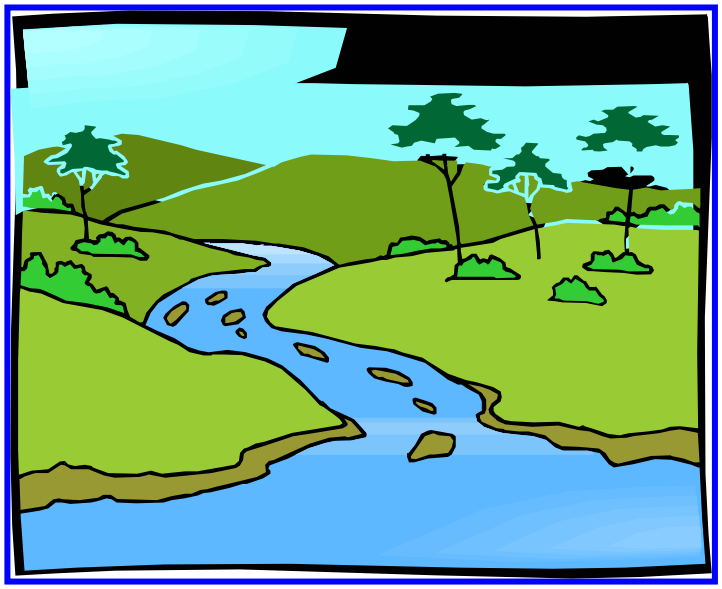

NATURAL RESOURCES

SURFACE WATER

SURFACE WATER

Surface water is defined as water on the earth's surface exposed to the atmosphere such as rivers, lakes, and creeks.[1]

These resources are part of a system commonly known as a watershed. Watersheds are land areas, or drainage areas, which collect precipitation and contribute runoff to a receiving body of water or point along a watercourse.[2]

Centre County's land area is part of the Susquehanna River Watershed which drains to the Chesapeake Bay. Three out of the six subbasins of the Susquehanna River Basin are found in Centre County. These subbasins, shown on the map in Appendix A-1, are the West Branch Susquehanna Subbasin, Juniata Subbasin and the Lower Susquehanna Subbasin.

The Susquehanna River Basin Commission (SRBC) was established as part of a Federal Compact to oversee the water resources for this watershed which encompasses the Susquehanna River and its tributaries. The mission of the Commission is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin.[3]

Centre County tributaries of the Susquehanna River include six smaller watersheds. These basins, shown on the map in Appendix A-2, are Upper and Lower Bald Eagle Creek, Beech Creek, Moshannon Creek, Penns Creek, and Spring Creek. It is important to note that Centre County is the headwaters to all of these streams and smaller streams with the exception of Beech Creek. There are also smaller watersheds situated at the edges of the County. Each of these watersheds is divided yet into smaller watersheds. These geographical areas delineated by natural drainage also serve as planning areas for stormwater management and watershed planning, i.e., a watershed plan[4].

Runoff from rain or snow melt in these basins will flow from higher elevations downward into streams. Streams may be classified as ephemeral, intermittent and perennial. Ephemeral streams only carry water during rainstorms. Downstream from ephemeral streams are intermittent streams. These stream channels carry water during wet periods of the year. Perennial streams which are further downstream carry water year-round.[5]

Surface water is integrally related to wetlands and floodplains. Streams are the floodways of our floodplains, and the majority of Centre County's wetlands are found in the floodplain areas of streams and lakes. Figure 1 illustrates a Natural Floodplain and stream channel. A more specific example of this inter-relationship is Black Moshannon Lake which is surrounded by the Black Moshannon Wetlands, a moderately significant Natural Heritage Inventory Site. The Lake and Wetlands are fed by clear springs and small streams. The clear water turns to a tannic color as it flows through the sphagnum moss and plants in overlapping wetlands giving the Lake its name, Black Moshannon.

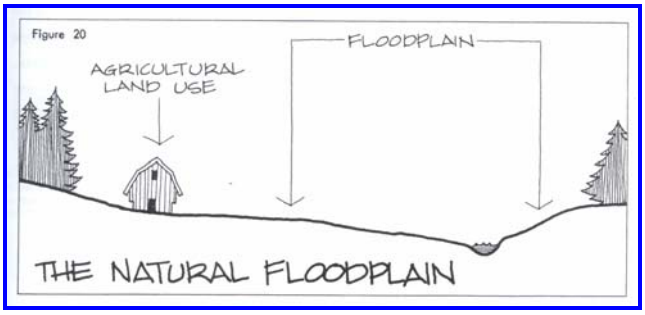

Figure 1 : The Natural Floodplain (Source: Directions for the Future: Guidelines for Decision Making, Centre County Planning Commission, 1979)

[1] *A Glossary of Zoning, Development, and Planning Terms*, American Planning Association, Planning Advisory Service, 491/492, December 1999
[2] Ibid
[3] Source: Susquehanna River Basin Commission's Website
[4] A watershed plan is a comprehensive document which includes an assessment of the watershed as well as plans for the future of a specific watershed.
[5] *Watersheds: An Integrated Water Resources Management Plan for Chester County, Pennsylvania and Its Watershed*, Review Draft-May 2002

Surface Water in Centre County-Streams

Centre County is home to many high quality streams with some being nationally recognized by anglers as premier wild trout streams. The Pennsylvania Fish and Boat Commission (PFBC) maintains a list of the state's Class A Wild Trout Streams. These are streams which, "support a population of naturally produced trout of sufficient size and abundance to support a long-term and rewarding sport fishery."[6]

In Centre County, 37 sections of streams for a total of 117.8 miles are classified as Class A Wild Trout Streams by the Commission. The naturally producing trout include Wild Brook and Wild Brown Trout (Figure 2). A third member of the Trout Family commonly found in Centre County's streams is the Rainbow Trout. This trout was introduced to Pennsylvania's streams during the turn of the century in an effort to restore the state's degraded trout fishery.

Another category of streams in Pennsylvania is the Wilderness Trout Waters. These streams are not only native trout fisheries but are special protected waters with ecological requirements necessary for the natural production of trout and wilderness aesthetics. Wilderness Trout Waters may be found in the more remote areas of the County. Sections of Centre County's

Figure 2: Native Brook Trout (Above) *Salvelinus fontinalis, Pennsylvania's Official Fish;* Brown Trout (Below) *Salmo trutta, Brown Trout are not native to Pennsylvania, but have naturalized in the wild. (Source:PFBC's Website)*

streams with this classification are: Benner Run, Hayes Run, Panther Run, Roaring Run, Rock Run, Wallace Run and Yost Run.

The Pennsylvania Fish and Boat Commission has also identified other segments of the County's stream network as Special Regulation Areas for Trout Streams which are noted in Figure 3. Appendix A-3 lists the regulations for these classifications and a map of streams.

SPECIAL REGULATION AREAS FOR TROUT STREAMS		
BLACK MOSHANNON CREEK	Delayed Harvest Artificial Lures Only	1.3 Miles: From Dry Hollow downstream to 0.3 miles downstream of Huckleberry Road bridge
LICK RUN	Trophy Trout	2.5 miles; From headwaters to mouth
PENNS CREEK	All Tackle Trophy Trout	7 miles from the confluence with Elk Creek downstream to the Catch and Release Area
SPRING CREEK	Miscellaneous Special Regulations	From SR 3010 Bridge at Oak Hall above the HRI Quarry to the mouth
SPRING CREEK	Heritage Trout Angling	1 mile: Lower boundary of Spring Creek Fish Culture Station to a point adjacent to the Stack house School Pistol Range. (No species may be killed or had in possession.

Figure 3: Special Regulation Areas for Trout Streams (Source PFBC's Website)

[6] Pennsylvania Fish and Boat Commission, Pennsylvania Class A Wild Trout Streams, Pennsylvania Fish and Boat Commission Website

Streams are also classified by the Pennsylvania Department of Environmental Protection (PADEP) based on an 'existing use' of a waterbody as defined by Title 25, Environmental Protection, Chapter 93. Each state was required by the Federal government to develop water quality standards for streams in order to comply with the Federal Clean Water Act.

Existing use is defined as, "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards."[7] All water uses are protected as existing uses. In the majority of the stream classifications, the protected use applies to the basin drainage area for a particular stream. These classifications are based on on-going stream evaluations conducted by the PADEP.

Chapter 93 stream classifications for Centre County streams include: Trout Stocking (TSF), Cold Water Fishes (CWF), High Quality Waters (HQ) and Exceptional Value Waters (EV).

Trout Stocking and Cold Water Fishes classifications are based on maintenance or propagation of fish species or both and the flora and fauna which are native to their habitat.

The Special Protection waters, High Quality[8] and Exceptional Value[9] classifications, are to be maintained and protected based on the water quality standards established for these classifications. The difference between the two is Exceptional Value is a higher level of protection since High Quality classification provides for anti-degradation based on specific criteria.

Chapter 93 streams are shown on the map in Appendix A-4.

Anti-degradation requirements, "1) apply to new or increased point and non-point source discharges to specifically designated waterbodies and 2) are more stringent than other water quality standards adopted under the authority of the Pennsylvania Clean Streams Law."[10] Degradation of a High Quality stream may be permitted in order to accommodate 'important economic or social development'.

Surface Water in Centre County-Lakes, Dams and Ponds

Figure 4: Bald Eagle State Park-Foster Joseph Sayers Dam (Source: Pennsylvania Department of Conservation and Natural Resources' Website)

[7] *Pennsylvania Statewide Existing Use Classifications*, Pennsylvania Department of Environmental Protection (PADEP), Bureau of Water Management, November 7, 2002 (Source: PADEP Website)

[8] *High Quality Waters is a stream or watershed which has excellent quality waters and environmental or other features that require special water quality protection.* (Source: *Special Protection Waters Implementation Handbook*, Commonwealth of Pennsylvania, Department of Environmental Resources, First Edition, November 1992)

[9] *Exceptional Value Waters is a stream or watershed which constitutes an outstanding national, state, regional or local resource, such as waters of national, state or county parks or forests; or waters which are used as a source of unfiltered potable water supply, or waters of wildlife refuges or state game lands, or water which have been characterized by the Fish and Boat Commission as 'Wilderness Trout Streams,' and other waters of substantial recreational and ecological significance.* (Source: *Special Protection Waters Implementation Handbook*, Commonwealth of Pennsylvania, Department of Environmental Resources, First Edition, November 1992)

[10] *Special Protection Waters Implementation Handbook*, Commonwealth of Pennsylvania, Department of Environmental Resources, First Edition, November 1992

Other surface waters in Centre County include ponds, lakes, reservoirs and dams. Notable surface waters in the County are Colyer Lake, Black Moshannon Lake, Foster Joseph Sayers Dam (Figure 4), Cold Stream Dam, and Penn Roosevelt and Poe Lakes. These bodies of water serve many functions; however, it is important to note that none of them support industrial production.

Colyer Lake, situated in Potter Township, was developed by the Pennsylvania Fish and Boat Commission (PFBC) in 1966 as a recreational use for public boating and fishing. Sinking Creek was impounded for this purpose. This lake is classified by PFBC as a Conservation Lake with special regulations for warmwater and coldwater species. The regulations are designed to improve the population balance among the lake's fish species while helping maintain a more desirable size.[11]

Black Moshannon Lake is a 250-acre lake located in Rush Township. This lake, a part of the Black Moshannon State Park, is owned and managed by the Pennsylvania Department of Conservation and Natural Resources (PADCNR) as a State Park. Springs and small streams flowing through tannic bogs feed the lake.

Bald Eagle State Park is the home of Foster Joseph Sayers Dam. Built in 1969, this US Army Corps of Engineers project, fed by Bald Eagle Creek, was constructed to manage flood waters. A secondary use of this impoundment is to provide recreational opportunities. This facility, encompassing 1,730 acres, is owned by the US Army Corps of Engineers and leased to PADCNR.

Cold Stream Dam serves as a gateway to Philipsburg. This 20 acre impoundment on Cold Stream was constructed in the late 1700s to support the logging and lumber industries. It was then used for recreational uses until the mid-1990s. Pollution in the form of acid mine drainage rendered this water unsuitable for human activities until an acid mine remediation project, sponsored by the Wood Duck Chapter of Trout Unlimited, was put in place. The project entailed diverting acid mine drainage from the headwaters of Cold Stream to below the Dam. Today, Cold Stream Dam provides fishing opportunities as a result of the improved water quality.

Penn Roosevelt Lake, situated within the Rothrock State Forest at the confluence of Sassafras Run and Standing Stone Creek, is 3.5 acres in size. The main recreational opportunity for this water body is fishing.

Poe Lake, a natural feature of the Poe Valley State Park, is a 25 acre lake situated in the southeast portion of Centre County and fed by Lingle Stream. Boating, fishing and swimming are permitted.

Reservoirs, impoundments designed to provide drinking water, are also considered surface water bodies. In Centre County, there are two reservoirs, Shingletown Gap and Philipsburg. Both provide drinking water to nearby communities.

Smaller-sized ponds and impoundments may be found through the County's landscape. They serve a multitude of purposes including stormwater management, recreation, habitat for wildlife as well as for their aesthetic value.

Groundwater Connection to Surface Water

Groundwater and surface water are inter-connected with groundwater providing a source of water for the base flow of streams in Centre County. Groundwater discharges to the streams directly or through seeps and springs. This inter-connection becomes evident during extreme climate conditions. Droughts lower the underground water table which in turn slows or even stops the flow of water from the ground to the surface streams. Just the opposite occurs during long periods of wet weather conditions when the water table rises, increasing the flow of water to our surface streams. These conditions are part of the hydrologic cycle. The hydrologic cycle (Figure 4) is a process whereby water falls to the earth as rain or snow, much of which immediately evaporates back to the atmosphere, but some is taken up by plants for their use, some runs across the land to streams, lakes and eventually the ocean, and the rest goes to the groundwater reservoir.

[11] *Conservation Lakes*, Pennsylvania Fish and Boat Commission's Website

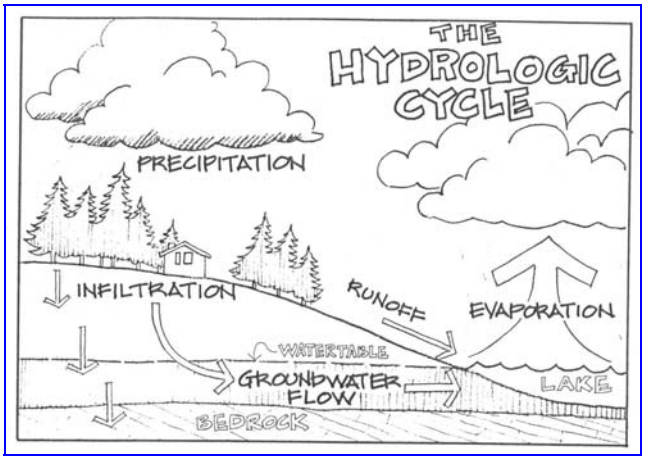

Figure 4: HYDROLOGIC CYCLE (Source: Directions for the Future: Guidelines for Decision Making, Centre County Planning Commission, 1979)

This inter-connection is also important as it relates to groundwater pollution. Contaminated groundwater has the potential to negatively affect the quality of surface water. The reverse is also true. Pollution prevention as part of a watershed management strategy is important to the health of our surface water bodies.

Regulatory Protections

In the 1970s the state initiated a water quality planning program known as COWAMP (Comprehensive Water Quality Management Planning Program). A study was conducted, priorities established and recommendations formulated.

The study includes historical data on surface water in Centre County not meeting water quality standards as noted in Appendix A-5. Major problems identified include: acid mine drainage, nutrient and toxic pollution, and sewage discharge. Recommendations were put in place to address mine drainage, rural wastewater management, groundwater quality management and data gathering, municipal wastewater management, better enforcement of existing programs and industrial wastewater management. Many of the recommendations were regulatory in nature and would have been the responsibility of the then Pennsylvania Department of Environmental Resources (PADER).

However, this program did result in priority being given to addressing point sources of pollution, including industrial discharges and community sewage discharges. Virtually all of the communities with identified sewage discharges have had treatment plants built, upgraded, or planned. Acid mine drainage discharges have gradually been addressed on a site by site basis by the Abandoned Mine Reclamation Program.

In addition, the information compiled serves as a valuable tool in better understanding the state of the County's surface water as well as actions needed to restore the health of this resource.

Regulations are oftentimes promulgated at the Federal level with states having the primary responsibility for enforcing the Federal rulemaking. This is the case with the Federal Clean Water Act.

The Clean Water Act (Federal Water Pollution Control Act) has historically regulated point source discharges into surface water which included discharges from industries and sewage treatment facilities. (Point source discharges are the release of pollutants at a specific discharge point.) The permit for these discharges is referred to as an NPDES Permit (National Pollution Discharge Elimination System).

Pennsylvania's Clean Streams Act (Title 25, Chapter 93) gives the state primacy to implement and enforce NPDES regulations. Today, permitted entities also include concentrated animal feeding operations (CAFOs) and municipal separate storm sewer systems (MS4). Stormwater systems manage "surplus surface water generated by rainfall that does not seep into the earth but flows overland…"[12]

The 1987 amendments to the Clean Water Act divided the MS4 permitting into two phases. Originally, the first phase regulated discharges within city limits with the second phase regulating discharges within Urbanized Areas (An Urbanized Area is defined as a place and nearby surrounding areas, the population of these areas would be a minimum 50,000 people and the density of 1000 persons per square

[12] *A Glossary of Zoning, Development, and Planning Terms*, American Planning Association, Planning Advisory Service, 491/492, December 1999

mile.[13]) Today, all MS4 Permits are for Urbanized Areas.

The designation of the Urbanized Areas is based on the 1990 and 2000 US Census. The Urbanized Areas of Centre County's are shown on the map in Appendix A-6.

Municipalities within Urbanized Areas will be required to implement a stormwater management program in their jurisdiction that contains the following elements:

- Public Education and Outreach
- Public Participation and Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Stormwater Management in New Development and Redevelopment
- Pollution Prevention and Good Housekeeping for Municipal Operations and Maintenance.

The Pennsylvania Stormwater Management Act of 1978, Act 167, requires that a County prepare and adopt a stormwater management plan for each watershed within its political boundaries. To date, three of the County's watersheds, Fishing Creek/Cedar Run (Centre and Clinton Counties), Spring Creek, and Buffalo Creek (Union County and encompassing a small area in the eastern edge of Centre County) have plans in place. Two other plans are in progress which are White Deer Creek (Union and Centre Counties) and Kishacoquillas Creek (Mifflin and Centre Counties). These plans are implemented at the local level through the adoption of a stormwater management ordinance which regulate new development. The recently approved Plan for the Spring Creek Watershed is the first Plan in the state to comply with new state regulations requiring water quality and recharge components to stormwater planning.

In addition, Act 167 planning ties in with Federal requirements for MS4s which requires that a permittee implement and enforce a stormwater management program which satisfies both Federal and state regulations.

Centre County is unique in that the urbanized area does not have a large stream to discharge pollutants such as wastewater, stormwater, and non-point pollution.

Two other Federal requirements under Section 303 (d) of the Clean Water Act are the listing of impaired waters and TMDL (Total Maximum Daily Loading) provisions. In compliance with this section of the Federal Act, the PADEP is presently assessing the water quality of Centre County's streams. The Act further requires that states develop a list of all impaired waters not supporting protected uses even after water pollution technologies have been put in place. The protected uses include:

- *Aquatic Life*
- *Water Supply*
- *Recreation*
- *Special Protection*

In a preliminary report, the PADEP identified seven reaches of the Spring Creek basin that are impaired. The map in Appendix A-7 shows the location of these reaches. Impairments found through the biological assessment are noted in Figure 5. In addition, a 3,000 foot reach of the Buffalo Run Subbasin in the Briarly/Filmore area was also determined to be impaired due to effects of agriculture.

Other preliminary findings report that Bald Eagle Creek from the Centre/Blair County line to Sayers Dam is **not** impaired. This stream segment is approximately 35 miles in length. However, 12 miles of this Creek from the Sayers Dam to the mouth has been found to be impaired. Causes of impairment to this section of Bald Eagle Creek are: 'Reservoir Outlet Effect' whereby the dam discharges organics,

[13] *StormWater Phase II Permits,* DEP Bureau of Water Supply and Wastewater Management, *Borough News*, October 2002

depressed levels of oxygen, and unnaturalized stabilized temperature and flow. A second source of impairment in this 12 mile reach is Acid Mine Drainage, which begins at the mouth of Beech Creek, approximately two miles below Sayers Dam. Beech and Moshannon Creeks have both been adversely impacted by Acid Mine Drainage and also considered impaired. The findings for Penns Creek have yet to be reported.

Once the stream assessments are completed and a listing of the impaired streams compiled, the PADEP is required to calculate the Total Maximum Daily Loads (TMDLs) for the listed waters. Total Maximum Daily Load is "the maximum amount of pollutant that a waterbody can receive and still meet water quality standards and allocates pollutant loadings among point and nonpoint sources."[14]

Pending Federal rulemaking would require that remediation plans be put in place in order to meet TMDLs. This rulemaking is referred to as the 'Watershed Rule'. The costs associated with developing a remediation plan would be paid for with available grant dollars or passed on to the responsible parties for remediation of a stormwater system that impairs a stream segment by entities contributing to the daily loads. For example, municipal entities would be loading it with sediment.

To date, TMDLs have not been calculated for the impaired streams of Centre County. PADEP has approximately eight to thirteen years to calculate the TMDLs for the listed streams once the assessments have been completed.

As noted elsewhere in the Surface Water analysis, the High Quality and Exceptional Value

STREAMS RECOMMENDED FOR 303(d) LIST			IMPAIRMENTS	
MAP ID	**STREAM NAME**	**LENGTH (mi.)**	**SOURCES**	**CAUSES**
1	Spring Creek-Headwaters to Galbraith Gap Run	1.9	Elks Golf Course Residential Runoff Agriculture Removal of Riparian Vegetation	Silt Thermal Modifications
2	Slab Cabin Run- SR 26/45 intersection to Spring Creek	7.0	Grazing Flow Modifications Centre Hills Golf Course Urban Runoff	Silt Flow Variability Thermal Modifications
3	Thompson Run	1.0	Urban Runoff	Silt
4	Spring Creek-Slab Cabin Run to Big Hollow	2.7	Urban Runoff Storm Sewers	Silt
5	Spring Creek-PFBC Benner Spring Fish Culture Station	1.0	Industrial Point Source	Organic Enrichment
6	Spring Creek-PFBC Bellefonte Fish Culture Station	1.0	Industrial Point Source	Organic Enrichment
7	Logan Branch-Pleasant Gap Fish Culture Station	1.0	Industrial Point Source	Organic Enrichment
8	Buffalo Run	0.6	Agriculture Surface Runoff	Nutrient Loading
TOTAL IMPAIRED MILES:		**16.2**		

Figure 5 : List of Streams Recommended for the 303 (d) List (Source: Springs & Sinks Special Edition, Spring Creek Watershed Community)

[14] *Overview of Current Total Maximum Daily Load-TMDL-Program and Regulations*, US Environmental Protection Agency (Source: US Environmental Protection Agency's Website)

stream classifications, Chapter 93 of Title 25, offer additional regulatory safeguards for protecting these water resources. A social and economic justification is required for any new, additional or increased discharge or discharges of sewage, industrial wastes or other pollutants into waters having a High Quality classification protective use. Any project or development would be required to:

(1) Utilize the best available combination of treatment and land disposal technologies and practices for the wastes, where the land disposal would be economically feasible, environmentally sound and consistent with all other provisions of this title; or

(2) If the land disposal is not economically feasible, is not environmentally sound, or cannot be accomplished consistent with other provisions of this title, utilize the best available technologies and practices for the reuse and discharge of the wastes.[15]

An example of this is the upgrade of the University Area Joint Authority's Wastewater Treatment Facility. In order for the Authority to increase sewage discharge by approximately three million gallons per day, a social economic justification study had to be conducted to look at alternative methods of discharge. This study was required since Spring Creek is classified as a High Quality Cold Water Fishery. The preferred method of handing the additional effluent was a method referred to as Beneficial Reuse. Through this process treated wastewater is brought to drinking water quality standards and will eventually be piped to the head waters of the Slab Cabin Basin of Spring Creek for the recharge of this watershed.

Exceptional Value waters as a protective use may not be degraded. One example is a segment of Corridor O was relocated in the planning phase in order to avoid placement of the highway in an Exceptional Value watershed.

Another Chapter of Title 25, Environmental Protection, protects two surface water basins in Centre County by prohibiting surface mineral extraction of coal reserves. Chapter 86, Surface and Underground Coal Mining, designates the surface water drainage basin of Upper Cold Stream upstream from the mouth of Tomit Run and the surface water drainage basin of Black Bear Run as **Areas Unsuitable for Mining (UFM)**. This designation is granted in the form of rulemaking by the Pennsylvania Environmental Quality Board (EQB) and protects areas 'where surface mining could cause significant damage to or long term losses of important environmental features'[16]. The basis for Upper Cold Stream and Black Bear Run UFM designations is that both are High Quality watersheds.

Protecting surface water by regulating the management of livestock wastes for certain intensive farm operations is provided for in the **Pennsylvania Nutrient Management Act** (Act 6). The Nutrient Management Act (Act) "requires all CAOs (Concentrated Animal Operation) to file a nutrient management plan under the Act. CAOs are defined as agricultural operations where the animal density exceeds two animal equivalent units (AEUs) per acre of suitable land on an annual basis. An AEU is 1,000 pounds of live animal weight. Suitable land can be owned or rented. Farmstead areas and forest land are not to be included as suitable land. The density and suitable cropland criteria are only used to determine if an operation is a CAO, and do not prevent the development or expansion of an operation, or the spreading of manure."[17]

Operators of CAOs are required to have a plan developed by a certified manure management specialist for the management of manure. The

[15] Special Protection Waters Implementation Handbook, Pennsylvania Department of Environmental Protection, First Edition, November 1992

[16] *Areas Unsuitable for Mining Program-Summary*, Pennsylvania Department of Environmental Protection (Source: PADEP Website)

[17] *Nutrient Management Program Administrative Manual*, Pennsylvania Department of Environmental Protection, November 2000

Act also encourages farmers whose operations do not come under these regulations to voluntarily develop manure management plans. To date, the Centre County Conservation District's Certified Nutrient Management Specialists have prepared 23 required and voluntary plans for County landowners.

Proper handling of animal wastes and the implementation of agricultural Best Management Practices will protect surface water from nutrient runoff. The Centre County Conservation District is available to assist farmers by providing technical assistance and financial incentives for implementing improved agricultural practices.

Local regulations also offer protections to these bodies of water in an effort to maintain and improve their health and value in our natural systems. Examples of the types of local regulations which protect surface water include:

Stream Corridor Overlay Zoning Districts which provide for buffer areas and may control the percentage of any allowable impervious coverage as well as permitted uses.

Conservation Design Subdivision/Land Development and Zoning Regulations which provide for clustering of development and a required percentage of open space. This technique may be used to protect environmentally sensitive areas, i.e., floodplains, wetlands, stream corridors and prime agricultural lands by deducting these areas from the amount of land to be developed on a site.

Comprehensive Stormwater Management Ordinances which reduce the volume of stormwater generated, provide for groundwater recharge and removal of pollutants from stormwater runoff.

Non-regulatory Protections for Surface Water

Any approach to protecting surface water should be comprehensive in nature. Regulations play an important role in protecting the County's bodies of water and watercourses; however, non-regulatory strategies often compliment regulations in a more holistic way.

At the end of 2002, the Governor signed **Water Resources Planning legislation** which not only calls for the update of the state's Water Plan but more importantly links ground and surface water as a 'single hydrologic resource'. In addition, the measure requires that the updated Plan include 'an inventory of the surface water resources of each region of the Commonwealth, including an identification of the boundaries of significant watersheds and an estimate of the safe yield of such sources for withdrawal and nonwithdrawal uses during periods of normal conditions and drought.'[18] The Plan would also give consideration to the provisions of comprehensive plans and zoning ordinances as a way of balancing the management of this resource with land use planning. The state has five years from the effective date of the Act to complete the update of the State Water Plan.

For the past 47 years, the Pennsylvania Department of Conservation and Natural Resources' Bureau of Forestry has been developing forest management plans. The most recent plan, **State Forest Resource Management Plan 2001-2005**, recognizes water as a valuable resource of our state forest system. This recognition is extremely important since our forests are recharge areas for groundwater which in turn provides baseflow to streams.

During this current five-year period of the Plan, the Bureau of Forestry is planning a 'holistic and proactive approach' to managing the water resource on state forest lands. The Plan's goals for Water are:

- To maintain water quality,
- To restore degraded water quality,
- To optimize potable water production,
- To protect and maintain aquatic and riparian ecosystem health; and,
- To restore degraded aquatic and riparian ecosystems to a healthy state.

The objectives to these goals as listed in Appendix A-8 lay out an implementation strategy for protecting this forest resource.

As noted in the goals and objectives, the Bureau of Forestry is taking an 'ecosystem management approach'[19] to managing these public lands.

[18] House Bill 2302, Session 2002

[19] Ecosystem management is the implementation of practices that promote the long-term health of the forest ecosystem as measured by important ecological indicators. (Source: State Forest Resource Management Plan 2001-2005, Pennsylvania

Figure 6: Moshannon State Forest Stream (Source: Pennsylvania Department of Conservation and Natural Resources Website)

Figure 7: Bear crossing a stream in the Sproul State Forest (Source: Pennsylvania Department of Conservation and Natural Resources Website)

The **Natural Heritage Inventory** (NHI) for Centre County is a listing of the County's significant ecological resources. The Inventory was first completed in 1991 and updated in 2002. The update includes the identification of new sites and notes changes to the sites identified in 1991. The Inventory also provides a narrative on 'Threats and Stresses' as well as recommendations specific to particular sites.

This Inventory lists surface waters throughout Centre County as environmentally sensitive/ecological important areas and presents the following recommendations:

"Broad-scale planning efforts for the ecological health of the valley landscapes should work towards the restoration of water quality in major streams and groundwater aquifers, and the development of an ecologically designed greenway network based along riparian corridors and associated areas of riparian hydrology. Natural areas remaining in the landscape today are often isolated, and their potential to support wildlife and native biodiversity could be greatly enhanced by establishing connective corridors between them. Restoration of native vegetation to riparian corridors and buffers will help greatly in improving water quality and enhancing the habitat value of the waterways for various aquatic and semi-aquatic species. Reduction in the release of pollutants into runoff, including sediments, nutrients, and chemical contaminants, will also be necessary to improve water quality. Attending to the basic ecological functions of streams and wetlands will pay dividends by ensuring the continued capacity of land in supporting agriculture, maintaining fisheries and providing the quality of life for which the region is known."

More importantly, these recommendations in the Inventory's Executive Summary are followed by a section on 'Evaluating Proposed Activity Within Natural Heritage Areas'. This section provides a procedure for property owners and developers to follow when a proposed activity is located within a Natural Heritage Area. The Centre County Planning Office is the first point of contact and is responsible for making an initial determination as to whether a resource is within the project area. Once a positive determination is made then the Western Pennsylvania Conservancy would provide direction as to the next steps in assessing the impact the land development activity would have on the site. This procedure is extremely important in the protection of these rare and sometimes endangered sites.

Studies are also an important non-regulatory approach to protecting our natural resources. In 1998, the Susquehanna River Basin Commission published a report, ***Instream Flow Studies Pennsylvania and Maryland***. This study was conducted in cooperation with the Pennsylvania Department of Environmental Protection, Pennsylvania Fish and Boat Commission and the National Biological Survey.

The goal of the study was to "develop a procedure for determining instream flow protection levels that: (1) is based on fishery resource protection; (2) is clearly applicable to Pennsylvania streams; (3) does not require specific studies; and (4) can be easily applied

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Department of Conservation and Natural Resources, Bureau of Forestry)

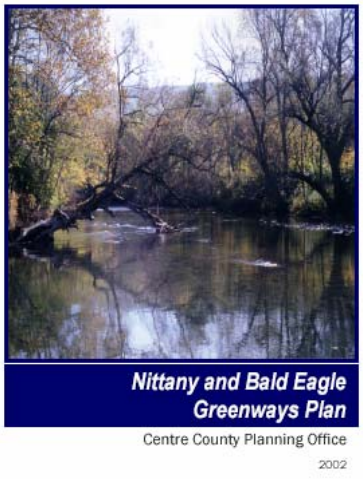
during the administrative review of applications for surface water allocations."[20]

The Commission focused on reproducing trout streams with a drainage area of less than 100 square miles.

One outcome of the study was the development of a computer model to look at the relationship between groundwater withdrawals, surface water flow and impact on fishery habitat. As a result, habitat and withdrawal impact numerical curves where developed which serve as a basis for formulating policies for determining withdrawal limits and passby flows[21].

This study in conjunction with state Water Resources Planning will help guide counties and local jurisdictions in developing sustainable land use plans for our future.

A recently completed County Planning Office study is the **Nittany and Bald Eagle Greenways Study**. Streams, also referred to as Blueways, are an integral part of greenways as linear connections. This Study also places a special emphasis on streams as a natural resource and recommends that they be identified and incorporated into a comprehensive system of greenways in order to promote their protection and preservation.



Other studies include the **Spring Creek Rivers Conservation Plan** and the **Upper Penns Creek Watershed Assessment**. These are timely watershed planning documents. It is important that municipalities begin thinking on a watershed level when planning for the protection of the natural resources within their political boundaries. The goal is to have consistency between watershed and water resource planning and land use planning.

Funding is critical to implementing non-regulatory strategies as well as addressing regulatory requirements. One of the most instrumental funding sources used to protect surface water is the **Growing Greener Grant Program**. A significant amount of monies from this program has been awarded to 32 projects in Centre County. The Table in Appendix A-9 lists the projects that have received financial support through the Growing Greener Program.

Chesapeake Bay Program

The impact human activities have on surface water bodies came to light in the 1980s when state officials acknowledged these effects by creating the tri-state Chesapeake Bay Commission. The Commission was charged with addressing the impact these activities had on the health of the Chesapeake Bay. As a result, the Chesapeake Bay Program was initiated with oversight provided by the Chesapeake Bay Commission, the legislative arm of this Program. The three participating states are Pennsylvania, Maryland and Virginia and also the District of Columbia. Pennsylvania's portion of this vast watershed contributes half of the freshwater to the Bay; therefore, the state of streams and tributaries in the upper reaches of this watershed is critical to the Bay's eco-system.

The Chesapeake Bay Program is based on signed agreements and outlines specific goals to be met by each participant. Goals include: reduction in nutrient loading, restoration of wetlands and riparian forest buffers, preservation of land, and installation of Best Management Practices on farms.

One of the key partners working towards achieving these goals are the county

[20] *Instream Flow Studies Pennsylvania and Maryland, Summary Report, Publication 191A*, May 1998, Susquehanna River Basin Commission

[21] The flow rate below which a withdrawal cannot be allowed. (Source: *Instream Flow Studies Pennsylvania and Maryland, Summary Report, Publication 191A*, May 1998, Susquehanna River Basin Commission)

conservation districts. Centre County's Conservation District has taken an active role in implementing programs that protect surface water. The Conservation District participates in the Chesapeake Bay Financial Assistance Funding Program which provides up to $30,000 per landowner to implement agriculture Best Management Practices, i.e., manure storage and barnyard stabilization. These monies are available to farmers with nutrient management plans in place. To date, the Conservation District has assisted 34 landowners through this program.

Local Strategies to Protect Surface Water

One of the most effective methods to protect surface water and enhance the eco-system is through the establishment of riparian[22] buffers. Banks with vegetative buffers lessen the thermal impact of stormwater runoff, filter pollutants, and reduce erosion of stream banks as well as providing habitat for aquatic and terrestrial life.

Criteria recommended for establishing buffers vary depending on the setting. Urban (Figure 8), suburban, forest and agriculture buffers all differ somewhat in terms of buffer widths.

The width of a buffer should be set based on the intensity and type of the adjacent land use. The first Table in Appendix A-10 provides recommended minimum and ideal buffer widths for different settings. Figure 8 is an illustration of the recommended widths for urban/developed areas.

These criteria may also vary depending on the buffers function. The Tables in Appendix A-10 provide recommended buffer widths for both settings and functions which can be used as a basis for planning and regulations. For example, establishing green corridors along streams as recommended in the Spring Creek River Conservation Plan with the cooperation of landowners is an effective strategy for protecting the health of a waterways eco-system.

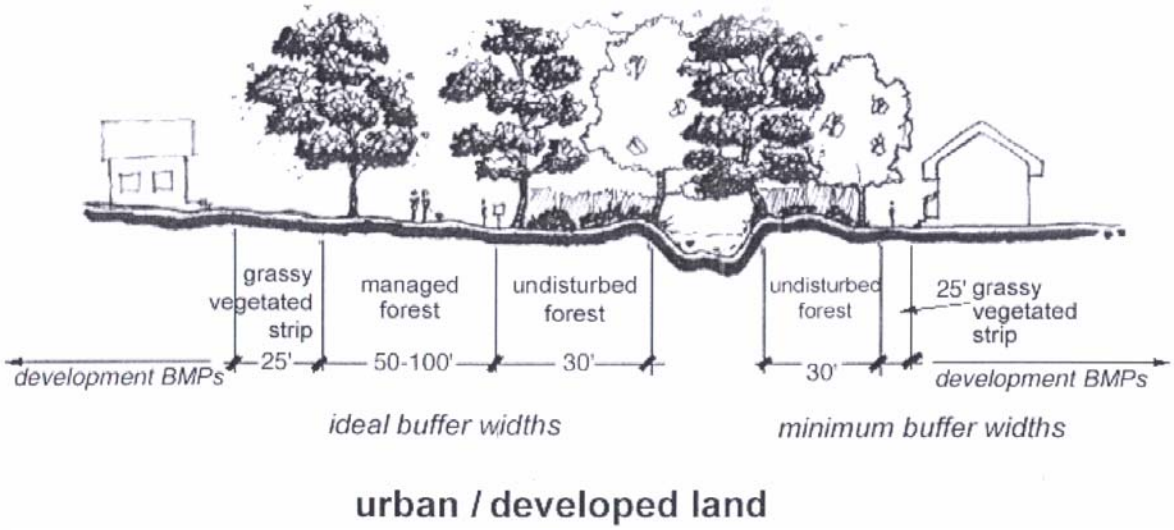


Figure 8: Recommended Buffer Widths for Urban/Developed Land (Source: Spring Creek

[22] Riparian is defined as the land area which borders a stream or river and which directly affects and is affected by the water quality. This land area often coincides with the maximum water surface elevation of the 100 year storm. (Source: *Better Site Design: A Handbook for Changing Development Rules in Your Community*, Center for Watershed Protection, August 1998

Other techniques include:

Streambank fencing and livestock crossings in agricultural areas which create a vegetative buffer improving water quality by reducing soil erosion and nutrient deposition cased by livestock.

Conservation easements which protect the land and its important features from inappropriate development while retaining private ownership of the property in perpetuity.

Threats to Surface Water

Threats to surface waters, particularly streams, are having a negative impact on the health of these waters and their eco-systems. Some sections of streams have reached the saturation point and are no longer able to effectively manage the pollutant levels being discharged into them.

Threats such as sediment loading, thermal pollution (stormwater runoff), and salts stem from urbanization. Agricultural run-off, malfunctioning on-lot septic systems and illegal dumping all pose risks to the health of our streams in the rural areas of the County. Acid mine drainage in Beech Creek and Moshannon Creek basins has impaired the life of stream segments for decades to come.

In addition to the Federal and state programs that regulate surface water, several watershed associations have formed in Centre County in an effort to protect the water resources in their own backyards. These volunteer organizations have made great strides in assessing their watersheds, educating watershed stakeholders on the value of our water resources, implementing best management practices, and organizing watershed clean-ups just to name a few.

Figure 9: Jonathan Run, Tributary to the South Fork of Beech Creek, Beech Creek Watershed Association Project. The problem addressed was run-off from acid-bearing, excess road fill material from the construction of I-80 deposited in a wetland area located at the headwaters to Jonathan Run. The Beech Creek Watershed Association was awarded a Growing Greener Grant for the reclamation of Jonathan Run. (Source: *Beech Creek Watershed Association News*, Fall/Winter 2001)

Threats being addressed by non-profit watershed associations in the following watersheds include:

Beech Creek-Beech Creek Watershed Association
Acid mine drainage (Figure 9), illegal dumping

Moshannon Creek- Moshannon Creek Watershed Association
Acid mine drainage

Penns Creek- Penns Valley Conservation Association
Agricultural run-off (Figure 10), malfunctioning on-lot septic systems

Spring Creek
Demand placed on wastewater treatment facilities, sedimentation, stormwater, groundwater withdrawals, agricultural run-off, and pollutants from urban run-off.

It is important to note that the Impaired Streams Assessment included in the Regulatory section of this analysis also lists threats to the impaired segments of streams in Centre County.

These threats will continue to jeopardize the health of our streams. Cooperation, voluntary participation and regulatory constraints, and in some cases a high level of intervention are needed in order to mitigate these threats. The state provides an incentive in the form of grant monies through the Growing Greener Program. This Program provides much needed funding which may be used for restoring the quality of surface water.

Figure 10: Streambank Fencing Project sponsored by the Penns Valley Conservation Association using a US Fish and Wildlife Service program and personnel. Top photo: Before; Bottom Photo: Stream area after the fencing project was initiated. (Source: Penns Valley Conservation Association's Website)

Furthermore, these threats need to be addressed in land use policy documents at the local level. Any recommendations formulated should include Best Management Practices and implementation strategies to address the impact of threats on this water resource.

Finally, one threat that we have no control over is drought. Drought lowers the water table which in turn decreases and sometimes stops baseflow to streams. One way to minimize this effect is by monitoring groundwater withdrawals of high capacity wells near streams. Another approach is to initiate water conservation measures.

Conclusion

If future generations are to remember us with gratitude rather than contempt, we must leave them more than the miracles of technology. We must leave them a glimpse of the world as it was in the beginning, not just after we got through with it.
President Lyndon B. Johnson
(Upon signing of the Wilderness Act, 1964)

Surface water is one natural resource where President Johnson's quote is most fitting. Our lakes, ponds and streams are not only woven into our scenic landscapes but more importantly they play a critical role in our natural eco-systems. However, these water resources represent much more to us. They are places where we recreate, places where we go to appreciate natural beauty, and places that we feel a strong need to protect. Surface waters also make up a key component of our natural open space greenway corridor network, and they are part of our precious open space legacy.

Today, surface water is one of Centre County's most threatened natural resource. Urban and agricultural run-off, acid mine drainage, drought, overloading of organic material, depletion of oxygen, sediment, and thermal pollution, to name a few, are stressing our surface waters and their aquatic systems.

We've received a 'wake-up call' with the listing of impaired stream segments and relentless droughts. We cannot keep doing things the way we have traditionally been doing them. Water conservation needs to be practiced; groundwater withdrawals monitored, stormwater managed in

a comprehensive way, groundwater recharge areas protected, riparian areas established along stream segments, and land use policies put in place that offer protections for this fragile resource.

Many efforts are underway to restore and/or protect surface water. Elected officials need to continue to think on a 'watershed level'. County and local planning needs to be integrated with watershed planning, and everyone needs to be communicating.

Centre County (through the update of the Comprehensive Plan), the Centre County Conservation District's Watershed Specialist, and ClearWater Conservancy are in a position to facilitate better coordination between all parties as well as develop tools for local municipalities and watershed associations to implement. As part of this effort, best management strategies applicable to Centre County should be compiled as a resource for land use planning.

Education is also key to improving the health of our watersheds. Water resources are a natural heritage that we will leave to our children and to their children. Teaching children and adults to appreciate and better manage our water resources is one of the most valuable gifts that we can give to future generations.

Figure 11: Ann Donovan, Centre County Watershed Specialist, Centre County Conservation District, working with students from Bellefonte (Photo: Courtesy of the Centre County Conservation District)

Natural Resources Plan
SURFACE WATER ANALYSIS

GOAL

Identify, preserve, and monitor Centre County's environmental natural resources for the benefit of present and future generations.

OBJECTIVES

Promote the wise use and management of the County's natural resources that include prime agricultural lands, forested areas, and mineral resources.

Protect watershed features such as surface and underground water supplies, streams, floodplains, wetlands, fish and wildlife habitats, and aquifer recharge areas.

Promote and preserve the County's identified natural areas for scenic, educational, historic, environmental, recreation, and tourism purposes.

Use identified natural resource areas and public open spaces to provide guidance with land development activities.

Reduce air, water, land, noise, and visual pollution.

RECOMMENDATIONS

Coordinate efforts of County Agencies to maximize protection of water resources.

Support efforts of existing watershed associations and encourage the formation of new watershed associations throughout the County.

Make the protection of water resources a priority through regulations for any major land development activity including highway development.

Promote stream corridor management techniques, i.e., riparian buffers and stream corridor overlay districts.

Support watershed initiatives that restore and protect surface water.

Integrate local land use planning and watershed planning.

Develop stormwater management plans for the remaining Centre County watersheds.

Modify the Centre County Subdivision and Land Development Ordinance to include conservation design principles.

Coordinate educational activities through County agencies. Include Penn State Cooperative Extension in the planning and implementation of these activities.

Incorporate regulatory provisions of the Spring Creek Act 167 Stormwater Management Plan into the Centre County Subdivision and Land Development Ordinance.

Explore opportunities to protect surface water through the implementation of special plans such as the Nittany and Bald Eagle Greenways Plan, Spring Creek River Conservation Plan and the Upper Penns Creek Watershed Assessment.

Support the conservation of forested mountain slopes.

Identify groundwater recharge areas and develop strategies to protect them.

Encourage measures to eliminate enforcement of illegal dumping.

Develop a 'toolkit' of Best Management Practices for protecting water resources.

Encourage Centre County municipalities to:

- Adopt stream corridor overlay districts.
- Incorporate the establishment of riparian buffers into local regulations using native plant species.
- Prohibit incompatible development in the 100-year floodplain.
- Prohibit plantings of invasive species by property owners.
- Modify local subdivision/land development and zoning regulations to include conservation design provisions.
- Explore opportunities to protect surface water through the implementation of the Nittany and Bald Eagle Greenway Plan, Spring Creek River Conservation Plan and the Upper Penns Creek Watershed Assessment
- Prohibit the discharge of unmanaged stormwater into surface waters through local stormwater management regulations.
- Support the conservation of forested mountain slopes.
- Support efforts of existing watershed associations and encourage the formation of new watershed associations throughout the County.
- Make the protection of water resources a priority through regulations for any major land development activity including highway development.

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APPENDICES

Appendix A-1

Map of the Susquehanna River Basin Watersheds

(To be included)

APPENDIX A-2

Map of the Susquehanna River Basin Sub-watersheds

(To be included)

APPENDIX A-3

Pennsylvania Fish and Boat Commission Stream Regulations and Map of Streams (To be included)

APPENDIX A-4

Map of Chapter 93 Streams

(To be included)

APPENDIX A-5

COWAMP
(Comprehensive Water Quality Management Planning Program)
Surface Waters Not Meeting Water Quality Standards

APPENDIX A-6

Map of Urbanized Areas for Storm Water

APPENDIX A-7

Map of Streams Recommended For 303(d) Listing

(To be included)

APPENDIX A-8

State Forest Resource Management Plan 2001-2005
Water Section

APPENDIX A-9

Growing Greener Grants-Centre County

APPENDIX A-10

Recommended Buffer Widths for Riparian Areas