to the water. As discussed later, this proximity increases pollutant entry into the waterways.

There are many springs and seeps, often being wetlands. The majority of these areas produce little water, with the exception of Fountain Rock Spring. Since these springs and seeps may provide important conditions required for certain species (e.g. brook trout and pearl dace), these sites may provide good opportunities for protection. The wetlands located in the mountain region, often getting water from seeps, contain rare plant species.

Trout streams include the following: Furnace Branch, Glade Branch, Bear Branch, Friends, Ballenger, Owens, Hunting, Tuscarora, and Fishing Creek. Trout populations are higher in the northern waterways, suggesting that water quality in general is better in the north. Waterfowl densities are highest on the Monocacy near Michael's Dam, through the Monocacy Natural Resource Management Area to the Potomac. There are some wetlands in this area that could be protected to maintain wildlife habitat.

During the period of this study, the most dominant land use along the river was agriculture and old fields, with some residential development and light industry. The forest buffer width along the Monocacy River was generally poor, with only about half of the streambanks having adequate buffers (with good buffers being found within park property).

Water impacts include: three major developed areas withdrawing water from the Monocacy River (Frederick, Westminster, and Gettysburg), sewage disposal, and agricultural and residential land use. An important issue in this waterway is suspended sediment, which inhibits aquatic species. This watershed discharges over two times the amount of sediment per acre than any other Potomac River watershed upstream of Point of Rocks. Other pollutants of concern in the Monocacy are nutrients and pathogens. Conversion of the natural buffers and creation of structures within the floodplain increases pollution entering the waterways and increases flash flooding.

This plan proposed developing a Monocacy River overlay extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is wider or in areas where there are sensitive resources outside the existing conservation buffer. The following streams should be protected: Furnace Branch, Rocky Fountain Run, Tuscarora Creek, Ballenger Creek, Bennett Creek, Glade Creek, Bush Creek, Toms Creek, Carroll Creek, Owens Creek, Fishing Creek, Friends Creek, and Hunting Creek. Streams that should be developed into stream valley parks include: Glade Creek, Ballenger Creek, Linganore Creek, and Tuscarora Creek. The City of Frederick has already established parts of Carroll Creek as a stream valley park and intends to develop a Monocacy River linear park.

A Watershed Restoration Action Strategy (WRAS) was completed for the Frederick County portion of this watershed. The WRAS process included a watershed characterization, stream corridor assessment, nutrient synoptic survey, and final strategy. More information on this process can be found in the description within the Frederick County section.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways, including along the Monocacy River, Piney Creek, and tributaries. There are also additional small wetlands that are not directly associated with a waterway. Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Emergent: 530 acres
    - Scrub shrub: 290 acres
    - Forested: 1,883 acres
    - Unconsolidated bottom: 657 acres
    - Unconsolidated shore: 5 acres
    - Farmed: 224 acres
- Riverine unconsolidated shore: 3 acres
- Total: 3,592 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140303	-1.70	1.67	0	0	-0.03

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a “designated use” in the Code of Maryland Regulations 26.08.02.08. For the Carroll County portion they are as follows:

- Use IV-P: recreational trout waters and public water supply; Monocacy River and all tributaries above Rte. 40.

Water Quality

The source water assessment for the City of Taneytown found that wells withdrawing from the unconfined aquifer were susceptible to nitrates, VOCs, naturally occurring radionuclides, and bacteria (in one well).

The 1998 Clean Water Action Plan classified the watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It was also classified as "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failed indicators included high nutrient concentrations (especially phosphorus), poor benthic index of biotic integrity (BIBI), high percent unforested stream buffer (61%), and high soil erodibility (0.28). Indicators suggesting need for preservation included a high in-stream habitat index, a high fish index of biotic integrity (FIBI), a high imperiled aquatic species indicator, presence of trout spawning area, and providing fish hatchery water supply. It also had 3,489 acres of Wildland and 4 drinking water intakes.

According to the *2002 Maryland Section 305(b) Water Quality Report*, the upper Monocacy River and large tributaries fail to support all designated uses due to bacteria. Wadeable streams (stream order ≤ 4) do not support all designated uses due to low fish or benthic index of biotic integrity, low pH, and siltation. These poor communities may be the result of agricultural runoff, stream channelization, and poor bank stabilization. Pollutant sources are agricultural runoff, channelization, and habitat alteration. Hunting Creek Lake, a 46-acre lake within Cunningham Falls State Park, is also within this watershed and has seasonally low oxygen levels due to elevated nutrients from nonpoint source runoff. High fecal coliform bacteria was reported in this lake in 1996, resulting in a temporary restriction on swimming. This lake is not on the 303(d) List for impaired waters.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairments are as follows:

- *Monocacy River*; fecal coliform, suspended sediments, and nutrients.
- *Tuscarora Creek* (021403030240 in Frederick County); poor biological community.
- *Glade Creek* (021403030242 in Frederick County); poor biological community.
- *Fishing Creek* (021403030243 in Frederick County); poor biological community.
- *Steep Creek Unnamed Tributary* (021403030243 in Frederick County); poor biological community.
- *Buzzard Branch* (021403030244 in Frederick County); poor biological community.

- *Little Hunting Creek* (021403030244 in Frederick County); poor biological community.
- *Little Hunting Creek Unnamed Tributary* (021403030244 in Frederick County); poor biological community.
- *Creagers Branch* (021403030245 in Frederick County); poor biological community.
- *Graceham Run* (021403030251 in Frederick County); poor biological community.
- *Muddy Run* (021403030251 in Frederick County); poor biological community.
- *Sandy Run* (021403030244 in Frederick County); poor biological community.
- *Unnamed tributary to Monocacy River* (021403030245 in Frederick County); poor biological community.
- *Motter's Run* (021403030249 in Frederick County); poor biological community.
- *Owens Creek* (021403030250 in Frederick County); poor biological community.
- *Owens Creek* (021403030253 in Frederick County); poor biological community.
- *Hunting Creek* (021403030251 in Frederick County); poor biological community.
- *Hunting Creek* (021403030252 in Frederick County); poor biological community.
- *Unnamed tributary to Hunting Creek* (021403030251 in Frederick County); poor biological community.
- *High Run* (021403030251 in Frederick County); poor biological community.
- *Piney Creek* (021403030254 - in Carroll County); poor biological community.
- *Piney Creek* (021403030257 - in Carroll County); poor biological community.
- *Unnamed tributary to Piney Creek* (021403030255 - in Carroll County); poor biological community.
- *Unnamed tributary to Piney Creek* (021403030256 - in Carroll County); sedimentation.
- *Turkey Creek* (021403030259 in Frederick County); poor biological community.
- *Toms Creek* (021403030259 in Frederick County); poor biological community.
- *Flat Run* (021403030260 in Frederick County); poor biological community.
- *Middle Creek* (021403030260 in Frederick County); poor biological community.

An assessment of Piney and Alloway Creeks was conducted in 1990-1991 by DNR and MDE. This watershed is completely located in Carroll County and Pennsylvania. Although it is not in Frederick County, it is in the Upper Monocacy Watershed and drains into the Monocacy River, so is important in restoring Frederick County waterways. The study found that these waterways had relatively good water in dry months but water high in phosphorus and sediment in wet months. Nonpoint sources were found to be the main contributors of nutrients. There have been dense mats of algae in Alloway stream in the spring. Benthic and fish analysis show a degraded stream system. Piney Creek had poorer streamside habitat than Alloway Creek, including inadequate riparian buffers and livestock access to streams.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There are some hydric soils that are not mapped wetlands (based on NRCS SSURGO GIS data and

NWI/DNR wetlands). These include "poorly drained" soils along the Monocacy River, along Piney Creek, and along the tributaries and within the headwaters. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration. While not classified as hydric soils, there are many additional areas of "somewhat poorly drained" soils scattered throughout. These areas may be good locations for wetland creation, since in general it would be relatively easy to establish wetland hydrology.

Within the Carroll County portion of this watershed, there is a Green Infrastructure corridor along the Monocacy River that is unprotected. Since a large amount of this corridor is agriculture, they may be potential sites for restoration to natural vegetation. The only protected areas in this watershed are two small County properties and a MET. According to the Maryland Greenways Commission, there are two proposed greenways.

- *Monocacy Scenic River Greenway.*
- *Monocacy River Water Trail.*

There are no State-designated Nontidal Wetlands of Special State Concern within the Carroll County portion of this watershed.

Specific recommendations for restoration:

- Scenic River: Monocacy River. Including development of a Monocacy River buffer extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is wider or in areas where there are sensitive resources outside the existing conservation buffer (The Monocacy Scenic River Local Advisory Board, 1990).
- Candidates for scenic river status: Friends Creek (in Frederick County), Owens Creek (in Frederick County), and Piney Creek (in Carroll County) (The Monocacy Scenic River Local Advisory Board, 1990).
- Restore "gaps" within the Green Infrastructure hub along the Monocacy River to natural vegetation.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Scenic River: Monocacy River. Including development of a Monocacy River buffer extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is wider or in areas where there are sensitive resources outside the existing conservation buffer (The Monocacy Scenic River Local Advisory Board, 1990).
- Candidates for scenic river status: Friends Creek (in Frederick County), Owens Creek (in Frederick County), and Piney Creek (in Carroll County) (The Monocacy Scenic River Local Advisory Board, 1990).
- Springs and seeps along the Monocacy River and tributaries (The Monocacy Scenic River Local Advisory Board, 1990).
- Protect these trout streams and their associated wetlands: Furnace, Glade, and Bear Branches, Friends, Ballenger, Owens, Hunting, Tuscarora, and Fishing Creeks (The Monocacy Scenic River Local Advisory Board, 1990).

- Protect the following streams: Rocky Fountain Run, Bennett Creek, Bush Creek, Toms Creek, and Carroll Creek (The Monocacy Scenic River Local Advisory Board, 1990).
- Protect portions of Green Infrastructure that are not currently protected.
- Protect the DNR-designated Ecologically Significant Areas along the Monocacy River. These two locations contain State-listed species.
- Protect wetlands and streams within the headwaters.

Double Pipe Creek (02140304)

Background

The majority of this watershed is located within Carroll County, with the remainder within Frederick County. This watershed drains into the Monocacy River, a State-designated Scenic River. Based on MDP 2002 GIS land use data, the Carroll County portion of the Double Pipe Creek watershed has 22 acres of open water and 105,640 acres of land. The land acres are divided as follows: urban 13,932 acres (13%), agriculture 70,006 acres (66%), forest 21,467 acres (20%), wetlands 193 acres (<1%) and barren land 42 acres (<1%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate.

A large amount of the Carroll County portion of this watershed is classified as prime farmland (based on NRCS SSURGO GIS data), with highest amount in the western portion of the watershed. In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

Carbonate rock is located in a large portion of this watershed, including around Union Bridge, New Windsor, and Westminster. Another large strip follows Silver Run in the northern portion of the watershed. These carbonate areas are important because they have a potential for sinkhole formation and groundwater contamination.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways, (e.g. along the Big Pipe Creek, Silver Run, Bear Branch, Meadow Branch, and tributaries). There are also additional small wetlands that are not directly associated with a waterway.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Emergent: 1,119 acres
    - Scrub shrub: 327 acres

  - Forested: 1,240 acres
  - Unconsolidated bottom: 310 acres
  - Unconsolidated shore: <1 acres
  - Farmed: 171 acres
- Total: 3,167 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140304	-2.89	3.47	19.33	0	19.92

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. For the Carroll County portion they are as follows:

- Use IV-P: recreational trout waters and public water supply; Monocacy River and all tributaries above Rte. 40.

Water Quality

Source water assessments were completed for several water supplies within this watershed. The water supply name and susceptibility are as follows:

- *Town of Manchester* (unconfined aquifer): nitrates, VOCs, coliform, and naturally occurring radon.
- *Town of New Windsor* (unconfined aquifer): nitrates, viruses, bacteria, VOCs, and naturally occurring radon (depending on the approved maximum contaminant levels) and radionuclides.
- *Pleasant Valley* (unconfined): nitrates, bacteria, protozoans, and naturally occurring Radon-222.
- *City of Westminster*: nitrates, disinfection byproducts, fecal coliform, and sedimentation.
- *Bark Hill* (unconfined): nitrates, and naturally occurring Radon-222.

The 1998 Clean Water Action Plan classified the watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It was also classified as Category 3, a pristine or sensitive watershed that needs protection. Failed indicators included high nutrient concentrations (especially phosphorus), poor benthic index of biotic integrity (BIBI), and a high percent unforested stream buffer (75%). Indicators suggesting need for preservation included a high imperiled species indicator and a high amount of wetland-dependent species.

According to the *2002 Maryland Section 305(b) Water Quality Report*, portions of the Double Pipe Creek mainstem fail to support all designated uses due to bacteria from natural and unknown sources. Wadeable tributaries (stream order $\leq$ 4) to this creek fail to support all designated uses due to poor benthic community from siltation of agricultural runoff, habitat alteration, and changes in hydrology.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Double Pipe Creek*; fecal coliform, nutrients, sedimentation.
- *Sam's Creek* (021403040269); poor biological community.
- *Sam's Creek Unnamed Tributary* (021403040248); poor biological community.
- *Sam's Creek Unnamed Tributary* (021403040268); sedimentation.
- *Haines Branch* (021403040269 in Frederick County); poor biological community.
- *Clemson Branch* (021403040269 in Frederick County); poor biological community.
- *Beaver Dam Creek* (021403040270 in Frederick County); poor biological community.
- *Beaver Dam Branch* (021403040270 in Frederick County); poor biological community.
- *Roop Branch* (021403040272 in Carroll County); poor biological community.
- *Priestland Branch* (021403040273 in Carroll County?); poor biological community.
- *Little Pipe Creek* (021403040276 in Carroll County); sedimentation.
- *Little Pipe Creek* (021403040274); poor biological community.
- *Copps Branch* (021403040276 in Carroll County); poor biological community.
- *Meadow Branch* (021403040277 in Carroll County); poor biological community.
- *Meadow Branch* (021403040278 in Carroll County); sedimentation.
- *Meadow Branch Unnamed Tributary* (021403040277 in Carroll County); poor biological community.
- *Bear Branch* (021403040281 in Carroll County); poor biological community.
- *Bear Branch* (021403040282 in Carroll County); poor biological community.
- *Bear Branch Unnamed Tributary* (021403040281 in Carroll County); poor biological community.
- *Big Pipe Creek* (021403040284 in Carroll County); poor biological community.
- *Big Pipe Creek* (021403040286 in Carroll County); poor biological community
- *Big Pipe Creek* (021403040280 in Carroll County); poor biological community.
- *Big Pipe Creek* (021403040283 in Carroll County); poor biological community.
- *Big Pipe Creek Unnamed Tributary* (021403040280 in Carroll County); poor biological community.
- *Big Pipe Creek Unnamed Tributary* (021403040283 in Carroll County); poor biological community.
- *Big Pipe Creek Unnamed Tributary* (021403040279 in Carroll County); poor biological community.

- *Big Pipe Creek Unnamed Tributary* (021403040287 in Carroll County); poor biological community.
- *Big Pipe Creek Unnamed Tributary* (021403040278 in Carroll County); poor biological community.
- *Big Silver Run* (021403040285 in Carroll County); poor biological community.
- *Big Silver Run Unnamed Tributary* (021403040285 in Carroll County); poor biological community.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There are some "poorly drained" hydric soils that are not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). These include some of the waterways around Union Bridge/New Windsor, Copperville, Mayberry, and the headwaters on the east side of the watershed. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration. While not classified as hydric soils, there are many additional areas of "somewhat poorly drained" soils, located mostly in the western portion of the watershed. These areas may be good locations for wetland creation, since in general it would be relatively easy to establish wetland hydrology.

There is a linear Green Infrastructure hub/corridor running east and west from Hawasha Environmental Appreciation Center. Only a small portion of this Green Infrastructure is protected by County-owned land. There are also a few METs outside of the Green Infrastructure network. Much of the corridor is currently in agriculture, sites which may be potentially restored to natural vegetation (DNR, 2000-2003). According to the Maryland Greenways Commission, there are two existing or proposed greenways.

- *Little Pipe Creek Greenway* (potential ecological greenway).
- *Union Mills to Westminster Greenway* (potential and existing greenway).

The following information is based on the document *Rural Legacy FY 2003: Applications and State Agency Review*. Little Pipe Creek Rural Legacy Area includes approximately 20,365 acres. This area is currently largely undeveloped (83%). This area was chosen in order to protect Little Pipe Creek watershed water quality and to ensure a healthy future agricultural economy. The goal is to protect 15,271 acres (75%). Currently, 8,638 acres (42%) of this land are protected through various methods. The sponsors are Carroll County. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not adequate enough to support all of these requests, other programs should consider preservation of these sites.

While there are no designated Nontidal Wetlands of Special State Concern within this watershed, there are several potential WSSC, located in the northeast portion of the watershed. These are not protected.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure along Big Pipe Creek to natural vegetation.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect portions of Green Infrastructure that are not currently protected.
- Protect Rural Legacy areas that are not currently protected.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
    - Most of the Potential WSSC in the far eastern headwaters are within a designated Ecologically Significant Area containing federally listed species.
    - A Ecologically Significant Area is located adjacent to and within Union Mill Reservoir. This area contains species or natural communities of concern to DNR, but with no official status. It is mostly protected by the County.
- Protect wetlands and streams within the headwaters.

<u>Patapsco River Lower North Branch (02130906)</u>

Background

Only a small amount of this watershed is located within Carroll County. The majority of this watershed is located within Howard and Baltimore Counties, with portions also located in Anne Arundel County and Baltimore City. Based on MDP 2002 GIS land use data, the Carroll County portion of the Patapsco River Lower North Branch watershed has 512 acres of land. The land acres are divided as follows: urban 23 acres (4%), agriculture 47 acres (9%), and forest 442 acres (86%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate.

Most of the watershed is in the Piedmont Province. A small area near the Baltimore Harbor, Deep Run, and northern Anne Arundel County is in the Coastal Plain. Channel morphology changes near the boundary of the Piedmont/Coastal Plain physiographic regions. Significant sediment deposition normally occurs in the transition area downstream of the boundary as the material, which had been carried by the higher velocity flows from the Piedmont, settles out since it can no longer be transported by the slower flows of the flatter Coastal Plain province.

For the Carroll County portion of this watershed, there is some soil classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along the North Branch Patapsco River are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas

should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

The following information relates to the entire watershed (not just the Carroll County portion). Wetlands are typically found in relatively narrow floodplains of streams. The primary source of hydrology in the wetlands is high ground water. Overbank flooding, though it does occur, apparently is not of sufficient duration to be the primary source of hydrology in wetlands. Concentrated development in parts of this watershed has also often resulted in incised stream channels, further reducing the likelihood of overbank flooding (Follweiler, 2004 pers. comm.). Some wetlands are also supported by seepage of water from the bases of slopes adjacent to the floodplains. A few wetlands may be found in upland depressions. In the small Coastal Plain portion of the watershed in Howard County, wetlands may be found on relatively wide, flat landscapes in comparison with wetlands in the Piedmont region. Within the Carroll County portion, wetlands are mainly along the North Branch Patapsco River.

Most wetlands within this watershed are forested, dominated by oak, sweetgum, red maple, and in some places willow and alder (Matthews and Hershberger, 1968). The Howard County Soil Survey reported that some wetlands were drained to create pasture. These areas would represent opportunities for restoration, though the extent of any converted pasture area is probably very limited. There appears to be limited areas to restore floodplain access in much of the watershed due to adjacent development.

In comparison with the very poorly drained soils most often found on the lower Coastal Plain, soils in this watershed are seasonally wet for shorter periods of time, and have less organic matter. Wetlands in the Patapsco watershed are thus likely to have a lower capability to transform nutrients than wetlands with lengthy periods of saturation and inundation. However, vegetated wetlands on floodplains still may reduce flood flows and retain surface waters, allowing some sediments and nutrients to settle, providing some water quality improvement. The high ground water and seepage from slopes may also contribute to base flow maintenance and food chain support for streams. Wetlands that extend up the side of slopes, in contrast to depressions in floodplains, do not significantly retain water, thus providing only limited flood attenuation and water quality improvement functions.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 121 acres
    - Scrub shrub: 1 acre
    - Unconsolidated shore: 15 acres
- Lacustrine unconsolidated shore: 2 acres
- Palustrine
    - Aquatic bed: 1 acre
    - Emergent: 222 acres
    - Scrub shrub: 40 acres

  - Forested: 564 acres
  - Unconsolidated bottom: 192 acres
  - Unconsolidated shore: 5 acres
  - Farmed: 1 acre
- Riverine
  - Emergent: 1 acre
  - Unconsolidated shore: 44 acres
- Total: 1,207 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02130906	-18.53	22.80	0	0.21	4.48

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. For the Carroll County portion they are designated Use 1: water contact recreation and protection of aquatic life.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include poor non-tidal benthic index of biotic integrity (BIBI), high percent impervious surface (22%), high population density, and high soil erodibility (0.31). Wetland loss was estimated to be 8,422 acres. Indicators for Category 3 include high imperiled aquatic species indicator and migratory fish spawning area.

According to the *2002 Maryland Section 305(b) Water Quality Report*, the nontidal waters (from the mainstem to Liberty Dam) fully supports all designated uses. The majority of the nontidal, wadeable tributaries (117 miles) failed to support all designated uses due to biological community from urban runoff, habitat alteration, and channelization. Field surveys also noted siltation, streambank instability, agricultural runoff, and hydromodification as factors that may affect the aquatic community (DNR, 2000). Some areas are closed to shellfish harvesting due to pollution from nonpoint source runoff (DNR, 2002)

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Patapsco River* (non-tidal); metals, nutrients, sediments.

- *Patapsco River Unnamed Tributary 1* (021309061017 non-tidal); poor biological community.
- *Patapsco River Unnamed Tributary 3* (021309061019 non-tidal); poor biological community.
- *Patapsco River Unnamed Tributary* (021309061012 non-tidal); poor biological community.
- *Deep Run* (021309061014 non-tidal); poor biological community.
- *Deep Run Unnamed Tributary* (021309061014 non-tidal); poor biological community.
- *Deep Run Unnamed Tributary 1* (021309061015 non-tidal in Howard); poor biological community.
- *Deep Run Unnamed Tributary 2* (021309061015 non-tidal in Howard); poor biological community.
- *Soapstone Branch* (021309061016 non-tidal in Baltimore County); poor biological community.
- *Tiber Run* (021309061017 non-tidal); poor biological community.
- *Falls Run* (021309061019 non-tidal in Baltimore Run); poor biological community.

A Draft Water Quality Analysis was completed for metals in Lower North Branch Patapsco River. Metal levels are not exceeding those required based on water quality designations, except Herbert Run (021309061012), with a single exceedance of copper. It is recommended that Lower North Branch Patapsco River (except Herbert Run) be removed from the 303d list for impairment by heavy metals.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There is one area mapped as hydric "poorly drained" soil that is not currently a mapped wetland (based on NRCS SSURGO GIS data and NWI/DNR wetlands). This is located within the Patapsco Valley State Park. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

The Carroll County portion of this watershed is covered by a portion of a large Green Infrastructure hub, connecting Liberty Reservoir and Patapsco Valley State Park (DNR, 2000-2003). The portion within this County is protected by Patapsco Valley State Park. According to the Maryland Greenways Commission, there is a greenways which is partially existing and partially proposed. Patapsco Regional Greenway runs along Liberty Reservoir and connects with Patapsco Valley State Park, Morgan Run NEA, and Patapsco River.

There are no State-designated Nontidal Wetlands of Special State Concern within the Carroll County portion of this watershed.

Existing restoration recommendations:

- No voluntary wetland restoration projects can be confirmed in the Howard County portion of this watershed.
- Five retrofit projects were proposed in residential subdivisions. Projects included wetland creation as part of the retrofits. (KCI Technologies, Inc., 1999.)
- Reforestation in the undeveloped floodplain of Patapsco Valley State Park (DNR, 1981. Patapsco)
- Fish passage and fish habitat improvement (DNR, 1981. Patapsco)
- Flooding does occur in the Ellicott City vicinity, however, there may not be opportunity to restore floodplain access due to infill development. (Follweiler, 2004 pers comm.)
- Wetlands in stormwater retrofits may present the best opportunity to re-create wetlands in the watershed. Permittees have found it difficult to locate mitigation sites to replace lost wetlands and some stream restoration projects have been proposed as an alternate form of mitigation (Follweiler, 2004 pers comm.).
- Artificially drained pastures. There is a wetland on pasture formerly operated as a University of Maryland Horse Farm that may benefit from enhancement such as removal of multiflora rose and plugging of any ditches (Boellner, 2004 pers comm.).
- Restore "gaps" in the Green Infrastructure network to natural vegetation.
- Restore wetlands and streams within the headwaters.

Existing preservation recommendations:

- Deep Run (Howard County).
- Stony Run WSSC (Anne Arundel County).
- Forested riparian corridors.
- Protect portions of Green Infrastructure that are not currently protected.
- Protect wetlands and streams within the headwaters.

<u>Liberty Reservoir (02130907)</u>

Background

Carroll County contains the majority of this watershed (83%), with the remainder located in Baltimore County (17%). Based on MDP 2002 GIS land use data, the Carroll County portion of the Liberty Reservoir watershed has 2,139 acres of open water and 85,050 acres of land. The land acres are divided as follows: urban 24,387 acres (29%), agriculture 36,650 acres (43%), forest 23,983 acres (28%), wetlands 29 acres (<1%) and barren land 1 acres (<1%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate. As suggested by the name, this watershed contains Liberty Reservoir.

This watershed is located within the Piedmont Province, with topography ranging from gently rolling to steep slopes. The proportion of hydric soils is small, and they are generally located in stream and headwater areas. Roughly one fourth of the land is prime farmland, and is scattered throughout the watershed. Interior Forest covers roughly 16% of the land in this watershed. A small amount of carbonate rock is located west of

Hampstead, with the largest portion following Brodbeck Road. These carbonate areas are important because they have a potential for sinkhole formation and groundwater contamination.

There is a lot of soil classified as prime farmland within this watershed (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

The Liberty Reservoir impoundment is owned by Baltimore City Department of Public Works, and is used for recreation and Baltimore City public water. Inflows are Patapsco River, Morgan Run, and several tributaries. It discharges into the Lower North Branch of the Patapsco River. The watershed has elevations ranging from 420 feet to 980 feet. Stream channels are generally well-incised and tend to follow rock fractures and weathered rock. Soils have mostly moderate to high infiltration and are moderately well to excessively drained (MDE, 2003a). 499 acres within Morgan Run Natural Environmental Area is included in the Maryland Wildlands Preservation System, suggesting the protected area has retained its wilderness character and/or contains rare species or habitat.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways, with larger wetlands in the northern and western portions of Liberty Reservoir, along Morgan Run, Joe Branch, Middle Run, Beaver Run, West Branch, and Cranberry Branch. There are also additional small wetlands that are not directly associated with a waterway.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine unconsolidated shore: 387 acres
- Palustrine
    - Emergent: 855 acres
    - Scrub shrub: 399 acres
    - Forested: 1,610 acres
    - Unconsolidated bottom: 269 acres
    - Farmed: 78 acres
- Total: 3,599 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02130907	-2.91	1.91	0	0	-1.00

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. For the Carroll County portion they are as follows:

- Use I-P: water contact recreation, protection of aquatic life, and public water supply;
    - Liberty Reservoir above Liberty Dam
    - All tributaries to West Branch Patapsco River
    - All tributaries to North Branch Patapsco River except those designated below as Use III-P or Use IV-P above Liberty Reservoir
- Use III: natural trout waters; Roaring Run (Carroll County), confluence with the North Branch Patapsco River to headwaters
- Use III-P: natural trout waters and public water supply;
    - Morgan Run and all tributaries
    - Beaver Run and all tributaries
    - Snowdens Run and all tributaries
    - Stillwater Creek and all tributaries
    - Carroll Highlands Run and all tributaries
    - Autumn Run and all tributaries
    - East Branch Patapsco River and all tributaries
- Use IV-P: recreational trout waters and public water supply;
    - North Branch Patapsco River Mainstem only above Liberty Reservoir
    - West Branch Patapsco River Mainstem only
    - Cranberry Branch and all tributaries Above MD Route 852 (Old Manchester Road)

Water Quality

There are three permitted surface water withdraws in this watershed: Baltimore City and Freedom District, withdrawing from Liberty Reservoir, and Westminster, withdrawing from the reservoir, Cranberry Branch, and West Branch Patapsco.

Source water assessments were completed for several water supplies within this watershed. The water supply name and susceptibility are as follows:

- *Town of Manchester* (unconfined aquifer): nitrates, VOCs, coliform, and naturally occurring radon.
- *City of Westminster*: nitrates, disinfection byproducts, fecal coliform, and sedimentation.
- *Freedom District*: (surface – withdraws form Liberty Reservoir): dissolved solids, chlorides, disinfection by-product precursors, nutrients (mainly P), contaminant spills, protozoas, viruses, bacteria, and turbidity.

- *Town of Hampstead* (unconfined aquifer): nitrates, VOCs, SOCs, and naturally occurring radionuclides.
- *Hillandale Mobile Home Park* (unconsolidated aquifer): nitrates, VOCs, and naturally occurring radon.
- *Todd Village Mobile Home Park* (unconsolidated aquifer): nitrates, VOCs, and naturally occurring radon.

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high nutrient concentrations and high soil erodibility (0.28). Wetland loss was estimated to be 3,987 acres. Indicators for Category 3 include high non-tidal fish index of biotic integrity (FIBI), high non-tidal instream habitat index, trout spawning areas, presence of designated Wildlands (within Morgan Run NEA), and presence of four drinking water intakes.

According to the *2002 Maryland Section 305(b) Water Quality Report*, the mainstem (above Liberty Reservoir) fully supports all designated uses. The majority of the tributaries (115 miles) fail to support all designated uses due to agricultural runoff, habitat alteration, and channelization. Liberty Reservoir failed to support all designated uses due to Hg from atmospheric deposition.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Liberty Reservoir Impoundment*; nutrients, sediments. This impoundment is also impaired by methylmercury in fish tissue, for which a TMDL has been completed.
- *Cranberry Branch* (021309071061 in Carroll County); fecal coliform.
- *Unnamed Tributary to Liberty Reservoir* (021309071046); poor biological community.
- *Morgan Run Unnamed Tributary* (021309071047 in Carroll County); poor biological community.
- *Morgan Run* (021309071054 in Carroll County); sediments.
- *Beaver Run* (021309071057 in Carroll County); poor biological community.
- *Beaver Run Unnamed Tributary* (021309071057 in Carroll County); poor biological community.
- *East Branch Patapsco* (021309071059 in Carroll County); poor biological community.
- *West Branch Patapsco* (021309071062 in Carroll County); poor biological community.

A water quality analysis was completed in 2003 for chromium and lead in Liberty Reservoir Impoundment. This impoundment was on the 1996 303d list for water quality

impairment due to chromium (Cr) and lead (Pb). This 2003 analysis found this impoundment was not impaired by Cr or Pb, so should be removed from the 303d list for impairment by these pollutants.

The following information is based on the Liberty Reservoir WRAS Characterization. Baltimore City has reported increasing levels of chloride in Liberty Reservoir. This may be associated with increasing use of road salt. MBSS surveys found most sites to be rated as good or fair for benthic and fish IBI. Sites with poor or very poor ratings were often associated with developed and agricultural areas. Habitat conditions were generally rated as good or fair, with a few sites rated as poor and one as very poor (near Warfieldsburg). Native brook trout is present in some smaller streams around the reservoir, the North and East Branch Patapsco River, Morgan Run, and Beaver Run. The County decided to focus on a few subwatersheds: Middle Run, Snowdens Run, and North Branch of the Patapsco. Middle Run and Bonds Run contributed some of the highest amounts of phosphorus and sediments. Snowden Run was selected since it is the most densely developed subwatershed while the North Branch Patapsco was chosen since it was the least developed. Dry weather total phosphorus is decreasing in this reservoir. Based on this pollutant, Liberty Reservoir is the healthiest of the three local reservoirs (Liberty, Loch Raven, and Prettyboy). Nitrate-nitrite levels increased between the 1880's and mid 1990's, but now appear to be leveling off. Based on the DNR Fish Passage Program database, there are three fish passage barriers in this watershed. These are located on Cranberry Branch, West Branch Patapsco, and North Branch Patapsco.

The following is summarized from the 2002 nutrient synoptic survey, focusing on the subwatersheds Snowden Run, Middle Run, Roaring Run, and West Branch. While nutrient levels were elevated or excessive at some sites, samples taken at the subwatershed outlets were baseline or only moderately elevated. One exception was the elevated nitrate-nitrite yields at Middle Run. Macroinvertebrate samples were rates as fair to good, except one site in Middle Run, apparently affected by an upstream pasture. Eroding streambanks and sedimentation within the streams was the main habitat limitation. This sedimentation and poor riparian buffer impacted the fish communities.

Restoration/Preservation

A stream corridor assessment was completed for Middle Run, Snowdens Run, and the West Branch Patapsco in 2002. Of the 121 stream miles surveyed, 497 potential problems were identified. The most commonly reported problem was erosion (150 sites), scattered throughout the three subwatersheds. A relatively high proportion of these were rated as severe or very severe. Another problem was inadequate stream buffers (114 sites; accounting for roughly 15% of the stream miles surveyed). Reported land use along the inadequately buffered sections were mostly pasture and lawn. Other reported problems included pipe outfalls (125 sites), fish barriers (32 sites), trash dumping (22 sites), and channel alteration (21 sites). Other concerns were unusual conditions, exposed pipes, and in/near stream construction. There were several reports of livestock in the stream.

The WRAS Strategy document for Liberty Reservoir prioritizes the evaluated subwatersheds. Middle Run subwatershed should be restored before Snowdens Run watershed because while Snowdens Run has more impervious surface, Middle Run is more degraded. Within Middle Run, subwatersheds were ranked for restoration and preservation. Subwatershed 103 should be one of the top priority subwatersheds for restoration within Middle Run. Many of the stream banks are eroded, with many ranked as severe. Most of the stream miles have poor or nonexistent stream buffers, the worst among the subwatersheds sampled. Nutrient loadings were also the highest among the Middle and Snowdens Run subwatersheds sampled. Subwatershed 104 is ranked second priority for restoration and also should be protected. Eroding streambanks are often caused by poorly managed stormwater. There are also some poor stream buffers. Subwatershed 106 is ranked third for restoration due to high nutrient yields, eroding stream banks, and inadequate stream buffers. Within Snowdens Run subwatershed, smaller subwatersheds were also ranked for restoration and protection priority. Subwatershed 203 was ranked first priority for restoration due to eroding stream banks caused by inadequate stormwater management and a significant fish passage barrier. Subwatershed 201 is second priority for restoration due to poor stream buffers and inadequate stormwater management. Subwatershed 205 is third priority for restoration due to a long stretch of eroding stream bank below two storm drains.

Examples of past and current restoration projects include (Shanks, 2002):

- Stream restoration along Linton Road and next to Hodges Landfill.
- A watershed assessment of potential restoration opportunities within Longwell Branch watershed in the City of Westminster. This assessment resulted in stormwater management creation and a stream channel restoration project.
- Reconstructing stormwater management dry ponds at Liberty High School in Eldersburg to reduce downstream channel erosion.

Hydric soils suggest where wetlands are currently or were historically. There are many "poorly drained" hydric soils that are not currently mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). These are mostly located along the waterways and are spread throughout the watershed. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

There is a large Green Infrastructure hub around Liberty Reservoir and Morgan Run Natural Environmental Area. This hub is mostly protected for Baltimore's water supply and Morgan Run NEA, and a MET. There is still a relatively small section of Green Infrastructure hub that is unprotected, north of Morgan Run NEA. Since a Green Infrastructure corridor connecting portions of the Reservoir is partially in agriculture, it may be desirable to restore this section to natural vegetation (DNR, 2000-2003). According to the Maryland Greenways Commission, there is a greenways which is partially existing and partially proposed. Patapsco Regional Greenway runs along Liberty Reservoir and connects with Patapsco Valley State Park, Morgan Run NEA, and Patapsco River.

The following information is based on the document *Rural Legacy FY 2003: Applications and State Agency Review*. The Upper Patapsco Watershed Rural Legacy Area includes approximately 14,145 acres. This area is currently largely undeveloped (76%). This area was chosen in order to protect productive agriculture, headwaters of significant drinking water supply, and forest for wildlife corridors. The goal is to protect 10,000 acres (71%). Currently, 2,740 acres (19%) of this land is protected through various methods. The sponsor is Carroll County. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not adequate enough to support all of these requests, other programs should consider preservation of these sites.

While there are no designated Nontidal Wetlands of Special State Concern within this watershed, there are several potential WSSC, located in the northern portion of the watershed. These are not protected.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Middle Run subwatershed should be top priority for restoration (Carroll County Department of Planning Bureau of Resource Management. 2003).
    - Subwatershed 103 should be one of the top priority subwatersheds for restoration within Middle Run.
    - Subwatershed 104 is ranked second priority for restoration and also should be protected.
    - Subwatershed 106 is ranked third for restoration.
- Snowdens Run subwatershed should be second priority (Carroll County Department of Planning Bureau of Resource Management. 2003).
    - Subwatershed 203 was ranked first priority for restoration.
    - Subwatershed 201 is second priority for restoration.
    - Subwatershed 205 is third priority for restoration.
- Restore wetlands designed to improve water quality within Liberty Reservoir.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect Rural Legacy areas that are not currently protected.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
    - Most of the Potential WSSC in the northern headwaters are within a designated Ecologically Significant Area containing Federally listed species.
    - The Potential WSSC in the western part of the watershed (south of Friendship Valley Middle School) is within a designated Ecologically Significant Area containing State listed species.

  - The designated Ecologically Significant Area along the North Branch Patapsco River, just upstream of the land protected by Liberty Reservoir, containing State listed species.
  - The designated Ecologically Significant Area within the Hampstead area, containing Federally listed species.
- Within Middle Run, Subwatershed 104 is high priority for protection (Carroll County Department of Planning Bureau of Resource Management. 2003).
- Protect wetlands that provide water quality improvement functions for Liberty Reservoir.
- Protect wetlands and streams within the headwaters.

South Branch Patapsco (02130908)

Background

This watershed is within Carroll and Howard Counties. Based on MDP 2002 GIS land use data, the Carroll County portion of the South Branch Patapsco watershed has 326 acres of open water and 38,580 acres of land. The land acres are divided as follows: urban 12,906 acres (33%), agriculture 15,434 acres (40%), forest 10,075 acres (26%), wetlands 39 acres (<1%) and barren land 126 acres (<1%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate. This watershed includes Piney Run Reservoir.

A large amount of the Carroll County portion of this watershed is classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways, including along the South Branch Patapsco River, Gillis Falls, Piney Branch, and tributaries. There are also additional small wetlands that are not directly associated with a waterway.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
  - Aquatic bed: 6 acres
  - Emergent: 105 acres
  - Scrub shrub: 56 acres
  - Forested: 162 acres
  - Unconsolidated bottom: 355 acres
  - Unconsolidated shore: 1 acre
  - Farmed: 2 acres

- Riverine unconsolidated shore: 14 acres
- Total: 700 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02130908	-2.51	2.04	3.00	0	2.53

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. For the Carroll County portion they are as follows:

- Use III: natural trout waters;
  - Piney Run and all tributaries From mouth to Slacks Road (on Springfield State Hospital grounds)
  - Gillis Falls and all tributaries
  - South Branch Patapsco and all tributaries Above confluence with Gillis Falls tributaries
- Use III-P: natural trout waters and public water supply; Piney Run and all tributaries Above Slacks Road (on Springfield State Hospital grounds)
- Use IV: recreational trout waters; South Branch Patapsco River Mainstem only

Water Quality

Source water assessments were completed for several water supplies within this watershed. The water supply name and susceptibility are as follows:

- *Town of Mt. Airy* (unconfined aquifer): nitrates, VOCs, SOCs, naturally occurring radionuclides, and bacteria/viruses (in two wells).
- *Freedom District*: (surface – withdraws form Liberty Reservoir): dissolved solids, chlorides, disinfection by-product precursors, nutrients (mainly P), contaminant spills, protozoas, viruses, bacteria, and turbidity.
- *Gaither Manor Apartments* (unconsolidated aquifer): nitrates, VOCs, and naturally occurring radon.
- *Ashleys Trailer Park* (unconsolidated aquifer): nitrates, VOCs, arsenic, radon.
- *Pleasant Ridge* (unconfined aquifer): naturally occurring radon-222 (depending on approved maximum contaminant levels).
- *Pleasant View Nursing Home* (unconsolidated aquifer): nitrates and naturally occurring Radon-222 (depending on approved maximum contaminant levels).

The 1998 Clean Water Action Plan classified the watershed as Category 3, a pristine or sensitive watershed in need of protection. Failed indicators included high nitrogen

loading. Indicators suggesting need for preservation included a high non-tidal in-stream habitat index, high non-tidal fish index of biotic integrity, a high imperiled aquatic species indicator, and presence of trout spawning areas.

According to the 2002 303(b) report, a portion of the wadeable tributaries (47 miles) fail to support all designated uses due to habitat alteration. Piney Run Reservoir failed to support all designated uses due to nutrients, low dissolved oxygen, and aquatic plants.

The 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Patapsco River*; nutrients, sediments.
- *Piney Run* (021309081023 in Carroll County); poor biological community.
- *Piney Run Unnamed Tributary* (021309081024 in Carroll County); poor biological community.
- *Hay Meadow Branch Unnamed Tributary* (021309081027 in Howard County); poor biological community.

A water quality analysis for sediments was completed for Piney Run Reservoir and is summarized here. Piney Run Reservoir, a 298-acre Carroll County-owned reservoir is located near Eldersburg. This impoundment was created for water supply, flood control, and recreation. Piney Run and an unnamed tributary (under White Rock Road) are the inflows and Piney Run is the outflow. Soils surrounding the lake are well-drained, with rolling/hilly topography. The watershed of this reservoir is half agriculture (50%), followed by urban (24%), forest/herbaceous (22%), and open water (4%) (MDP, 2000 data). This reservoir is a Use III-P designation, water contact recreation, natural trout, public water supply. A 1994 Maryland Lake Management Survey recommended that shore erosion should be controlled, leading to this waterway being listed on the 1998 303d list for impairment due to sedimentation. Further investigation of sedimentation surveys and secchi depth determined that sedimentation is not currently a significant problem. This report recommended that Piney Run Reservoir be removed from the 303d list for sediments.

A DRAFT water quality analysis for eutrophication was completed for Piney Run Reservoir, with results summarized as follows. This report found that water quality was not impaired by nutrients (based on the use designation requirements). However, water is just within the standards for nutrients, being borderline mesotrophic and eutrophic. Since this area is developing quickly, Carroll County must develop a Watershed Protection Plan to protect the impoundment. This plan should address protection of the water supply, managing water-based recreational activities, and monitoring the changes in the watershed. The only significant point source is South Carroll High School WWTP, discharging into Piney Run.

Restoration/Preservation

A stream corridor assessment should be completed for Piney Run Reservoir in 2006. A Piney Run watershed management plan, although not begun yet, may be completed in 2007 (Nelson, 2006 pers comm.). This will include data collection, water quality monitoring, and a resulting watershed management plan. Piney Run reservoir watershed is roughly 10.6 sq. miles. It is dominated by agriculture (50%), forest (33%), and low to medium density residential (15%) (Carroll County, 2004).

Hydric soils suggest where wetlands are currently or were historically. There are many "poorly drained" hydric soils that are not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). These are located mainly along waterways and are scattered throughout the watershed. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

There is a large Green Infrastructure hub along Patapsco River and smaller hubs around Piney Run Park and northeast of Mt. Airy. These hubs are largely protected by Patapsco Valley State Park, Piney Run Park, and Gillis Falls Watershed Park. There is still a portion of unprotected hub north of Gillis Falls Watershed. Since many of the Green Infrastructure corridors are currently in agriculture, these may be sites for restoration of natural vegetation (DNR, 2000-2003). There are additional protected sites owned by the County and METs. According to the Maryland Greenways Commission, there are two existing or proposed recreational greenways.

- *Patapsco Regional Greenway*.
- *Piney Run Greenway*.

There is a State-designated Nontidal Wetlands of Special State Concern, called Hoods Mill, in this watershed. Information about this site is summarized from the document *Nontidal Wetlands of Special State Concern of Five Central Maryland Counties and Coastal Bay Area of Worcester County, Maryland*. Hood Mill was originally listed as a WSSC due to an endangered butterfly. Since it is believed this butterfly is extirpated in Maryland, DNR has recommended this site be removed from the WSSC designation.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along the waterways.
- Restore wetlands designed to improve water quality of Piney Run Reservoir.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers (unless it is removed from the WSSC list).
- Protect portions of Green Infrastructure that are not currently protected, especially along the waterways.
- Protect wetlands that provide water quality improvement functions for Piney Run Reservoir.
- Protect wetlands and streams within the headwaters.

Prettyboy Reservoir (02130806)

Background

This watershed is located within Carroll and Baltimore Counties and in Pennsylvania. Based on MDP 2002 GIS land use data, the Carroll County portion of the Prettyboy Reservoir watershed has 5 acres of open water and 20,816 acres of land. The land acres are divided as follows: urban 4,374 acres (21%), agriculture 11,121 acres (53%), and forest 5,320 acres (26%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate. As suggested by the name, this watershed contains Prettyboy Reservoir (within Baltimore County).

There is a fair amount of soil within the Carroll County portion of this watershed classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

Small amounts of carbonate rock are located within this watershed, with the largest strip following Alesia Road. These carbonate areas are important because they have a potential for sinkhole formation and groundwater contamination.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways. However, some wetlands are not directly associated with a waterway. These are scattered throughout the watershed.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine unconsolidated shore: 133 acres
- Palustrine
    - Emergent: 280 acres
    - Scrub shrub: 55 acres
    - Forested: 186 acres
    - Unconsolidated bottom: 113 acres
    - Farmed: 48 acres
- Riverine unconsolidated shore: <1 acre
- Total: 815 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02130806	-0.12	0	0	0	-0.12

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Gunpowder Falls and tributaries (above Loch Raven Dam): Use III-P natural trout waters and potable water supply.

Water Quality

Source water assessments were completed for several water supplies within this watershed. The water supply name and susceptibility are as follows:

- *Town of Manchester* (unconfined aquifer): nitrates, VOCs, naturally occurring radon, and coliform.
- *Town of Hampstead* (unconfined aquifer): nitrates, VOCs, SOCs, and naturally occurring radionuclides.

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high nutrient concentrations, high population density, high percent unforested stream buffer (46%), and high soil erodibility (0.29). Wetland loss was estimated to be 892 acres. Indicators for Category 3 include high non-tidal instream habitat index, high non-tidal fish index of biotic integrity (FIBI), trout spawning areas, and presence of designated Wildlands.

According to the 2002 305(b) report, the mainstem river (above Prettyboy Reservoir) fails to support all designated uses due to bacteria. A portion of the nontidal wadeable tributaries (36 miles) fails to support all designated uses due to an impaired biological community. Prettyboy Reservoir fully supports all designated uses. Lack of stream cover have resulted in seasonally high water temperatures (DNR, 2000).

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Prettyboy Reservoir Impoundment*; nutrients. Methylmercury in fish tissue is causing impairment, but already has a completed TMDL.
- *Gunpowder River* (Reservoir to Falls Road); fecal coliform.
- *Compass Run* (021308060313 in Baltimore County); poor biological community.

- *Poplar Run* (021308060313); poor biological community.
- *Prettyboy Branch* (021308060313 in Baltimore County); poor biological community.
- *Prettyboy Branch Unnamed Tributary 1* (021308060313 in Baltimore County); poor biological community.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There is a lot of "poorly drained" hydric soil that is not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). These include areas along most of the waterways. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

Within the Carroll County portion of this watershed, State-designated Green Infrastructure is mostly linear, including a few small hubs and connecting corridors. There are some "gaps" in natural vegetation within some of the hubs and corridors. These may be good areas for restoration to natural vegetation. The only protected land are METs and some County-owned land.

There is one State-designated Nontidal Wetland of Special State Concern in this watershed. Information about this site is summarized from the document entitled *Nontidal Wetlands of Special State Concern of Five Central Maryland Counties and Coastal Bay Area of Worcester County, Maryland*. Alesia Swamp (DNR name: Alesia Wetlands) is a circumneutral seepage wetland located north of Alesia on an unnamed tributary to Gunpowder Falls. It contains seven rare, threatened, or endangered plant species, a federally threatened species, and three uncommon "watch list" species. The site is surrounded by farm fields and roads and is privately owned. Threats to the system are from sediment, non-native species, and ATVs. Some ATV damage has already occurred. This system is sensitive to changes in surrounding hydrology and development. It is recommended that a forested buffer be created around the site. Due to the high number of sensitive species present at this site, and the fact that it may be the only designated WSSC within Carroll County (assuming Hoods Mill will be removed from the WSSC list), this site should be high priority for preservation.

In addition to the above designated WSSC, there are numerous potential WSSCs, located throughout the watershed. These are unprotected.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Restore wetlands designed to improve water quality within Liberty Reservoir.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected.

- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected. Over half of the Carroll County portion of the watershed is designated Ecologically Significant Area, containing Federally listed species. The Potential WSSC are within this designated area.
- Protect wetlands that provide water quality improvement functions for Liberty Reservoir.
- Protect wetlands and streams within the headwaters.

Loch Raven Reservoir (02130805)

Background

The majority of this watershed is within Baltimore County, with a small amount in Carroll and Harford Counties. Based on MDP 2002 GIS land use data, the Carroll County portion of the Loch Raven Reservoir watershed has 535 acres of land. The land acres are divided as follows: urban 354 acres (66%), agriculture 150 acres (28%), and forest 31 acres (6%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this document, is a better estimate. As the name suggests, this watershed contains the Loch Raven reservoir.

The Carroll County portion of this watershed contains some soil classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Aquatic bed: 6 acres
    - Emergent: 105 acres
    - Scrub shrub: 56 acres
    - Forested: 162 acres
    - Unconsolidated bottom: 355 acres
    - Unconsolidated shore: 1 acre
    - Farmed: 2 acres
- Riverine unconsolidated shore: 14 acres
- Total: 700 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent	Permittee	Programmatic	Other Gains	Net Change

	Impacts (acres)	Mitigation (acres)	Gains (acres)	(acres)	(acres)
02130805	-1.27	1.23	0	0.08	0.05

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Gunpowder Falls and tributaries (above Loch Raven Dam): Use III-P natural trout waters and potable water supply.

Water Quality

The sourcewater assessment for the Town of Hampstead found the water supply withdrawing from the unconfined aquifer was susceptible to nitrates, VOCs, SOCs, and naturally occurring radionuclides.

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high population density and high soil erodibility (0.31). Wetland loss was estimated to be 2,261 acres. Indicators for Category 3 include trout spawning areas, presence of designated Wildlands, and the presence of a drinking water intake.

According to the 2002 305(b) report, the mainstem river (Loch Raven Reservoir to Prettyboy Dam) and the Loch Raven Reservoir fully support all designated uses. A portion of the wadeable tributaries (190 miles) supports all designated uses. Another portion fails to support all designated uses (31 miles) due to an impaired biological community from habitat alteration (bank instability and channelization) and changes in hydrology. The remainder of the wadeable tributaries were inconclusive (16 miles).

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Loch Raven Reservoir Impoundment* (non-tidal); nutrients, sediments. Methylmercury in fish tissue also impairs water, but a TMDL has been completed for this contaminant.
- *Greene Branch* (021308050301 non-tidal in Baltimore County); poor biological community.
- *Unnamed Tributary to Carroll Branch* (021308050304 non-tidal in Baltimore County); poor biological community.

- *Little Falls* (021308050312 non-tidal in Baltimore County); poor biological community.
- *Oregon Branch* (021308050302 non-tidal in Baltimore County); poor biological community.
- *Loch Raven Reservoir Unnamed Tributary* (021308050300 non-tidal in Baltimore County); poor biological community.
- *Long Quarter Branch Unnamed Tributary* (021308050300 non-tidal in Baltimore County); poor biological community.
- *Piney Run* (021308050308 non-tidal); poor biological community.
- *Piney Run Unnamed Tributary 1* (021308050308 non-tidal); poor biological community.
- *McGill Run Unnamed Tributary* (021308050308 non-tidal in Baltimore County); poor biological community.
- *Second Mine Branch* (021308050309 non-tidal); poor biological community.
- *First Mine Branch* (021308050309 non-tidal); poor biological community.
- *Fourth Mine Branch* (021308050309 non-tidal in Baltimore County); poor biological community.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There are some "poorly drained" hydric soils that are not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands), located along the tributaries of Little Piney Run. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

The Carroll County portion of this watershed does not contain any designated Green Infrastructure.

There are no State-designated Nontidal Wetlands of Special State Concern within the Carroll County portion of this watershed.

Conewago Creek (02050301)

Background

The majority of this watershed is within Pennsylvania. However, there is a small portion in Carroll County. Based on MDP 2002 GIS land use data, the Carroll County portion of Conewago Creek watershed has 3,364 acres of land. The land acres are divided as follows: urban 523 acres (16%), agriculture 1,979 acres (59%), and forest 862 acres (26%). Since the MDP estimates of wetland acreage are often underestimated, DNR wetland data, as described later in this section, is a better estimate.

There is an impoundment on Conewago Creek within Pennsylvania that provides drinking water to Hanover, PA (DNR, 2000).

Some of the Carroll County portion of this watershed is classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as "prime farmland when drained." While it may not be desirable to exclude all soils classified as "prime farmland when drained" from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

Mapped wetlands (based on DNR and NWI GIS data) are mainly located along waterways. There are also additional small wetlands that are not directly associated with a waterway.

Estimates of wetland acreage for the entire Maryland portion of this watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Emergent: 13 acres
    - Scrub shrub: 1 acre
    - Forested: 9 acres
    - Unconsolidated bottom: 6 acres
    - Farmed: 4 acres
- Total: 32 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there have been no regulated impacts to wetlands (Walbeck, 2005).

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments within Carroll County are designated Use I, recreation contact and protection of aquatic life.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Failing indicators include high nitrogen loadings and high amount of unforested stream buffer (52%). Indicators for Category 3 include high amount of wetland-dependent species.

According to the 2002 305(b) report, data for the wadeable tributaries was inconclusive.

Restoration/Preservation

Hydric soils suggest where wetlands are currently or were historically. There are some "poorly drained" hydric soils that are not mapped wetlands (based on NRCS SSURGO

GIS data and NWI/DNR wetlands), located along the waterways. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

The Carroll County portion of this watershed contains some Green Infrastructure hub and corridors around Hanover Wildlife Management Area (DNR, 2000-2003).

While there are no designated Nontidal Wetlands of Special State Concern within this watershed, there is one potential WSSC, located in the southern portion of the watershed. This is not protected.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation.
- Restore wetlands designed to improve water quality within the Pennsylvania reservoir.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect portions of Green Infrastructure that are not currently protected.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected. The Potential WSSC is within a designated Ecologically Significant Area containing Federally listed species.
- Protect wetlands that provide water quality improvement functions for the Pennsylvania reservoir.
- Protect wetlands and streams within the headwaters.