PLATE 3.11 - ENERGY RESOURCES MAP

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and
Washington Counties, Pennsylvania
Scale: 1" = 1 Mile December 2014
BioMost, Inc., Mars, PA

PLATE 3.11 - ENERGY RESOURCES MAP

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and Washington Counties, Pennsylvania
Scale: 1" = 1 Mile December 2014
BioMost, Inc., Mars, PA

Section 4: Water Resources

Introduction

Fresh, clean water is vital to all life on Earth. The Raccoon Creek Region is blessed with abundant supplies of water in the many miles of major creeks and smaller tributaries that feed into Raccoon Creek or flow westward into West Virginia toward the Ohio River. Throughout the development of the Raccoon Creek Region Conservation Plan, residents and stakeholders made it very clear that clean water and recreational access to waterways are among their chief concerns.

This section of the Plan will detail the major streams in the Region and their protected uses; describe key water features, dams and impoundments; explore water quality challenges, particularly Abandoned Mine Drainage and its treatment; and briefly describe public water uses and supplies.

Pennsylvania Watershed Designations

The Pennsylvania Department of Environmental Protection (DEP) divides the Waters of the Commonwealth into six major drainage basins: Great Lakes, Ohio, Upper/Middle Susquehanna, Lower Susquehanna, Potomac and Delaware. The Ohio River basin in Pennsylvania has a total drainage area of 3084 square miles and encompasses all of Beaver and Lawrence Counties, much of Mercer, Butler, Allegheny, and Washington Counties, and small portions of Crawford, Venango and Greene Counties.

The Raccoon Creek Watershed is located in the Ohio River Basin which is listed by the DEP as Basin Number 20. Within Basin Number 20, the Raccoon Creek Watershed is designated as Sub-basin 20D. 20D includes not only Raccoon Creek at its tributaries, but also the watersheds between it and the state line which flow westward toward the Ohio River through the West Virginia panhandle. The 20D Region covers 330.5 square miles in Beaver, Allegheny and Washington Counties. [1] It is illustrated in “Plate 4.1: State Water Plan 20D Sub-basins and Watersheds” found at the end of this section.

Watershed Address

Much like the US Postal Service uses zip+4 codes to locate cities, towns and individual streets; the US Geological Survey (USGS) has developed a system for cataloging and describing the location of surface water resources in the United States. USGS divides the continental United States into eighteen major geographic regions, further dividing those regions into sub-regions, then into accounting units and finally into cataloging units. The end result is blissfully unknown

---

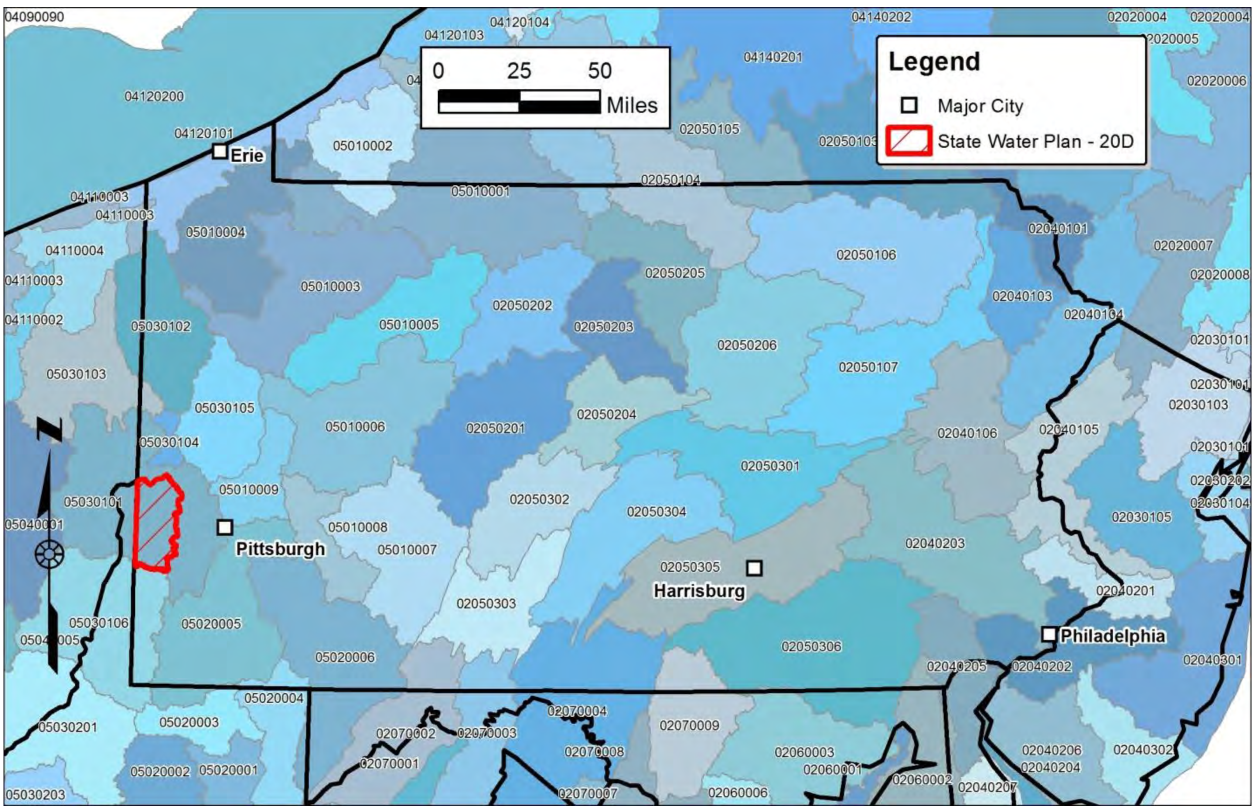
[1] Pennsylvania Department of Environmental Protection, Watershed Notebook, available at http://www.dep.state.pa.us/redirector/?varURL=http://www.epa.gov/surf2/hucs/05030105/, accessed 7/3/2014.

to the streams themselves, but is called a Hydrologic Unit Code, or HUC. The HUC Code can be considered a watershed's "address."

The Raccoon Creek Watershed Region's HUC code, 05030101,[2] is depicted in Figure 4.1 and decoded as follows:

Region 05:	All waterways draining into the Ohio River Basin (excluding the Tennessee River Basin)
Sub-region 03:	Upper Ohio
Accounting Unit 01:	Upper Ohio-Beaver
Cataloging Unit 01:	Raccoon

Figure 4.1: Pennsylvania Hydrologic Unit Codes (HUC)



[2] USGS Water Resources, Hydrologic Unit Maps, available at http://water.usgs.gov/GIS/huc.html, accessed 7/3/2014.

Major Streams in Sub-basin 20D Raccoon Creek

Within the 330.5 square-mile Raccoon Creek Region are numerous major streams, each having named and un-named tributaries. Details of these major streams, also provided in "Section 1: Project Characteristics," are listed in Table 4.1 and depicted on "Plate 4.1: Water Resources" found at the end of this Section.

Table 4.1: Major Streams of the 20D Raccoon Creek Sub-basin[3]

Major Stream Name	Stream Order at Mouth*	Stream Length (miles)	County or Counties	Receiving Waterway
Raccoon Creek, Main Stem	5	47.70	Bvr. & Wash.	Ohio River
Cross Creek	5	16.02	Washington	Ohio River
Aunt Clara Fork, King's Creek	4	9.09	Bvr. & Wash.	Ohio River
King's Creek	4	6.64	Washington	Ohio River
Little Raccoon Run	4	6.40	Washington	Raccoon Creek
Mill Creek	4	7.90	Beaver	Ohio River
North Fork, Cross Creek	4	8.49	Washington	Ohio River
Raredon Run	4	5.24	Alleg. & Bvr.	Raccoon Creek
Service Creek	4	9.40	Beaver	Raccoon Creek
Traverse Creek	4	9.45	Beaver	Raccoon Creek
Brush Run	3	5.00	Washington	Raccoon Creek
Burgetts Fork	3	9.87	Washington	Raccoon Creek
Cherry Run	3	2.87	Washington	Raccoon Creek
Harmon Creek	3	8.87	Washington	Raccoon Creek
Little Traverse Creek	3	5.57	Beaver	Raccoon Creek
Middle/North Forks, Cross Creek	3	4.59	Washington	Ohio River
North Fork, King's Creek	3	5.33	Beaver	Ohio River
Pegg's Run	3	3.09	Beaver	Ohio River
Potato Garden Run	3	6.23	Allegheny	Raccoon Creek
Scott Run	3	3.49	Washington	Ohio River
South Fork	3	1.55	Beaver	Ohio River
South Fork, Cross Creek	3	7.00	Washington	Ohio River
St. Patrick's Run	3	3.56	Washington	Ohio River

**Stream ordering is a method of assigning a numeric order to links in a stream network. Stream order identifies and classifies types of streams based on their numbers of tributaries. Upstream segments (headwater links) are always assigned an order of 1. The stream order increases when streams of the same order intersect. Therefore, the intersection of two first-order links will create a second-order link, the intersection of two second-order links will create a third-order link, and so on. However, the intersection of a first-order and a second-order link will not create a third-order link but will retain the order of the highest-ordered link.[4] The Strahler method, developed by Arthur Strahler in 1952, is the most common stream ordering method and was used in the development of Table 4.1.*

---

[3] Geographic Information Systems compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

[4] ArcGIS Resource Center, How Stream Order Works, available at http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//009z000000z3000000.htm, accessed 7/4/2014.

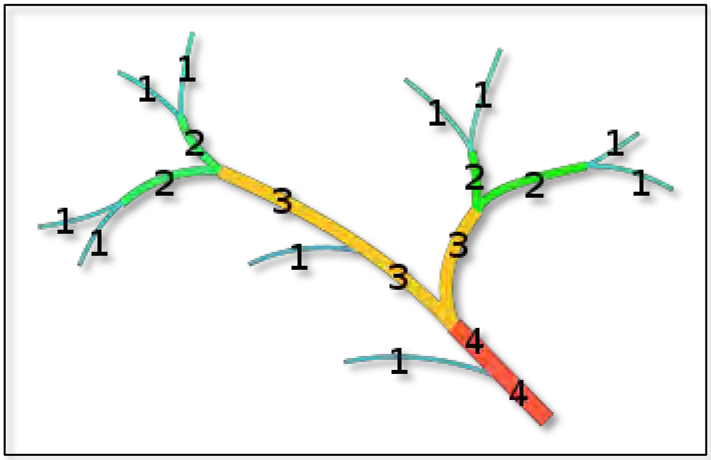


Figure 4.2: Illustration of the Strahler stream order, used to define stream size based on a hierarchy of tributaries.

Stream Designations & Water Quality Standards

The Pennsylvania Department of Environmental Protection (DEP) has established water quality standards for all surface waters in the Commonwealth of Pennsylvania: our streams, rivers, and lakes. These standards establish designated uses and criteria to protect those uses.[5]

Legal standards for water quality in Pennsylvania are set in PA Code Title 25, Chapters 92 and 93. These standards are designed to implement the requirements of the PA Clean Streams Law (Sections 5 and 402) and the Federal Clean Water Act (Section 303-33 U.S.C.A. §1313). The water quality standards are developed to define:

- Designated uses of the surface waters of the Commonwealth of Pennsylvania.
- Specific numerical narrative criteria necessary to achieve and maintain those uses.
- Anti-degradation policy.

Protected Use: Aquatic Life

PA Code Title 25, Chapter 93 provides a list of designated water uses and criteria to determine those uses. Water quality standards are in-stream water quality goals that are implemented by specific regulatory requirements, such as effluent limits on individual sources of potential pollution.[6] Designated water uses for streams in the Raccoon Creek Watershed are briefly described below:

[5] Pennsylvania Department of Environmental Protection, available at http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/stream_redesignations/553982; accessed 7/3/2014.

[6] Pennsylvania Code, Pennsylvania Department of Environmental Protection, Chapter 93 Water Quality Standards. n.d.; available at http://www.pacode.com/secure/data/025/chapter93/chap93toc.html; accessed 7/3/2014.

Cold Water Fisheries (CWF) support maintenance and propagation of fish species and additional flora and fauna which are indigenous (native) to a cold water habitat.

Warm Water Fisheries (WWF) support maintenance and propagation of fish species and additional flora and fauna which are indigenous (native) to a warm water habitat.

Trout Stocked Fisheries (TSF) support maintenance of stocked trout from February 15 to July 31; maintenance and propagation of fish species and additional flora and fauna which are indigenous (native) to a warm water habitat.

Protected Use: Special Protection

High Quality Waters (HQ) are of excellent quality and have environmental or other features that require special water quality protection. Based on at least one year of data, the surface waters exceed quality levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water.

Exceptional Value Waters (EV) are also of excellent quality in terms of temperature, pH, dissolved oxygen and absence of pollutants. Biologically, the water meets at least one of these criteria: it supports a high-quality aquatic community of sensitive macroinvertebrates; it is a Class A wild trout stream; the water is within a National wildlife refuge, a State game propagation and protection area, designated State park natural area or State forest natural area, National natural landmark, Federal or State wild river, Federal wilderness area or National recreational area.[7]

[7] Pennsylvania Code, Pennsylvania Department of Environmental Protection, Chapter 93 Water Quality Standards. n.d.; available at http://www.pacode.com/secure/data/025/chapter93/s93.4b.html; accessed 7/3/2014.

Table 4.2: PA Department of Environmental Protection (DEP) Stream Designations in the 20D Raccoon Creek Sub-basin[8]

Stream Name	Zone	County	Protected Water Use	Exceptions
Raccoon Creek	Basin, Source to Traverse Creek	Beaver	WWF	None
Traverse Creek	Basin, Source to Raccoon Creek State Park Dam	Beaver	HQ-CWF	None
Traverse Creek	Basin, State Park Dam to Mouth	Beaver	TSF	None
Raccoon Creek	Basin, Main Stem, Traverse Creek to Mouth	Beaver	WWF	None
Unnamed Tributaries to Raccoon Creek	Basins, Traverse Creek to Mouth	Beaver	WWF	None
Little Traverse Run	Basin	Beaver	WWF	None
Raredon Run	Basin	Beaver	WWF	None
Service Creek	Basin, Source to J.C. Bacon Dam	Beaver	HQ-CWF	None
Service Creek	Basin, J.C. Bacon Dam to Mouth	Beaver	WWF	None
Frames Run	Basin	Beaver	WWF	None
Trampmill Run	Basin	Beaver	WWF	None
Gums Run	Basin	Beaver	WWF	None
Fishpot Run	Basin	Beaver	WWF	None
Squirrel Run	Basin	Beaver	WWF	None
Haden Run	Basin	Beaver	WWF	None
Peggs Run	Basin	Beaver	WWF	None
Smiths Run	Basin	Beaver	WWF	None
Mill Creek	Basin, (all sections in PA)	Beaver	TSF	None
North & South Forks, Tomlinson Run	Basin, (all sections in PA)	Beaver	WWF	None
Kings Creek	Basin, (all sections in PA)	Washington	CWF	None
Harmon Creek	Basin, (all sections in PA)	Washington	WWF	None
Cross Creek	Basin, Source to Avella Water Intake	Washington	HQ-WWF	None
Cross Creek	Basin, (all sections in PA), Avella Water Intake to PA/WV State Border	Washington	WWF	None

[8] The Pennsylvania Code, § 93.9w. Drainage List W., Ohio River Basin in Pennsylvania, available at http://www.pacode.com/secure/data/025/chapter93/s93.9w.html; accessed 7/10/2014.

Wetlands

In ordinary, everyday terms, wetlands are swamps or marshes. They might also be called bogs, fens or vernal pools, depending on various site conditions in which they are found. Wetlands perform many valuable functions in nature. Please see "Section 5: Biological Resources" for an in-depth discussion of wetland habitats.

> ***Wetlands provide a multitude of ecological, economic and social benefits. They provide habitat for fish, wildlife and a variety of plants. Wetlands are also important landscape features because they hold and slowly release flood water and snow melt, recharge groundwater, recycle nutrients, and provide recreation and wildlife viewing opportunities for millions of people.***
>
> ***US Fish & Wildlife Service***

PA Department of Environmental Protection (DEP) Wetland Description

Wetlands are defined by the Commonwealth of Pennsylvania as, "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions..." Wetlands are regulated by DEP through PA Code Title 25, Chapter 105, as well as by the US Army Corps of Engineers through Section 404 of the Clean Water Act.

US Fish & Wildlife Service (USFWS) Wetland Description

The US Fish & Wildlife Service (USFWS) provides information on wetlands nationwide through the National Wetlands Inventory (NWI). There are two general categories of wetlands: coastal which include estuaries and inland which include rivers, lakes and riparian areas. In the Raccoon Creek Region, only inland wetlands are present.

Wetlands in the Raccoon Creek Region:

Wetlands cover about 2.5% of Pennsylvania.[9] Varying types of wetlands evolve in response to site characteristics such as topography, hydrology, climate, vegetation and water chemistry[10]. Based on the Cowardin classification system used by the US Fish and Wildlife Service, the following types of wetlands can be found in the Raccoon Creek Region:

[9] Goodrich, Laurie J., Brittingham, Dr. Margaret. *Wildlife Habitat in Pennsylvania: Past, Present, and Future.* 2002 (accessed May 29, 2010); available at http://www.fish.state.pa.us/promo/grants/swg/nongame_plan/pa_wap_sections/appx2habitat_pt2.pdf

[10] Gray, Ayesha. Brooks, Robert P., et all. Penn State Cooperative Wetlands Center *Pennsylvania's Adopt-a-Wetland Program Wetland Education and Monitoring Module.* 2001 (accessed on May 27, 2010); available at http://old.geog.psu.edu/wetlands/manual/toc.html#top

Table 4.3: Wetland Systems in the 20D Raccoon Creek Region[11]

Type of Wetland	20D Acreage	Description
Lacustrine	1252	Wetlands and deep-water habitats situated in a topographic depression or a dammed river channel; lakes and reservoirs; intermittent lakes; larger than 20 acres; lacking trees, shrubs, or persistent emergents.
Palustrine	1574	Non-tidal wetlands dominated by trees, shrubs, emergents, mosses or lichens; includes marshes, swamps, bogs and wet meadows, bottom-land hardwood forests, vernal pools; majority of vegetated freshwater wetlands in U.S. are palustrine.
Riverine	1084	Deep-water habitats, mostly nonvegetated wetlands contained in natural or artificial channels containing flowing water, or which form a connecting link between the two bodies of standing water; includes freshwater rivers, creeks, washes, ditches, stream channels and immediately adjacent wetlands
Total Wetland Acreage in 20D	**3910**	**1.85% of total acreage in the 20D Region is wetlands**

Figure 4.3: A Palustrine wetland formed by a beaver dam, Hillman State Park, 4/28/2011. Photo by Kevin Kisow.

[11] Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm

Wetlands are particularly important in the Raccoon Creek Region because of their ability to passively filter out and settle water-borne contaminants. One of the best examples is the Potato Garden Run valley, lined on both sides with massive, linear coal waste piles that leach Abandoned Mine Drainage into the stream. Through the natural action of beavers damming the waterway and creating wetlands, a significant amount of pollution treatment takes place without any human effort.

Figure 4.4: Apparently undaunted by foul water, beavers build lodges like this one and maintain many dams on Potato Garden Run, providing a degree of treatment for seepage from coal waste piles lining both sides of the creek. 4/2/2005.

The Unites States Environmental Protection Service (USEPA) conducted the country's first nation-wide land-cover mapping project, creating the National Land Cover Database (NLCD). The NLCD defines woody wetlands into further classifications.[12]

[12] US Environmental Protection Agency, National Land Cover Class Definitions 2001, available at http://www.epa.gov/mrlc/definitions.html; accessed 7/4/2014.

Table 4.4: US EPA National Land Cover Data
Forested Wetland Types in the 20D Raccoon Creek Region

Wetland Type	Acres	Characteristics
Palustrine Emergent	555	Dominated by persistent emergent vascular plants, emergent mosses or lichens; plants generally remain standing until the next growing season.
Palustrine Forested	430	Dominated by woody vegetation taller than 12 feet; total vegetation coverage is greater than 20 percent.
Palustrine Scrub Shrub	84	Dominated by woody vegetation less than 12 feet in height; total vegetation coverage is greater than 20 percent; species present could be true shrubs, young trees and shrubs or trees that are small or stunted due to environmental conditions.
Palustrine Unconsolidated Bottom	505	Unconsolidated bottoms are characterized by the lack of large stable surfaces for plant and animal attachment; usually found in areas with lower energy than rock bottoms; may be very unstable.[13]
Total Acres	**1574**[14]	

Floodplains

Flooding is part of a waterway's natural cycle. Before dams and other types of containment were built, rivers and creeks would spread out during a flood, spilling onto adjacent lowlands, which are call "floodplains." The flood waters would settle and be absorbed, the flora and fauna would be refreshed and renewed, and the soil would be enriched by nutrients carried in organic matter, silt and sediment. Even having wetland coverage of 4 percent to 5 percent in a watershed can reduce peak floods by half![15]

The federal Watershed Protection & Flood Prevention Act of 1954 provides for cooperation between the Federal government and the States and their political subdivisions in a program to

[13] Ecology Dictionary.org, Environmental Engineering Dictionary, available at http://www.ecologydictionary.org/WETLANDS,_PALUSTRINE; accessed 7/4/2014.
[14] Geographic Information Systems compiled from data collected by the Southwest PA Commission and PASDA.
[15] Bucco, Gloria. Pennsylvania Department of Conservation and Natural Resources. Floodplains: Don't Mess with Mother Nature. 2008; available at: http://www.dnr.state.ne.us/floodplain/PDF_Files/MotherNature_Part1.pdf, accessed on May 29, 2010.

prevent erosion, floodwater, and sediment damage; to further the conservation, development, utilization, and disposal of water; and to further the conservation and proper utilization of land.[16]

Statewide Flood Management Studies

The Pennsylvania Emergency Management Agency (PEMA) maintains Flood Study maps and data for use by local emergency management agencies, geographic information systems (GIS) and planning departments, watershed organizations, and other interested parties for hazard identification and risk assessment, mitigation planning and flood response training activities. PEMA Flood Study data estimates potential damages and locations by using the Federal Emergency Management Agency's Hazus flood analysis model. The maps and supporting analysis can be overlaid on other GIS maps (county, local roads, street maps, municipal maps, etc.) to show the location and extent of potential flood damages in a 100-year flood. They do not include all possible flood risk areas and are not based on actual past flood events.[17]

Figure 4.5: Flood damage on Raccoon Creek at Independence Marsh. 11/4/2004.

County Flood Management Studies

FEMA has completed Flood Management Studies for Allegheny, Beaver and Washington Counties. These studies show the main flooding problem for all waterways is the potential for flash flooding as a result of intense, localized thunderstorms. The main flooding season is usually from April to September; however, flooding can occur at any time of the year. Digital Flood Insurance Rate Mapping (DFIRM) for all Pennsylvania counties is available on FEMA's website, http://www.rampp-team.com/pa.htm; phone number 1-800-621-3362, TDD: 1-800-462-7585. The US Army Corps of Engineers has additional information regarding Flood Risk Management at http://www.usace.army.mil/CECW/PlanningCOP/Pages/flood.aspx.[18]

[16] USDA Natural Resource Conservation Service, Watershed and Flood Prevention Operations Program, available at http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wfpo/; accessed 7/5/2014.

[17] FEMA, Pennsylvania Emergency Management Completes Statewide Flood Study Using HAZUS-Multi Hazard, available at https://www.fema.gov/hazus/pennsylvania-emergency-management-completes-statewide-flood-study-using-hazus-multi-hazard; accessed 7/5/2014

[18] FEMA, Pennsylvania Mapping Status, available at https://www.rampp-team.com/pa.htm; accessed 7/5/2014.

Lakes and Ponds

There are several differences between lakes and ponds. The differences are listed in Table 4.6 and include size, creation, depth, chemistry and influence on climate. The primary difference is size – Relatively speaking, lakes are large while ponds are much smaller. Ponds often have the same temperature from top to bottom, whereas lakes can have dramatically different temperatures from the surface to the bottom waters.[19]

Table 4.5: General Comparison of Lakes and Ponds[20]

Attributes	Lakes	Ponds
Size	Larger	Smaller
Depth	Deeper	Shallower
Temperature (top vs. bottom)	Often dramatically different	Typically similar
Light penetration	Typically does not reach bottom in deep areas	Typically reaches bottom in all areas
Origin	Typically natural	Typically man-made
Climate impact	Large lakes can affect local climate	Typically, greatly affected by local climate

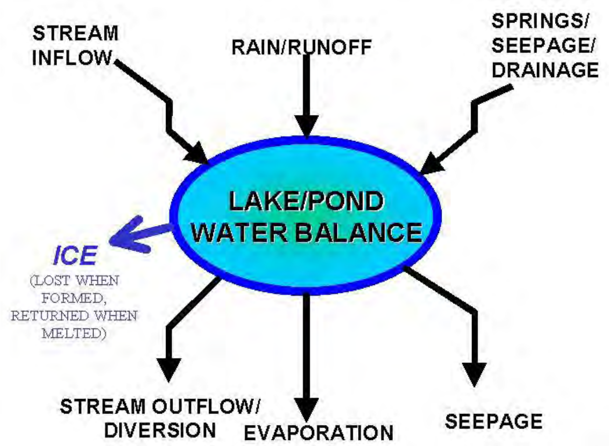
Water enters a lake or pond in a variety of ways: directly from precipitation falling on the surface of the lake, or indirectly from streams, rivers, springs, seeps or other drainage.

Water leaves the lake or pond by flowing into streams, seeping into the ground, or evaporating into the air. Lakes and ponds can lose water during the winter months to ice, which is mostly recovered in the spring when the ice thaws, although some water is lost due to sublimation - evaporation directly from the ice.

Freshwater contained in lakes and ponds is one of our most treasured natural resources. The Commonwealth of Pennsylvania contains 146,813 acres of lakes and ponds, much of which is used for recreation.[21] The 20D Raccoon Creek Watershed Region contains approximately 2,548 acres of lakes and ponds, comprising about 1.2% of the Region's total area.[22]

[19] United States Environmental Protection Agency. Lakes Ponds and Reservoirs, available at http://www.epa.gov/bioiweb1/aquatic/lake-r.html; accessed 7/5/2014.
[20] Ibid.
[21] USGS National Hydrography Dataset, available at http://nhd.usgs.gov/; accessed 7/5/2014.
[22] Geographic Information Systems compiled from data collected by the Southwest PA Commission and PASDA.

Figure 4.6: Water Intake/Out-take of a Lake[23]



Lakes available for public use in the Raccoon Creek Region include:

Cross Creek Lake – Cross Creek County Park's 258 acre lake has been open to the public since 1984. The lake's amenities include boat launches, a handicapped fishing pier, restrooms, pavilions and a playground. Work began on a second boat launch at Thompson Hill Road in May, 2014. Cross Creek Lake is a Big Bass and a Panfish Enhancement Lake. Special Regulations and Laws are provided by the Pennsylvania Fish & Boat Commission. Sailboating and motor boating by permit. Information is available at: http://www.co.washington.pa.us/DocumentCenter/View/1195.

Upper Lake – the original lake of Raccoon Creek State Park is open for fishing but not swimming. Located on the west side of the Park below the Group Camps, this 12-acre secluded lake is reverting from open water to wetlands and is a haven for wildlife.

Raccoon Lake – the main lake on the east side of Raccoon Creek State Park is one of its biggest attractions. This 101-acre lake features a 500' sand/turf beach with modern bath house and concession stand. Please read and follow posted beach rules; swim at your own risk. Canoes, kayaks and paddle boats are available for rental. Both of the Park's lakes are stocked with brook and rainbow trout. The main lake features an ADA-accessible fishing pier.

Harmon Creek Lake – please see page 16 for more information about this historic lake.

[23] Ecology of Lakes & Ponds for Anglers and Other Fish-ites, The Water Balance, available at http://www.combat-fishing.com/lakepondbalance.htm; accessed 7/5/2014.

Bennett Acres Campground – features two fishing lakes for guests with "prime fishing holes." No swimming. Located south of US Route 22 near First Niagara Pavilion. Information can be viewed at: http://www.bennettacres.com/.

Several other privately-owned lakes and nearly 600 ponds are also located in the 20D Raccoon Creek Region.[24] Please refer to "Plate 4.2: Water Resources" for locations.

Table 4.6: USGS-Recognized Named Lakes in the 20D Raccoon Creek Region[25]

Name	Size (acres)	Purpose	Municipality	County
Ambridge Reservoir	405.5	Municipal water supply; closed to the public.	Raccoon Township	Beaver
Cherry Valley Reservoir	51.6	Former municipal water supply; now private recreational lake.	Mount Pleasant Township	Washington
Upper Lake (Raccoon Creek State Park)	7.7	Fishing, wildlife observation; original main lake of Raccoon Creek State Park.	Hanover Township	Beaver
Raccoon Lake	74.9	Fishing, paddling, swimming; water supply for Raccoon Creek State Park (treated).	Hanover Township	Beaver
Zinc Dam Reservoir	10.6	Former municipal water supply for Burgettstown; dam is breached; closed to the public.	Smith Township	Washington

Harmon Creek Lake: A Hidden Treasure

Text and photos for this section were contributed by Kevin Kisow, a student at Indiana University of Pennsylvania, majoring in Criminology and minoring in Geographic Information Systems (GIS).

Just across Steubenville Pike from Hillman State Park lies the clearest water around Northern Washington County - Harmon Creek Lake. Built in the 1940's on a former strip mine owned by the Harmon Creek Coal Corporation, the 12-acre lake and its surroundings served as a retreat for company employees.

Harmon Creek Coal's owner, James Hillman, pioneered strip mine reclamation in the Burgettstown area at a time when the coal industry had very little government regulation imposed on it. Harmon Creek Coal's land reclamation practices were outstanding compared to other coal companies of that time. By building Harmon Creek Lake on a strip mine, Hillman

[24] United States Geological Survey National Hydrography Data set (USGS); available at http://nhd.usgs.gov
[25] Geographic Information Systems compiled from data collected by the Southwest PA Commission and PASDA.

proved that such land could be properly reclaimed for public recreation and wildlife habitat. This helped lead to new state regulations for the coal industry.

Harmon Creek Coal did not remove every highwall from the lands they stripped, but the efforts they did make went far beyond what any other coal company of that era provided. Multiple articles appeared in Pittsburgh and Washington newspapers showcasing the lake and other reclamation efforts nearby.

Harmon Creek Lake was strategically placed for the clean springs that supply water to it. In the lake's earliest days it once had four fishing piers and a large wooden suspension bridge that spanned across the left finger. Remnants of the bridge and an old brick stove can be found on the western shores.

A mid-1950's advertisement by Harmon Creek Coal Company read, in part:

> *"Harmon Creek Coal Corporation believes that when something of value is taken from the land, something of value must be returned. That's the philosophy behind our reclamation and reforestation program at our Burgettstown, Pa., mine, the largest strip mine operation in Western Pennsylvania.*
>
> *As the coal is mined, the land is restored to a greater value than originally…*
>
> *Ugly spoil banks have been replaced with a game preserve, recreation park, swimming pool, fishing lake and forests.*
>
> *We mine excellent coal from the land and we return the value in the coin of conservation…it's good business."*

Today, the lake still provides the Raccoon Creek Watershed a pristine body of water as intended by the Harmon Creek Coal Corporation and the Hillman Family. Over the last 60 years the lake has seen a lot of visitors, as it was once a part of State Game Lands 117.

Now owned by the Washington County Economic Development Partnership, Harmon Creek Lake and surrounding forest land is part of the Starpointe Business Park. In 2011 the dam underwent its first major restoration project. Contractor BKG Industries of Imperial, PA, was hired by Fourth River Development (developer of Starpointe Business Park) to clear vegetation, install a spillway, riprap, new manholes and improved drainage along the roadway.

I documented the entire restoration process for BKG. Background history including newspaper articles; historic aerial photos and literature cited are available at https://kkisow.squarespace.com/harmon-creek-lake/.

Harmon Creek Lake needs your help. Please be a good steward. Help keep the Raccoon Creek Watershed clean and pristine by lending a hand to remove litter from the lake area.

Figure 4.8: Winter snow reveals some of the strip mined terrain surrounding Harmon Creek Lake in Hanover Township, Washington County.
Photo by Kevin Kisow, 1/2/2013.

“Harmon Creek Lake, a Hidden Treasure,” Works Cited

"Awards Won By Harmon Creek Coal." *The Washington Reporter* [Washington, PA] 21 Jan. 1958: 41. Print.

"Free Park To Be Give To Burgettstown On Fourth." *Pittsburgh Post Gazette* [Pittsburgh, PA] 3 July 1945: 1. Print.

"Game Refuge To Be Created." *The Washington Reporter* [Washington, PA] 21 Jan. 1937: 14. Print.

"A Philanthropist And Conservationist." *Observer Reporter* [Washington, PA] 18 Jan. 1969, sec. A: 4. Print.

USGS Data Monitoring Stations

The US Geological Survey (USGS) operates a network of 229 continuous-record, stream-flow gaging stations on rivers and streams throughout Pennsylvania. These and other hydrologic-monitoring stations are operated and maintained in cooperation with the DEP, the US Army Corps of Engineers (USACOE), the National Weather Service (NWS), and various other federal, state, and local agencies. At 189 of the continuous-record stations, the recorded stream stages are transmitted on a near-real-time basis by way of satellite telemetry to the USGS computer in Lemoyne, PA and to other federal, state, and local agencies in the Commonwealth. During normal stream-flow conditions, the stations transmit stream-stage data every 4 hours; during floods, the data are transmitted, on average, every 15 minutes. Numerous agencies use the data to initiate evacuations and manage emergency response.

Gaging stations enable the automatic monitoring of streams, wells, lakes, reservoirs, and other water bodies. Instruments at these stations collect information such as water height, discharge, water chemistry and water temperature. These stations transmit data directly to the designated USGS facility via a satellite communication system. The data are then processed and delivered to the public via the internet.

High water terms used by the National Weather Service include bankfull stage, action stage, and flood stage. These are defined as follows:[26]

> **Bankfull Stage** - an established gage height at a given location along a river or stream, above which a rise in water surface will cause the river or stream to overflow the lowest natural stream bank.
>
> **Action Stage** - the stage which, when reached by a rising stream, represents the level where the NWS or a partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity (i.e., flooding). Gage data should be closely monitored by any affected people if the stage is above action stage.
>
> **Flood Stage** - an established gage height for a given location above which a rise in water surface level begins to create a hazard to lives, property, or commerce. The issuance of flood advisories or warnings is linked to flood stage. Not necessarily the same as bankfull stage.

There is only one USGS gaging station on Raccoon Creek - Moffett Mill in Potter Township. Action stage for Raccoon Creek at Moffett Mill is 10.4 feet; flood stage is 13 feet. Two other gages are located on the Ohio River, upstream and downstream of Montgomery Dam.

Table 4.7: USGS Gaging Stations in the 20D Raccoon Creek Region[27]

Gaging Station with General Location	**Site #**	**County**	**Municipality**	**Drainage Area (sq. mi.)**
Raccoon Creek at Moffett Mill* Bridge	03198000	Beaver	Potter Twp.	178
Ohio River at Montgomery Dam, upper pool	03108490	Beaver	Industry Boro.	21,714
Ohio River at Montgomery Dam, lower pool	03108500	Beaver	Potter Twp.	22,960

**USGS spells the name of this station "Moffatts Mill." Locally, the road upon which the gaging station is located is spelled "Moffett Mill."*

[26] National Weather Service, Alaska-Pacific River Forecast Center, available at http://aprfc.arh.noaa.gov/resources/docs/floodterms.php; accessed 7/5/2014.
[27] USGS Current Conditions for Pennsylvania: Stream Flow, available at http://waterdata.usgs.gov/pa/nwis/current/?type=flow; accessed 7/5/2014.

The Moffett Mill gaging station is located 4.2 miles upstream from the mouth of Raccoon Creek at the Moffett Mill Bridge. This gage was put in service in May of 1915. Moffett Mill transmits data to the internet via satellite telemetry. Hour-by-hour readings are available on the web at the USGS website: http://waterdata.usgs.gov/pa/nwis/uv/?site_no=03108000&PARAmeter_cd=00065,00060,00010.

As evidenced by the graph below, annual peak flows in Raccoon Creek have maintained a fairly steady pattern over the past 98 years. Ice-jam floods in March of 1920 and April of 1922 reached 9.8 feet and 10,000 cubic feet per second.[28] However, Hurricane Ivan on September 17, 2004, dumped over five inches of rainfall on the Region, causing devastating flooding and shattering all previous records. On September 18, 2004, Moffett Mill recorded 14.29 feet on the gage with a peak flow rate of 21,200 cubic feet per second.[29] That is roughly equal to the space occupied by a dozen Class A motorhomes!

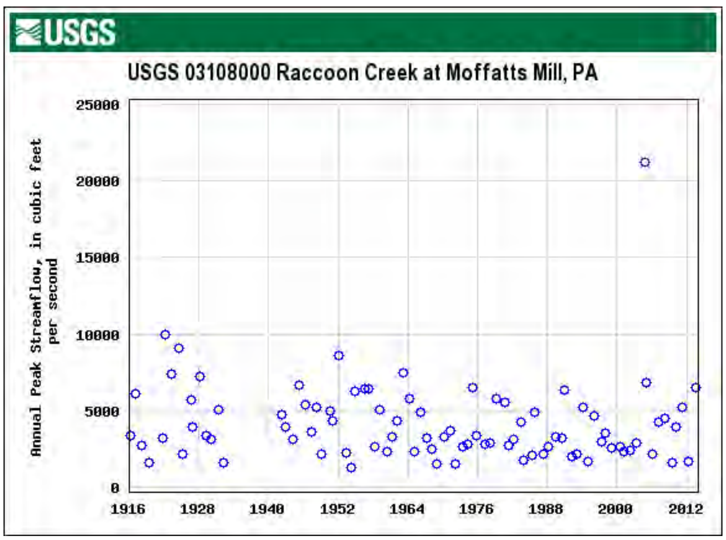


Figure 4.9: Annual peak flows for Raccoon Creek at the Moffett Mill Gage, 1916 through 2013, showing the magnitude of Hurricane Ivan's destruction in 2004.

[28] USGS, National Water Information System Web Interface, available at http://waterdata.usgs.gov/pa/nwis/uv/?site_no=03108000&PARAmeter_cd=00065,00060,00010; accessed 7/5/2014.

[29] USGS, Peak Stream Flow for the Nation, available at http://nwis.waterdata.usgs.gov/nwis/peak?site_no=03108000&agency_cd=USGS&format=html; accessed 7/5/2014.

Dams and Impoundments

The following is a summary of the Raccoon Creek Region's dams and impoundments, regulated by the PA Department of Environmental Protection.

Table 4.8: Impoundments with DEP-Regulated Dams in the 20D Raccoon Creek Region[30]

Name of Dam	County	Stream	Owner	Purpose	Year Built	Surface Area in Acres
PA-661	W	Cross Creek	Washington County Commissioners	Flood Control Recreation Water Supply	1979	260
Dinsmore No.2	W	Harmon Creek	Cherry Valley Lake Development Co.	Water Supply	1909	10
PA-481	W	Harmon Creek	Wash. Co. Comm.	Flood Control	1984	11
Little Blue Run	B	Little Blue Run	Pennsylvania Power Company	Tailings	1977	770
PA-486 Harmon Creek	W	Paris Run	Wash. Co. Comm.	Flood Control	1979	4
Cherry Valley	W	Raccoon Creek	Cherry Valley Lake Development Co.	Water Supply	1947	55
J.C. Bacon Dam	B	Service Creek	Ambridge Water Authority	Water Supply	1956	418
Emerald Lake (old dam)	W	St. Patricks Run	John Boschuk, Jr.	Recreation	1912	18
Harmon Creek PA-479	W	Tr. Harmon Creek	Wash. Co. Comm.	Flood Control	1969	4
Harmon Creek PA-484	W	Tr. Harmon Creek	Wash. Co. Comm.	Flood Control	1971	2
PA-480	W	Tr. Harmon Creek	Wash. Co. Comm.	Flood Control	1979	4
PA-482	W	Tr. Harmon Creek	Wash. Co. Comm.	Flood Control	1970	6
PA-485	W	Tr. Harmon Creek	Wash. Co. Comm.	Flood Control	1977	6
Bald Knob	A	Tr. Potato Garden Run	Aloe Coal Company	Other	1974	4
Duck Pond Dam	W	Tr. Raccoon Creek	Champion Processing, Inc.	Tailings	Blank	440
Ashton South Dam	W	Tr. Ralston Run	James A. Ashton	Recreation	Blank	1
PA-662	W	Tr. South Fork Cross Creek	Washington County Commissioners	Flood Control	1983	13
Group Camp	B	Traverse Creek	DCNR - Bureau of State Parks	Recreation	1938	8
Raccoon Creek	B	Traverse Creek	DCNR - Bureau of State Parks	Recreation	1948	80
PA-483	W	Ward Run	Wash. Co. Comm.	Flood Control	1973	4
Marshall Reservation No. 2	W	W. Br. St. Patricks Run	Paul J. Koepfer	Recreation	1928	15
East High Dissolved Solids Imp.	B	Wtrshd Ohio River	Pennsylvania Power Co.	Other	Blank	3
North Low Dissolved Solids Imp.	B	Wtrshd Ohio River	Pennsylvania Power Co.	Other	1974	3
South Low Dissolved Solids Imp.	B	Wtrshd Ohio River	Pennsylvania Power Co.	Other	1974	3
West High Dissolved Solids Imp.	B	Wtrshd Ohio River	Pennsylvania Power Co.	Other	1974	3
*Montgomery Dam	B	Ohio River	United States	Navigation	1936	-

*Operated and regulated by the US Army Corps of Engineers.
A = Allegheny County; B = Beaver County; W = Washington County

[30] US Army Corps of Engineers, National Inventory of Dams, available at http://geo.usace.army.mil/pgis/f?p=397:6:0::NO; accessed 7/11/2014.

Run-of-the-River Dams

According to the Pennsylvania Fish & Boat Commission's website, a "Run-of-the-River dam" is a manmade structure which:

1. is regulated or permitted by the Department of Environmental Protection (DEP) pursuant to the act of November 26,1978 (P.L.1375, No.325), known as the Dam Safety and Encroachments Act;
2. is built across a river or stream for the purposes of impounding water where the impoundment at normal flow levels is completely within the banks and all flow passes directly over the entire dam structure within the banks, excluding abutments, to a natural channel downstream; and
3. DEP determines to have hydraulic characteristics such that at certain flows persons entering the area immediately below the dam may be caught in the backwash.[31]

Figure 4.10: A cliff swallow flies to its nest in a drain on the spillway of the main lake at Raccoon Creek State Park. Photo courtesy of the Beaver County Times, 4/19/2012.

Historically, run-of-the-river dams were built to harness a stream's power to mill grain or power machinery. Today, these dams are often removed for habitat restoration and for safety reasons.

American Rivers is a national nonprofit organization which advocates for the removal of run-of-the-river dams. Lisa Hollingsworth-Segedy, Associate Director of River Restoration for American Rivers, can be contacted for further information at 412-727-6130 or by email at LHollingsworth-Segedy@americanrivers.org.

American Rivers' online Map of US Dam Removals 1936-2013 lists no dams removed in the 20D Raccoon Creek Region.[32] Likewise, the PA Fish & Boat Commission's online inventory of run-of-the-river dams shows none in the 20D Raccoon Creek Region.[33]

[31] Pennsylvania Fish & Boat Commission, Run of the River Dams, available at http://www.fish.state.pa.us/rrdam.htm; accessed 7/11/2014.
[32] American Rivers, Map of US Dam Removals 1936-2013, available at http://www.americanrivers.org/initiatives/dams/dam-removals-map/; accessed 7/11/2014.
[33] Pennsylvania Fish & Boat Commission, Run of the River Dams, available at http://www.fish.state.pa.us/rrdam.htm; accessed 7/11/2014.

Water Quality

Clean water for drinking, household use and recreation are very important to the residents of the Raccoon Creek Region. Along with preserving open green space, stakeholders are most concerned that water quality should continue to improve throughout the region. Since the late 1990s, great strides have been made by building Abandoned Mine Discharge treatment systems and improving public sewer systems. Residents are hopeful that new resource extraction industries will develop in ways that protect surface and ground water quality. Please see "Section 2: Issues, Concerns, Constraints" for further information.

In Pennsylvania, the Department of Environmental Protection (DEP) is charged with establishing standards for water quality, assessing the quality of waters statewide, and enforcing laws and regulations designed to protect our wetlands, floodplains, lakes and ponds. In 1997, DEP first implemented the Statewide Surface Waters Assessment Program and completed assessment of all "wadeable" sections of streams and rivers in 2006.

Figure 4.11: Iron and aluminum stain an unnamed tributary to Cross Creek near Browntown, 4/27/2005.

DEP establishes appropriate designated uses for aquatic life, water supply, recreation and fish consumption based on numerical or narrative measurements of levels of substances in streams. Please see "Plate 4.3: Designated Stream Uses" for mapping of the Region's streams according to their water quality designations.

Section 305(b) of the federal Clean Water Act requires periodic reports on the quality of waters in Pennsylvania.[34] Section 303(d) of the Clean Water Act requires states to list all impaired waters not supporting uses even after appropriate and required water pollution control measures have been taken. The source of impairment is listed, which may be one or more **point sources** (like industrial or sewage discharges), or **non-point sources** (such as abandoned

[34] Pennsylvania Department of Environmental Protection, *Assessment and Listing Methodology for Integrated Water Quality Monitoring and Assessment Reporting Clean Water Act Sections 305 (b)/303(d), 2012 Pennsylvania Integrated Water Quality Monitoring and Assessment Report* http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2012/1127203; accessed 7/6/2014.

mine lands or agricultural runoff).[35] "Plate 4.2: Water Resources" shows the Raccoon Creek Region's degraded streams with cause of impairment.

For aquatic life, negative impacts are identified primarily through stream biological community assessments. For streams that are used for water supplies, negative impacts are identified by evaluating the chemical quality of raw water monitored by water purveyors and by analyzing edible portions of fish. Recreational use impairments are identified using bacteriological data.[36]

Figure 4.12: Cliff Denholm and Margaret Dunn of BioMost sample drainage at the Francis Mine discharge, 11/23/2009. Photo courtesy of BioMost, Inc.

The 2012 PA Integrated Water Quality Monitoring and Assessment Report can be accessed at http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2012/1127203. The US EPA and DEP websites also provide information.

Table 4.9: PA DEP-Listed Causes of Impairment to Streams in the 20D Raccoon Creek Region shows causes of degradation to streams, or segments of streams, within the Raccoon Creek Region as identified by the Department of Environmental Protection.

"Plate 4.2: Water Resources Map" shows these degraded streams segments with cause of impairment. A color-coded key lists various types of pollution loading. Impaired stream sections are color-coded for their respective impairments. Note that some streams may be deemed impaired in their headwaters, but become cleaner in their lower reaches and are not color-coded as impaired. A good example of this is the main stem of Raccoon Creek itself.

---

[35] US EPA, *A Primer on Using Biological Assessments to Support Water Quality Management, October 2011, available at* http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/upload/primer_update.pdf; accessed 7/6/2014.

[36] Ibid.

Table 4.9: PA DEP-Listed Causes of Impairment to Streams in the 20D Raccoon Creek Region[37]

Source of Impairment	Miles
Abandoned Mine Drainage - Metals	**38.7**
Abandoned Mine Drainage - Metals ; Abandoned Mine Drainage - pH	**32.4**
Abandoned Mine Drainage - Metals ; Abandoned Mine Drainage - Siltation	**4.9**
Abandoned Mine Drainage - Metals ; Abandoned Mine Drainage – Suspended Solids	**15.0**
Abandoned Mine Drainage – Siltation; Abandoned Mine Drainage – Metals	**8.1**
Agriculture – Siltation; Road Runoff - Siltation	**9.1**
Erosion from Derelict Land - Siltation	**2.1**
Grazing Related Agriculture - Siltation ; Removal of Vegetation - Siltation	**23.7**
Habitat Modification - Siltation	**5.9**
Highway, Road, Bridge Construction – Siltation; Road Runoff - Siltation	**2.6**
Other - pH	**0.1**
Other - Siltation	**3.3**
Removal of Vegetation – Siltation; Road Runoff - Siltation	**1.2**
Road Runoff - Siltation	**0.7**
Small Residential Runoff – Organic Enrichment/Low Dissolved Oxygen; Road Runoff – Siltation	**2.5**
Source Unknown – Dioxins; Source Unknown - PCB	**0.4**
Source Unknown - Mercury	**6.2**
Source Unknown – Pathogens	**15.5**
Source Unknown – PCB; Source Unknown - Dioxins	**3.6**
Urban Runoff/Storm Sewers - Siltation	**0.03**
Total Miles of Impaired Streams	**177.9**

Point vs Nonpoint Sources of Water Pollution

Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.[38] That definition states:

The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.[39]

[37] Geographic Information Systems compiled from data collected by the Southwest PA Commission and PASDA.
[38] US EPA, What is Nonpoint Source Pollution? available at http://water.epa.gov/polwaste/nps/whatis.cfm; accessed 7/6/2014.
[39] Ibid.

Unlike pollution from industrial and sewage treatment plants, nonpoint source (NPS) pollution comes from many sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.

Nonpoint source pollution can include:[40]

- Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas
- Oil, grease and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet wastes and faulty septic systems
- Atmospheric deposition and hydromodification

Figure 4.13: A point source discharge from the Erie Mine stains the banks of Burgetts Fork near Burgettstown Blue Devils Stadium, 4/15/2004.

According to the US Environmental Protection Agency, nonpoint source pollution remains the leading cause of water quality problems nationwide, with harmful effects on drinking water supplies, recreation, fisheries and wildlife.[41]

National Pollution Discharge Elimination System (NPDES) Permits for Point Sources

National Pollutant Discharge Elimination System (NPDES) permits are issued by either the US EPA or an authorized state, such as Pennsylvania, to control point source discharges through the federal Clean Water Act. Each permit must contain industry-specific, technology-based and/or water-quality-based limits, and establish monitoring and reporting requirements.[42] Any facility that intends to discharge into waters of the United States must obtain a permit prior to initiating a discharge from pipes, spillways, ditches or any other point source. The

[40] Ibid.
[41] Ibid.
[42] US EPA, Water Quality Standards Handbook: Second Edition, March 2012, Available at http://water.epa.gov/scitech/swguidance/standards/handbook/; accessed 7/6/2014.

permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. Once the permit is approved, conditions are established under which a facility may discharge, along with effluent limits. The NPDES permit may also include discharge limits based on federal and state water quality criteria or standards designated to protect uses of surface waters. According to the USEPA, these standards, unlike the technology-based standards, generally do not take into account technological feasibility or project costs involved. [43]

PA Code Title 25, §92.1 defines a point source as "any discernible, confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, Concentrated Animal Feeding Operation (CAFO), landfill leachate collection system, or vessel or other floating craft, from which pollutants are or may be discharged."

Types of Regulated Pollutants

The DEP provides additional information regarding NPDES permits through a link on the Wastewater Operator Information website which can be accessed at: http://www.dep.state.pa.us/dep/deputate/waterops/redesign/PAGES/wwoperinfo.htm. The types of pollutants regulated include:

Conventional Pollutant— in sanitary wastes of households, businesses, and industries, including human wastes, ground-up food from sink disposals, laundry and bath waters

Fecal Coliform—bacteria in digestive tracts of humans and animals; indicates potential presence of pathogenic organisms

Oil and Grease—organic substances that may include hydrocarbons, fats, oils, waxes, and high-molecular fatty acids; often producing sludge solids difficult to process and properly treat

Toxic Pollutants—particularly harmful to human, animal or plant life; organics, the primary group, includes pesticides, solvents, polychlorinated biphenyls (PCBs), dioxins; metals includes lead, silver, mercury, copper, chromium, zinc, nickel, and cadmium

Nonconventional Pollutants— not conventional or toxic that may require regulation, including nutrients such as nitrogen and phosphorus

---

[43] United States Environmental Protection Agency, Aquaculture, available at http://www.epa.gov/agriculture/anaqulaw.html; accessed on 7/6/2014.

Total Maximum Daily Loads (TMDLs) for Point and Non-Point Pollution Sources

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters. A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.[44] In the Raccoon Creek Region, Harmon Creek, Raccoon Creek and the Ohio River have established TMDLs as shown in Figure 4.13 and Table 4.10.

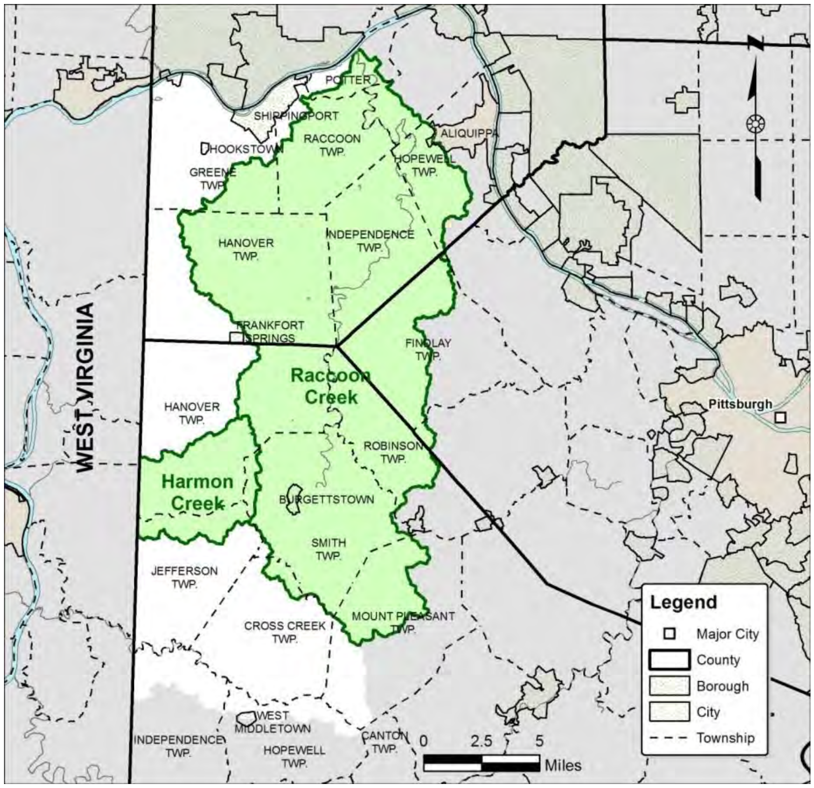
Table 4.10: 20D Region Streams with Established Total Maximum Daily Loads (TMDLs)[45]

Stream Name	County	Category	Cause	EPA Approval (date)	Online Report Hot-Link
Harmon Creek	Washington	AMD	Metals, pH, Siltation, Suspended Solids	4/4/2007	**TMDL:** Harmon Creek Watershed TMDL
Raccoon Creek	Allegheny, Beaver & Washington	AMD	Metals, pH, Siltation, Suspended Solids	4/7/2005	**TMDL:** Raccoon Creek Watershed TMDL
Ohio River	Beaver County	Fish Consumption	Chlordane, PCB	4/9/2001	**TMDL:** Ohio River Watershed TMDL

Figure 4.14: A look into the inlet pipe at the Langeloth Bore Hole Passive Treatment System in Langeloth, 12/10/2009. Photo courtesy of BioMost, Inc.

[44] EPA, Water: Total Maximum Daily Loads (303d), available at http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/; accessed 7/6/2014.
[45] Geographic Information Systems compiled from data collected by the Southwest PA Commission and PASDA.

Figure 4.15: 20D Region Streams with Established Total Maximum Daily Loads (TMDLs)[46]



Abandoned Mine Drainage

Drainage from abandoned coal mines is the largest source of nonpoint source pollution in Pennsylvania. Many of the waterways in the Commonwealth are impaired by the legacy effects of unregulated mining practices of the 19th through the mid-20th centuries. For over a hundred years, orange-running streams were considered signs of prosperity and the price of progress.

According to the draft 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report, over 5,500 miles of streams are degraded by Abandoned Mine Drainage (AMD).[47] In addition, 45 of Pennsylvania's 67 counties are impacted and there are over 250,000 acres of un-reclaimed mine lands, including 2.6 billion cubic yards of coal refuse piles.[48] Pennsylvania also has approximately 7,800 abandoned or inactive underground mines. In many cases, entire watersheds are nearly devoid of aquatic life. Today, we face a tremendous and expensive challenge to fix the mistakes of the past and secure a clean, healthy future for our waterways.

---

[46] Geographic Information Systems compiled from data collected by the Southwest PA Commission and PASDA.

[47] Pennsylvania Department of Environmental Protection. draft Pennsylvania Integrated Water Quality Monitoring and Assessment Report. 2014; available at http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/draft_integrated_water_quality_report_-_2014/1702856; accessed 7/9/2014.

[48] BioMost, Inc and Stream Restoration Inc. *Blacks Creek Restoration Plan.* 2007 (revised 4/2007)

AMD is the major impairment in the Raccoon Creek Region with more than 200 mine sites and 10,000 acres of surface mined lands. Forty miles of main stem Raccoon Creek and 30 to 40 miles of tributaries are degraded by AMD. Discharges are either highly alkaline or acidic; both types have very high concentrations of iron. Extensive impairment from abandoned deep mines is found in the Cherry Valley, Joffre and Burgettstown areas. Extensive limestone strata result in high base flow alkalinity. The major impairments, therefore, are iron hydroxide precipitate and sediment. Harmon Creek and Cross Creek are also impaired by metals and suspended solids from abandoned mine drainage.[49]

Coal Mining History of the Raccoon Creek Region

Most of the Raccoon Creek Region's coal mining has occurred in Washington County. Coal mining in the Region began in the late 18th century with the earliest known outcrop mine started in 1781. Because Washington County's coal was easy to access and of good quality, numerous small mines opened to provide coal for home heating and powering of small, localized industrial activity. After 1820, the need for coal for home heating grew as more homes were built.

By 1840, the early Pittsburgh iron and steel industrial complex became another consumer of the region's abundant coal resources. Soon, railroads, locks and dams were built to facilitate the transportation of coal to Pittsburgh. Circa 1880, Washington County delivered 700,000 tons of coal to market. From 1880 to 1923, coal production steadily increased to satisfy the booming industries on the Ohio and Monongahela Rivers. By 1923 a record 24.5 million tons of coal were produced In Washington County, much of it from the Raccoon Creek Region. Decreases in coal production occurred after 1923 until the 1960's when large steel companies created a certain amount of industry stability by owning seven of the nine major mines. In 1966, 14.1 million tons of coal was produced in 1966 in Washington County. But only one year later (1967), coal production in the Raccoon Creek Watershed was estimated to be less than 100,000 tons.[50]

Despite the fact that coal production has decreased since 1923, Washington County ranks number two among Pennsylvania's coal-producing counties. Besides the current active mining operations, the watershed contains millions of tons of coal refuse from abandoned and/or historic mining/waste sites. Un-reclaimed coal waste piles are the source of many water quality/environmental problems in the Raccoon Creek Region. [51]

The Raccoon Creek Watershed is known to have at least 175 to 200 AMD discharges. Of these, seven have been identified by the PA DEP as "primary AMD discharges" as detailed in Table

---

[49] Watershed Restoration Action Strategy (WRAS) Pennsylvania State Water Plan Subbasin 20D Raccoon Creek (Ohio River) Allegheny, Beaver and Washington Counties. 9/2003.
[50] PA DEP, *Final Raccoon Creek Watershed TMDL, Allegheny, Beaver, And Washington Counties for Acid Mine Drainage Affected Segments, Watershed History*, available at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/RaccoonCreek_FINAL_TMDL.pdf; accessed 7/9/2014.
[51] Ibid.

4.11. Remediation of these primary discharges is crucial to improving water quality in the Region. Treatment systems have been built for some of these discharges; they are described later in this Section.

Table 4.11: Primary AMD Discharges of the 20D Raccoon Creek Region[52]

Name of Discharge	PA DEP Designation	Receiving Stream	Municipality	County	Treat-ed?
Langeloth Borehole	L2	Burgetts Fork	Smith Twp.	Washington	Yes
East Plum Run	P6	Plum Run/ Burgetts Fork	Smith Twp.	Washington	No
West Plum Run	P7		Smith Twp.		No
Erie Mine	E1	Burgetts Fork	Smith Twp.	Washington	No
Joffre Branch 1	JB1	Raccoon Creek	Smith Twp.	Washington	Partial
Joffre Branch 2	JB2	Raccoon Creek	Smith Twp.	Washington	Yes
Hamilton Farm	H3	Potato Garden Run	Findlay Twp.	Allegheny	Partial

General Characteristics of Abandoned Mine Drainage (AMD)

The formation of mine drainage is essentially a weathering process that is a function of the geology, chemistry, biology, hydrology and mining methods at the site. Although the specific process may vary, AMD forms through a series of complex geochemical and, at times, microbial reactions that occur when water and oxygen contact sulfide minerals such as pyrite (FeS_2) which is typically present within coal and/or surrounding rock. Iron sulfide minerals break down in the presence of water and oxygen, not unlike a nail rusting, which in turn releases iron and forms sulfuric acid. Without the presence of water, oxygen, and sulfide minerals, AMD will most likely not form. When the iron is further oxidized and hydrolyzed (a reaction associated with water), iron compounds form and settle in ponds, wetlands, and streams.[53]

Because of the yellow, orange, and/or red color of these iron solids, they are often called "Yellowboy." Although there are a number of steps in the process, the reactions that form Yellowboy can be represented by the following general chemical equation:

$$4\,FeS_2 + 15\,O_2 + 14\,H_2O \rightarrow 4\,Fe(OH)_3 + 8\,H_2SO_4$$

In plain English, this reaction is:

Pyrite + Oxygen + Water → "Yellowboy" + Sulfuric Acid

---

[52] PA DEP, *Final Raccoon Creek Watershed TMDL, Allegheny, Beaver, And Washington Counties for Acid Mine Drainage Affected Segments, Watershed History*, available at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/RaccoonCreek_FINAL_TMDL.pdf; accessed 7/9/2014.

[53] BioMost, Inc. *McCaslin Road Mine Drainage Treatment Operation, Maintenance & Replacement Plan.* 2010.

The iron and sulfuric acid then react with other surrounding material to dissolve and release iron, aluminum, manganese and other metals that might be present, such as zinc, nickel, cadmium, calcium, magnesium, etc. As the water becomes oxygenated and/or gains alkalinity some of the metals form solids (called “precipitates”) that can also accumulate in ponds, wetlands and streams. When streambeds become coated with yellowboy, the habitat of aquatic insects may be smothered and destroyed. As benthic macroinvertebrates are critical to the food chain, loss of this habitat may prevent fish from living and/or reproducing in the stream. In addition, AMD often causes the stream to be acidic with a low pH which many organisms cannot tolerate.[54]

Figure 4.16: The Francis Mine Discharge along the Panhandle Trail, Smith Township, Washington County, 4/5/2005.

To choose the best method of treating an AMD discharge, the chemistry of the water is analyzed to characterize the AMD. The following parameters are typically measured:

pH indicates whether a solution is acidic, neutral, or basic (alkaline) based on hydronium (H_3O+) ions [a.k.a., hydrogen(H+) ion] concentration; the pH scale ranges from 0-14 with 0 most acidic, 7 neutral, 14 most basic.

Alkalinity is typically defined as the acid neutralizing or buffering capacity of a given volume of water. This refers to the ability of water, such as a stream, to neutralize acid. Depending on how much alkalinity is present, when acid is added, pH decreases or remains the same.

Acidity is typically defined as the ability of a solution to neutralize the alkalinity (base) of a given volume of water.

Dissolved Oxygen (DO) is the amount of oxygen dissolved in water; required for fish and other aquatic life.

[54] Ibid. BioMost, Inc. *McCaslin Road Mine Drainage Treatment Operation, Maintenance & Replacement Plan.* 2010.

Sulfate concentrations greater than 50 mg/L usually indicate coal mine drainage in Western Pennsylvania.

Specific Conductivity measures ability of water to carry an electrical current associated with presence of ions; readings are automatically normalized to 25^0C to eliminate variability.

Temperature affects various physical as well as chemical processes.

Oxidation/Reduction Potential (ORP) electron loss (oxidation) or gain (reduction); the higher the value above zero, the more oxidizing; the closer the value to zero the more reducing; negative values are reducing.

Total Suspended Solids (TSS) are the amount of solids retained from a given volume of water when passed through a certain pore-size filter, typically 0.45 µm (micrometers).

Total Dissolved Solids (TDS) are the combined content of all inorganic and organic substances small enough to pass through a 0.2 µm filter.

Total Solids include both TSS and TDS; these are usually measured by evaporating a water sample, then drying and weighing the remaining residue.

Metals iron **(Fe)**, manganese **(Mn)** and aluminum **(Al)** are most commonly monitored in mine drainage.

Passive Treatment Systems for AMD

The conventional treatment of mine drainage is labor and energy intensive and typically uses harsh chemicals. In contrast, passive systems use no electricity, require limited maintenance and use environmentally-friendly materials such as limestone aggregate and spent mushroom compost in a series of constructed ponds, beds, ditches and wetlands. Passive AMD treatment systems are a cost-effective way to add alkalinity to neutralize acidity while providing an environment suitable for beneficial chemical reactions and biological activity. For instance, dissolving limestone neutralizes acidity and raises pH, after which dissolved metals - through chemical, biological and physical processes - form particulates (solids) that are then retained in settling ponds and constructed wetlands. In some cases, where sufficient alkalinity is naturally present in AMD, only settling ponds and constructed wetlands are needed.[55]

When designing a passive system, the goal is to include components that provide long-term effective treatment, are economical to install and require minimal maintenance. There are several main types of passive treatment components that can be used, often in series and/or in parallel, to treat degraded mine drainage. These components are chosen based upon the AMD

[55] BioMost, Inc. *McCaslin Road Mine Drainage Treatment Operation, Maintenance & Replacement Plan.* 2010.

characteristics (quality and flow rate), preferred chemical or biological process and available construction space.[56]

Passive Treatment Systems in the 20D Raccoon Creek Region

Great improvements are happening in Pennsylvania's streams! About three hundred passive treatment systems have been installed throughout the state, greatly reducing the total load of pollutants[57]. In the Raccoon Creek Region, a cooperative group of local nonprofits, various government agencies, local businesses and landowners have been actively working to restore the severely degraded headwaters since 1999. Their collective efforts have resulted in the construction and ongoing maintenance of five passive treatment systems that remove about half of the total AMD loading into Raccoon Creek.[58]

Raccoon Creek's five passive systems are currently treating about 2.5 billion gallons of mine drainage per year, eliminating about 600 tons of iron, 62 tons of aluminum and over 1500 tons of acidity annually from Raccoon Creek and its tributaries. This reduction in pollution loading has significantly improved several miles of streams that until recently, no living person had ever seen any color but orange. Table 4.12 lists the AMD Treatment Systems in the Raccoon Creek Region and their effectiveness at reducing water pollution.

> ***Pennsylvania's AMD treatment systems are doing a tremendous job, treating over 77 billion gallons of water per year, removing over 8300 tons of iron, 1700 tons of aluminum, 720 tons of manganese and 9000 tons of acidity from our waterways yearly!***
>
> ***Datashed.org[59]***

Much of the work completed in the Raccoon Creek Watershed to date has been based upon background data collected by the DEP Greensburg District Mining Office and by Skelley and Loy as published in the year 2000 Raccoon Creek Watershed Survey and Restoration Plan. In 2007, BioMost, Inc. and Stream Restoration, Inc. published the *Raccoon Creek Operation and Maintenance Plan* for the four passive treatment systems in existence at that time.

---

[56] BioMost, Inc. *McCaslin Road Mine Drainage Treatment Operation, Maintenance & Replacement Plan.* 2010.
[57] Stream Restoration Inc., and Datashed. *Datashed Homepage*. 2014. (accessed on July 9, 2014); available at http://www.datashed.org.
[58] Raccoon Creek Watershed Association, About Us; available at http://www.independenceconservancy.org/about-raccoon-creek; accessed 7/9/2014.
[59] Datashed, Restoration Tote Board, available at http://www2.datashed.org/; accessed on 7/9/2014.

Even though great strides have been made to restore water resources affected by historical mining activities, much more funding is needed for ongoing maintenance of existing systems and construction of additional treatment systems at critical discharges.

Table 4.12: Effectiveness of AMD Treatment Systems in the Raccoon Creek Region[60]

Name of Treatment System	AMD Treated Gal./Yr.	Iron Removed Tons/Yr.	Aluminum Removed Tons/Yr.	Manganese Removed Tons/Yr.	Acidity Removed Tons/Yr.	Year Built	Owner
Hamilton Farm	210 million	165	1.5	2.4	181	2003	Private
JB1	1.952 billion	168	51	-	1027	2007	Private
JB2	137 million	62	8	-	170	2004	Independence Conservancy
Langeloth Bore Hole	55 million	112	63 lbs.	1	88	1999	Private
Solar Mine	142 million	96	2.3	3.2	40	2005	Independence Conservancy
Yearly Totals	**2.496 billion**	**603**	**62**	**6**	**1505**		

Figure 4.17: Tim Danehy of BioMost rolls up a flexible hose after testing the Erie Mine Discharge under Billy Boy's Pizza in Slovan, 3/26/2010. Photo courtesy of BioMost, Inc.

[60] Datashed, various, available at http://ww2.datashed.org/; accessed 7/9/2014.

Hamilton Farm AMD Treatment System

Figure 4.18: Upper settling basin of the Hamilton AMD Treatment System off Washington Rd. in Findlay Twp. The Burns-Hamilton Farmhouse is visible at far right. This National Register-eligible brick and cut stone home, built in 1841, was demolished in 2012. Photo 1/15/2004.

Solar Mine AMD Treatment System

Figure 4.19: The upper two of a series of settling basins & wetlands that treat the Solar Mine Discharge, located near Bald Knob along I-576 in Findlay Twp. Initial treatment of this discharge takes place in a massive limestone-filled channel under the highway. Photo 6/7/2012.

Joffre Branch 1 (JB1)

Figure 4.20: Former DEP Secretary David Hess (second from right) tours the JB1 Passive Treatment System under construction near Slak Lane in Smith Twp. L to R: Wayne Fuchs of Quality Aggregates, Margaret Dunn of Stream Restoration Inc., Hess, and Shaun Busler, also of SRI. Photo 12/12/2006.

Joffre Branch 2 (JB2)

Figure 4.21: Vicky Michaels and Al Moran of Independence Conservancy install the sign at JB2 on Joffre-Cherry Valley Road in Smith Twp. Listed are all the partners who made construction of this system possible. Photo 12/21/2007.

Langeloth Bore Hole

Figure 4.22: Split-rail fence and native wildflowers lend beauty to the Langeloth Bore Hole Passive Treatment System off Bologna Industrial Road near Slovan. Photo 6/26/2003.

Untreated AMD Discharges in the 20D Raccoon Creek Region

Abandoned underground mines in the Pittsburgh coal bed continue to be a source of pollution to over 30 miles of streams in the Raccoon Creek Watershed.[61] Of the seven "primary" Abandoned Mine Drainage discharges identified by the PA Department of Environmental Protection (see page 30), two are substantially treated with functioning passive systems in need of major maintenance; two are partially treated by systems that need renovation, expansion and upgrades; three are not treated at all.

In 2006, scientists with the nonprofit Stream Restoration, Inc., advanced an innovative treatment concept known as the "ELF," an acronym for Erie-Langeloth-Francis mines. The "ELF" proposes to move mine water via abandoned underground workings from the Francis Mine through the Langeloth Mine and then by siphon into the Erie Mine from where the water is to be conveyed through the in-mine workings and discharged to the east via horizontal bores.[62]

The "ELF" system would consolidate the discharges E1 (Erie Mine), L2 (Langeloth Mine), and P7A (Francis-Patterson Mines, aka Plum Run) in Slovan and Burgettstown by "inter-mine pool transfer" to a single discharge point for treatment by a single system located in a less populated

[61] "ELF" Inter-Mine Pool Transfer, Abatement, Treatment or Reuse Final Report, Smith Township, Washington County, PA June 2010, Burgetts Fork-Raccoon Creek-Ohio River Stream Restoration Inc.
[62] Ibid.

area to the east on the main stem of the already degraded Raccoon Creek. A single, consolidated treatment system would result in lower construction and maintenance costs compared to building separate systems for each discharge.[63]

Injection and withdrawal tests conducted in the winter of 2010 indicate that the Erie Mine discharge (E1), averaging 80-200 gallons per minute, can be successfully relocated by implementation of the “ELF” system. Withdrawing water from the Langeloth Mine Shaft with injection into the Erie Mine may substantially decrease the flow from the Francis Mine which is the major source of drainage issuing from the Patterson Mine, averaging 300-500 gpm. The physical feasibility of the “ELF” system to decrease or eliminate the flow at the Patterson Mine requires additional confirmation.[64]

Figure 4.23: A crew from BioMost, Inc. installs temporary piping to conduct a flow test from Raccoon Creek to Erie Mine, part of the feasibility study for the "ELF," the proposed treatment system for Erie, Langeloth and Francis Mines in Burgettstown, 2/4/2010. Photo courtesy of BioMost, Inc.

[63] “ELF” Inter-Mine Pool Transfer, Abatement, Treatment or Reuse Final Report, Smith Township, Washington County, PA June 2010, Burgetts Fork-Raccoon Creek-Ohio River Stream Restoration Inc.
[64] Ibid.

Water Supplies

Public Water Supplies

Please see "Section 1: Project Area Characteristics" for a detailed discussion of public water supplies and municipal water suppliers. "Plate 1.4: Public Utilities Map" shows the extent of public water service in the Raccoon Creek Region.

Private Water Wells

Most homeowners in the Raccoon Creek Region do not have municipal water and must rely on their own water sources. Many homes utilize groundwater through private water wells ranging from a few dozen to three hundred or more feet deep. Some residents use water supplies gathered from surface waters like springs, cisterns or ponds - or even water flowing from abandoned coal mines!

More than one million private water systems exist in Pennsylvania; 20,000 new wells are drilled in the state each year.[65] Pennsylvania has no statewide regulations for private water systems. Proper management is entirely voluntary.

Penn State Cooperative Extension offers a wide variety of educational resources to help people operate private water systems safely. Extension's Water Quality Website "…provides expert information and programs related to drinking water, water conservation, pond management, on-lot septic, non-point source pollution, water policy and watershed education."[66]

Extension's Master Well Owner Network is "a network of trained volunteers dedicated to promoting the proper construction and maintenance of private water systems in Pennsylvania and throughout the Mid-Atlantic Region."[67] To date, over 400 residents in 61 Pennsylvania counties have been trained as Master Well Owner Volunteers. To date, these volunteers have assisted over 25,000 homeowners with private water systems.[68]

---

[65] Penn State Extension, Water Quality, Drinking Water, available at http://extension.psu.edu/natural-resources/water/drinking-water; accessed 7/12/2014.
[66] Ibid.
[67] Penn State Extension, Water Quality, Master Well Owners Network, available at http://extension.psu.edu/natural-resources/water/mwon; accessed 7/12/2014.
[68] Ibid.

Section 4: Plates

Plate 4.1: State Water Plan 20D Sub-basins and Watersheds

Plate 4.2: Water Resources Map of the 20D Raccoon Creek Region

Plate 4.3: Designated Stream Use Map of the 20D Raccoon Creek Region

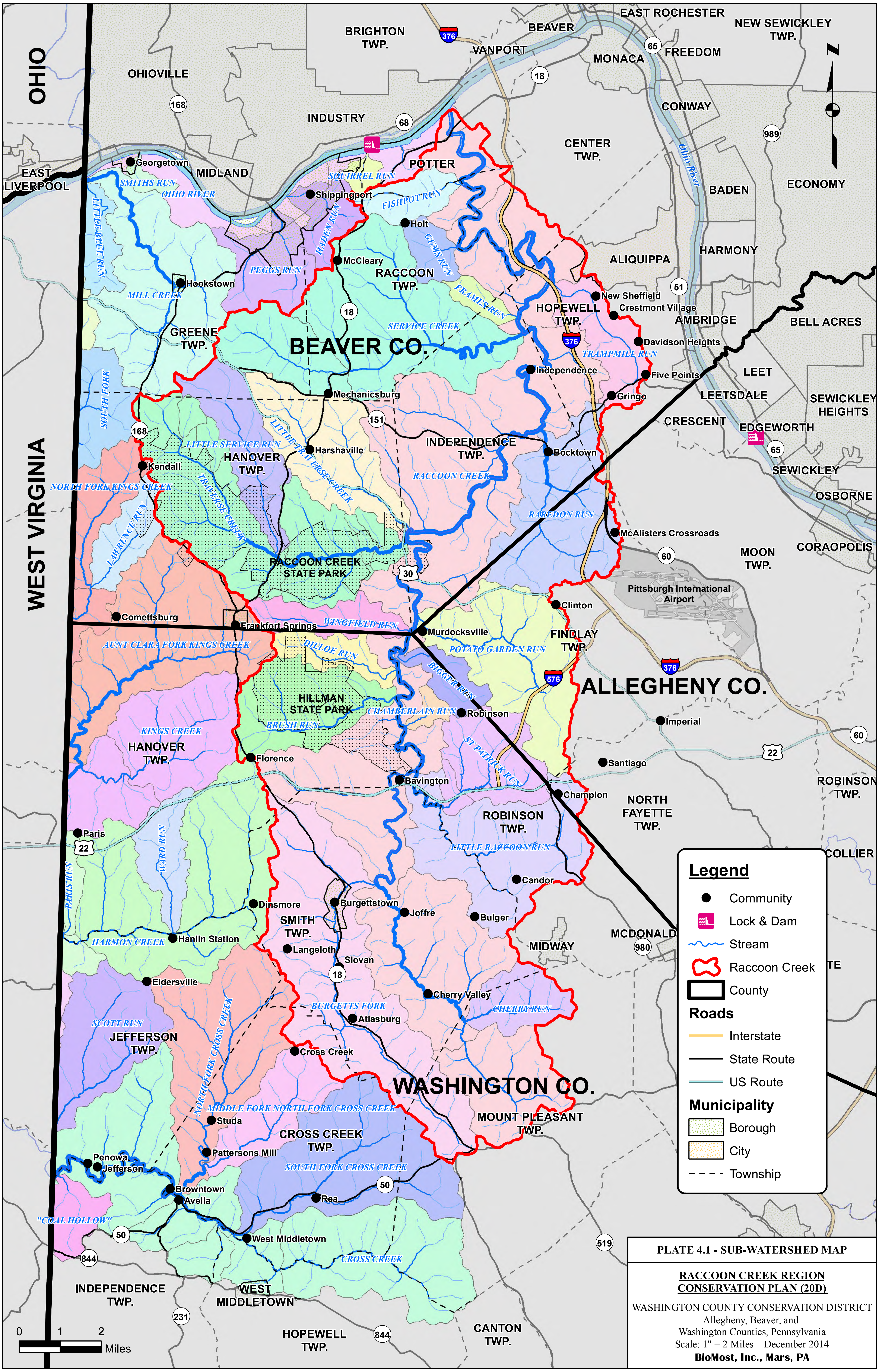


PLATE 4.1 - SUB-WATERSHED MAP

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and Washington Counties, Pennsylvania
Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA

PLATE 4.2 - WATER RESOURCES MAP

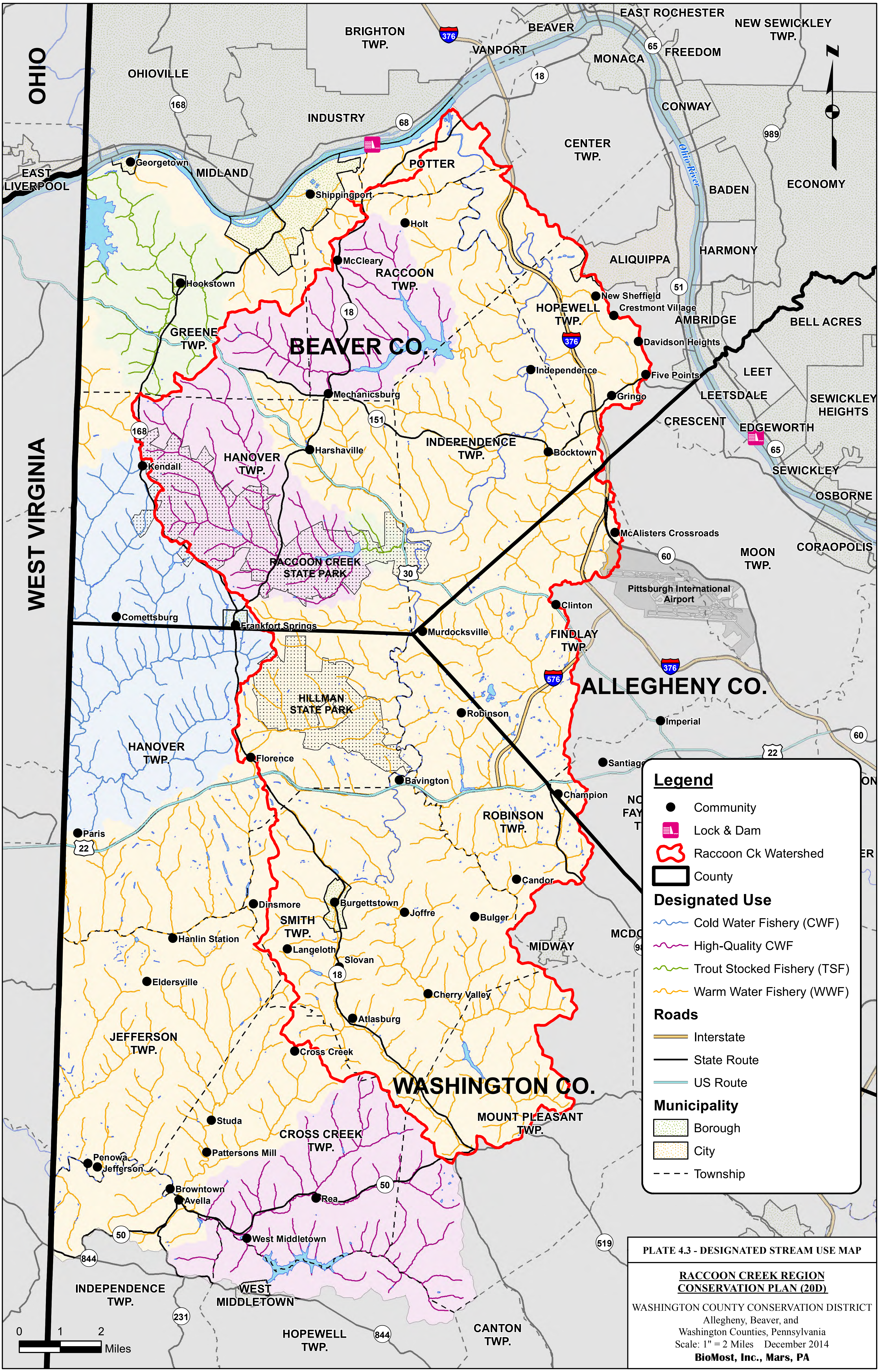
RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and Washington Counties, Pennsylvania
Scale: 1" = 1 Mile December 2014
BioMost, Inc., Mars, PA

PLATE 4.2 - WATER RESOURCES MAP

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and Washington Counties, Pennsylvania
Scale: 1" = 1 Mile December 2014
BioMost, Inc., Mars, PA



OHIO
WEST VIRGINIA
BEAVER CO.
ALLEGHENY CO.
WASHINGTON CO.
OHIOVILLE
BRIGHTON TWP.
INDUSTRY
MIDLAND
EAST LIVERPOOL
Georgetown
Shippingport
POTTER
Holt
McCleary
RACCOON TWP.
Hookstown
GREENE TWP.
HOPEWELL TWP.
New Sheffield
Crestmont Village
Davidson Heights
Independence
Five Points
Gringo
Mechanicsburg
INDEPENDENCE TWP.
Bocktown
HANOVER TWP.
Kendall
Harshaville
RACCOON CREEK STATE PARK
McAlisters Crossroads
Pittsburgh International Airport
Clinton
FINDLAY TWP.
Comettsburg
Frankfort Springs
Murdocksville
HILLMAN STATE PARK
Robinson
Florence
Bavington
Champion
ROBINSON TWP.
Candor
Paris
Dinsmore
Burgettstown
Joffre
Bulger
Hanlin Station
SMITH TWP.
Langeloth
Slovan
MIDWAY
Eldersville
Cherry Valley
Atlasburg
JEFFERSON TWP.
Cross Creek
MOUNT PLEASANT TWP.
Studa
CROSS CREEK TWP.
Patterson Mill
Penowa
Jefferson
Browntown
Avella
Rea
West Middletown
WEST MIDDLETOWN
INDEPENDENCE TWP.
HOPEWELL TWP.
CANTON TWP.
EAST ROCHESTER
BEAVER
VANPORT
MONACA
FREEDOM
NEW SEWICKLEY TWP.
CONWAY
CENTER TWP.
BADEN
ECONOMY
HARMONY
ALIQUIPPA
AMBRIDGE
BELL ACRES
LEET
LEETSDALE
SEWICKLEY HEIGHTS
CRESCENT
EDGEWORTH
SEWICKLEY
OSBORNE
MOON TWP.
CORAOPOLIS
Imperial
Santiago
Ohio River
Legend
Community
Lock & Dam
Raccoon Ck Watershed
County
Designated Use
Cold Water Fishery (CWF)
High-Quality CWF
Trout Stocked Fishery (TSF)
Warm Water Fishery (WWF)
Roads
Interstate
State Route
US Route
Municipality
Borough
City
Township
0 1 2 Miles
PLATE 4.3 - DESIGNATED STREAM USE MAP
RACCOON CREEK REGION CONSERVATION PLAN (20D)
WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and Washington Counties, Pennsylvania
Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA