II. BRODHEAD CREEK AND MCMICHAELS CREEK WATERSHED CHARACTERISTICS

A. Watershed Characteristics

The Brodhead Creek and McMichaels Creek Watershed as illustrated in Figure II-1 of Appendix D are located in south central, central, and northeastern Monroe County and southwestern Pike County.

The Brodhead Creek and McMichaels Creek Watershed are contained within seventeen (17) municipalities in Monroe County and one municipality in Pike County as follows:

Barrett Township
Chestnuthill Township
Coolbaugh Township
East Stroudsburg Borough
Greene Township (Pike County)
Hamilton Township
Jackson Township
Middle Smithfield Township
Mt. Pocono Borough
Paradise Township
Pocono Township
Price Township
Ross Township
Smithfield Township
Stroud Township
Stroudsburg Borough
Tobyhanna Township
Tunkhannock Township

Brodhead Creek drains a watershed area of approximately one hundred seventy-two (172) square miles in central and northeastern Monroe County and a small section of southwestern Pike County. Major tributaries to Brodhead Creek include Buck Hill Creek, Griscom Creek, Leavitt Branch, Marshalls Creek and its tributaries, Michael Creek, Middle Branch, Mill Creek, Paradise Creek and its tributaries, Pine Mountain Run, Poplar Run, Rattlesnake Creek, Sambo Creek, Spruce Cabin Run, and Stony Run.

McMichaels Creek drains a watershed area of approximately one hundred thirteen (113) square miles in south central Monroe County. Major tributaries to McMichaels Creek include Appenzell Creek, Bowers Creek, Fall Creek, Hypsy Creek, Kettle Creek, Lake Creek, Little Pocono Creek, Pocono Creek Sand Spring Run, and Spring Run. The Brodhead Creek and McMichaels Creek Watershed and major tributaries are shown in Figure II-1 of Appendix D.

Large scale mapping of the watershed is available for review at the Monroe County Planning Commission office and available online at the Monroe County Conservation District website.

The major traffic routes in the Brodhead Creek and McMichaels Creek Watershed include Interstate Route 80 as well as PA Routes 611, 940, 209, 33, 191, and 447. Interstate Route 80 runs east-west through the center of the watershed.

Land use in the watershed is primarily residential, especially in Jackson (central), Chestnuthill, and Ross Townships (southwest). There are large undeveloped areas found throughout the watershed. Urbanized areas are found in the Boroughs of Mount Pocono, Tobyhanna and Coolbaugh Townships (northwest), Pocono Township (central), Stroudsburg and East Stroudsburg Boroughs (southeast), and Smithfield and Stroud Townships (southeast). Commercial land uses have been concentrated along major arterial and collector highways such as Pa. State Routes 611, 940, 209, 191, and 447.

B. Topography

The topography of the Brodhead Creek and McMichaels Creek watershed, as shown on the Digital Elevation Model (DEM) in Figure II-2 of Appendix D, varies significantly along its reach. In the upper headwaters of the Brodhead, the terrain is primarily steep with widening valleys. In the middle reaches of the watershed, the terrain is steep to mild in slope with U-shaped valleys. And in the lower reaches, the terrain consists of steep to moderate slopes with wide to narrow valleys. The McMichaels Creek has steep to mildly sloping terrain in its headwaters with a widening valley. The middle reaches have a gently sloping terrain, with knobby hills and a wide valley. The lower reach contains steep to moderately sloping terrain with wide to narrow valleys.

C. Geology

Geology plays a direct role in surface runoff in the Brodhead-McMichaels Watershed because it affects the soil types within the watershed through parent material breakdown. The geology of the southernmost portions of both the Brodhead and McMichaels Creek watersheds consists of formations which include some deposits of limestone, as described below. The geologic map of the watershed can be found in Figure II-3 of Appendix D. Below is a description of geologic formations in the watershed.

1. **Beaverdam Run Member of Catskill Formation** - Alternating olive-gray siltstone and sandstone; marine fossils.

2. **Bloomsburg Formation** - Grayish-red siltstone, shale, and sandstone arranged in fining- upward cycles.

3. **Buttermilk Falls through Esopus Formation Undivided** - In descending order; Buttermilk Falls Limestone - gray fossiliferous limestone and black chert; Palmerton Sandstone – massive white siliceous sandstone; Schoharie Formation - gray calcareous, argillaceous siltstone; Esopus Formation - gray silty shale and sandy siltstone.

4. **Duncannon Member of Catskill Formation** - Grayish-red sandstone, siltstone, and claystone in fining-upward cycles; conglomerate occurs at base of some cycles.

5. **Long Run Member of Catskill Formation** - Gray and grayish-red sandstone and grayish-red siltstone and claystone in fining-upward cycles.

6. **Long Run and Walcksville Member** - Combination of Long Run and Walcksville Member descriptions.

7. **Mahantango Formation** - Gray, brown, and olive shale and siltstone; marine fossils. Includes following members, in descending order: Tully - limestone or calcareous shale; Sherman Ridge, Montebello (sandstone), Fisher Ridge, Dalmatia, and Turkey Ridge. In south central Pennsylvania, includes Clearville, Frame, Chaneysville, and Gander Run Members. Characterized by coarsening-upward cycles.

8. **Marcellus Formation** - Black, carbonaceous shale; sparse marine fauna and siderite concretions. Contains local limestone ("Purcell") member. Tioga bentonite included at base in eastern Pennsylvania.

9. **Packerton Member of Catskill Formation** - Greenish-gray to gray sandstone; some laterally persistent conglomerate beds in lower part.

10. **Poplar Gap Member of Catskill Formation** - Gray and light-olive-gray sandstone conglomerate containing intermittent red beds; laterally equivalent to Clarks Ferry, Sawmill Run, and Berry Run Members.

11. **Poplar Gap and Packerton Member** - Combination of Poplar Gap and Packerton Member descriptions.

12. **Ridgeley Formation-Coeymans Formation Undivided** - In descending order: Ridgeley Formation - white siliceous sandstone; Shriver Chert - gray siltstone and shale and dark- gray chert; Port Ewen Shale - dark-gray calcareous siltstone and shale; Minisink Limestone - dark-gray clayey limestone; New Scotland Formation - dark-gray fossiliferous shale and clayey limestone; Coeymans Formation - gray, clayey to sandy limestone.

13. **Towamensing Member of Catskill Formation** - Dominantly gray sandstone and some siltstone; freshwater fossils.

14. **Trimmers Rock Formation** - Olive-gray siltstone and shale, characterized by graded bedding; marine fossils; some very fine grained sandstone in northeast; black shale of Harrell Formation at base in Susquehanna Valley.

15. **Walcksville Member of Catskill Formation** - Greenish-gray sandstone and red siltstone and claystone in fining-upward cycles.

D. Soils (Hydrologic Soil Groups)

Soil characteristics are critical elements of stormwater runoff management. Each soil type has unique characteristics such as depth to bedrock (i.e., soil depth), texture, and structure, which define the ability to infiltrate stormwater and remove runoff pollutants. The soil characteristic of major importance to stormwater management planning is the Hydrologic Soil Group. Hydrologic Soil Groups account for physical soil characteristics as well as a slope factor to give an indication of runoff potential.

The USDA Natural Resources Conservation Service (NRCS) has established a criterion determining how soils will affect runoff by placing all soils into Hydrologic Soil Groups (HSGs) HSGs are broken down into four groups (A through D) based on infiltration rate and depth.

The A soils have high infiltration rates even when thoroughly wetted and consist mainly of deep, well-drained to excessively drained soils with moderately fine to moderately coarse textures. The A soils have a high rate of water transmission and low runoff potential

The B soils have moderate infiltration rates when thoroughly wetted and consist mainly of moderately deep or deep, moderately well or well drained soils with moderately fine to moderately coarse textures. The B soils have a moderate rate of water transmission.

The C soils have slow infiltration rates when thoroughly wetted and consist mainly of: (1) soils with a layer that impedes the vertical movement of water, or (2) soils with moderately fine or fine textures and slow infiltration rates. The C soils have a slow rate of water transmission.

The D soils have very slow infiltration rates when thoroughly wetted and consist mainly of: (1) clayey soils with high swelling capacity or potential, (2) soils with a high permanent water table, (3) soils with a claypan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. The D soils have a very slow rate of water transmission and a high runoff potential.

Hydrologic Soil Groups were mapped in the original Brodhead and McMichaels Creek Watershed Act 167 Plans. Soils and Hydrologic Soils Group designations for locations within the watershed may be obtained through the online USDA Web Soil Survey.