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WATERSHED ASSESSMENT/RESTORATION PLAN

I. BROAD EXPECTATIONS

What do we want to accomplish?

Rasler Run is a scenic mountain stream that flows off the eastern slopes of Chestnut Ridge into Indian Creek approximately 2.5 miles upstream from the confluence of Indian Creek with the Youghiogheny River. Reports from local anglers of naturally reproducing populations of native brook trout as well as non-native rainbow trout have been confirmed by the Pennsylvania Fish and Boat Commission. These trout populations may be in jeopardy of being lost if long term plans are not made to protect this watershed. Therefore, it is the goal of this project to gather pertinent background information on the Rasler Run watershed in order to "*identify potential problems & opportunities for stream conservation"* as is stated in the Coldwater Heritage Partnership grant application for Coldwater Conservation Plans.

It is expected that cooperation and communication between the Fayette County Conservation District (FCCD), concerned members of the community including Bullskin and Springfield Townships, the Chestnut Ridge Chapter of Trout Unlimited, local residents and businesses, etc. will be critical for the successful implementation of the recommendations made in this plan. While it is an objective of this plan for any interested person or group to be able to easily review the watershed critical areas, the suggested courses of action and to have a good road map for future projects, it should be noted that to be effective in cleaning up any of the watershed, a network of partners and/or supporters will not only be useful but will likely be necessary.

Some of the specific objectives of this conservation plan are to identify and focus on the pollution threats in the watershed as well as to recommend appropriate courses of action to preserve and protect the Rasler Run Watershed.

The primary threats or problems that encompass the watershed include:

- abandoned mine drainage
- acid precipitation
- illegal dumping
- invasive species
- sedimentation

Additional threats include:

- agricultural runoff
- sewage

The only known existing water quality data available for Rasler Run was collected by the Pennsylvania Fish and Boat Commission during the 1999 field investigation of naturally reproducing trout populations. It was not the purpose of this study to collect any current water quality data but to gather all pertinent background/existing data to create a picture of the watershed and its challenges. This portrait allowed for the identification of the major threats to the Rasler Run Watershed and lead to the development of the conservation plan recommendations.

The FCCD was able to complete a driving tour of the watershed along with a one-day field view which included the collection of field pH and documentation of the stream through photographs. This information was then combined with the existing background information and was reviewed by FCCD staff and its technical advisory committee to make recommendations for the conservation of this coldwater stream. This document should be viewed not as a fixed source of reference but as a good starting point that should be added to as additional information is gathered. The FCCD has started a database for water quality data and information should be added to this database as it is acquired. By constantly adding to and reviewing this document, it will become a useful tool to understanding the Rasler Run watershed and tracking trends within it over time.

Who has the expectations?

The FCCD has the expectation that the Rasler Run Coldwater Conservation Plan will be utilized not only by the FCCD but also by the community members including the Mountain Watershed Association, Inc. to begin the preservation and protection of the watershed. This report will be made available to any interested party with the hopes that concerned citizens and groups of citizens may take the necessary steps to ensure the continuation of this High Quality – Cold Water Fishery.

It is the expectation of the Coldwater Heritage Partnership that the Rasler Run Coldwater Conservation Plan will include all pertinent information regarding the background of the watershed but will more importantly discuss the major threats impacting Rasler Run and will provide a solid base for agencies, groups/organizations, etc. to ensure the responsible protection of the watershed and its fishery.

II. SPECIFIC OBJECTIVES INCLUDING EVALUATION CRITERIA

Goals/What do we want to achieve?

The goals of the coldwater conservation plan for Rasler Run were to:

- Gather existing data about the watershed
- Identify potential impacts, threats, problems & opportunities in the watershed
- Formulate a plan of action for proposed conservation & protection strategies
- Build community awareness & support for the conservation of the coldwater stream

What do the funding agencies want to achieve?

The Coldwater Heritage Partnership funded this project through a Coldwater Conservation grant and anticipates the following deliverables: a Rasler Run Coldwater Plan document. The views expressed herein are those of the authors and do not necessarily reflect the views of the Coldwater Heritage Partnership.

What are the capabilities of completing the goals?

As the project applicant, the FCCD has staff with the capability to complete the goals and objectives outlined in the Coldwater Conservation grant to complete this plan. The FCCD employs two full-time staff with Bachelor of Science Degrees in Environmental Conservation. These individuals partnered with agencies, groups and individuals to gather well rounded background information, to interpret that information/data to develop recommendations for the watershed and to complete the writing of this plan.

The chances of completing the recommended projects in the restoration plan are good but rely heavily on community support. Currently, there are two groups in the area who have an interest in supporting the conservation plan; Mountain Watershed Association, Inc. and Chestnut Ridge Chapter of Trout Unlimited. Both local groups have been successful, in the past, in leveraging funds for other projects in the same area. It is hoped that these existing groups will be effective in implementing some of the proposed actions in this plan and/or in encouraging other local citizens/groups of citizens to assist with proposed projects.

Criteria for measuring effectiveness/success of plan

The effectiveness and/or the success of this plan is based on the ability of the recommendations made in it to protect and preserve the Rasler Run Watershed. Organizations such as the Trout Unlimited and different state agencies will be the best resource for monitoring any changes within the stream as well as any changes in the mindset of area residents.

III. WATERSHED DESCRIPTION

Topographic

Rasler Run is an approximately 4,454-acre (6.96 square miles) watershed located in Bullskin and Springfield Townships, Fayette County (please reference Attachment A – Township Map and Attachment B – Watershed Area Map). The stream is a third order stream (please reference Attachment C – Stream Order Map) approximately 5.0 miles in length which empties into Indian Creek approximately 2.30 miles upstream of the confluence of Indian Creek and the Youghiogheny River. By referencing township populations provided by the county, the population of the watershed can be estimated to be around 370 people (please reference Attachment D – Population). The Rasler Run watershed is found on 4 USGS 7.5 minute quadrangles. These quadrangles or "quads" include Connellsville, Donegal, Mill Run and South Connellsville (please reference Attachment E – USGS 7.5 Minute Quadrangle Map).

This watershed encompasses many land uses such as farming, mining (past and present), and logging as well as residential development. Due to a review of available background information as well as field visits to the watershed, the FCCD has determined that impacts to the watershed include surface mining (which may result in acidic and/or alkaline discharges and sedimentation), farming (which may result in nutrient loading and sedimentation), logging (which may result in nutrient loading and sedimentation) and residential uses (which may result in nutrient loading, sedimentation and the introduction of household and industrial hazardous waste).

The Rasler Run watershed is characterized by several different land uses (please reference Attachment F – Land Use Map). Of the 4,454 total acres, 3,271 acres or 73% of the watershed is forested. These forested areas are large contiguous areas separated by small fields or former surface mined areas. Field or farmland represents a smaller portion of the watershed, only approximately 1,183 acres or 27% of the total watershed area. Former surface mine land comprises approximately 571 acres or 13% of the total watershed. These former mining areas are now either field or have been reforested since the mining has occurred. Some small communities are located within the watershed along Route 711 (please reference Attachment G – Villages Map). They are the villages of Pleasant Hill and Rasler Run. In addition, approximately 4 acres of land owned by the Municipal Authority of Westmoreland County is within the watershed (please reference Attachment H – Water Authority Land Map). As mentioned above, Rasler Run is located within two townships. Ninety-nine percent or 4,413 acres of the watershed is located in Springfield Township while 41 acres or 1% is located in Bullskin Township (please reference Attachment A – Township Map). The great variation in land uses in the Rasler Run watershed creates the potential for a number of impacts that lower the water quality of the stream and inhibit its potential uses.

The information for the topographic section of the plan was taken from the following sources: United States Geographical Survey (USGS) 7.5 minute series maps, ArcView/AVstREAMS computer mapping programs and the Fayette County Comprehensive Land Use Plan. For a complete literature citation, please refer to the bibliography section of the plan.

Biologic

Rasler Run watershed lies within a mesic forest dominated by numerous species including tuilptree (*Liriodendron tulipifera*), red oak (*Quercus rubra*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), scarlet oak (*Quercus coccinea*), chestnut oak (*Quercus prinus*), yellow birch (*Betula allegheniensis*) and slippery elm (*Ulmus rubra*). Other canopy species may include American basswood (*Tilia americana*) and eastern hemlock (*Tsuga canadensis*). Common understory species include striped maple (*Acer pennsylvanica*), rosebay rhododendron (*Rhododendron maximium*) witch-hazel (*Hamamelis virginiana*), sassafras (*Sassafras albidum*) and wild hydrangea (*Hydrangea arborescens*). Herbs present in the watershed may include Virginia waterleaf (*Hydrophyllum virginianum*), jewelweed (*Impatients* spp.), marginal shield fern (*Dryopteris marginalis*), hay-scented fern (*Dennsteadtia punctilobula*), indian cucumber root (*Medeola virginica*), round leaf violet (*Viola rotundifolia*) and Virginia creeper (*Parthenocissus quinquefolia*).

In addition to the many plant species found within the Rasler Run watershed, there are also numerous species of mammals indigenous to Pennsylvania found in the watershed. Some of the more common species found in the watershed include white-tailed deer (*Odocoileous virginianus*), raccoon (*Procyon lotor*), several squirrel species (*Sciurus* spp.), opossum (*Didelphis marsupialis*), skunk (*Mephitis mephitis*), chipmunk (*Tamias striatus*) and cottontails (*Sylvilagus* spp.). Other not so common species which have a good possibility of being within the watershed include black bears (*Ursus americanus*), bobcat (*Lynx rufus*), porcupine (*Erethizon dorsatum*), mink (*Mustela vison*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*) and coyote (*Canis latrans*). There are also numerous species of birds, small mammals, reptiles and amphibians that can be found in the watershed. The Rasler Run watershed is characterized by large wooded areas separated by small open sections. It is likely that a majority of the animal species are concentrated close to the stream itself or near the confluence of Rasler Run with Indian Creek.

An initial Pennsylvania Natural Diversity Index (PNDI) search was completed on 5,000 acres (maximum area allowed for conservation district internet search) of the Rasler Run watershed and resulted in 6 potential threatened and/or endangered species (flora and/or fauna) (please reference Attachment I – PNDI Search Results). Two of the potential conflicts are unnamed species where the Natural Diversity Section of the PA Fish and Boat Commission must be notified. There is also one potential mammal conflict and 3 potential plant conflicts. The Pennsylvania Game Commission must be notified for the mammal (Allegheny Woodrat – *Neotoma magister*) and the PA Department of Conservation and Natural Resources must be notified for the plants (Blue Monkshood – *Aconitum uncinatum*, St. Andrew's cross – *Hypericum stragulum* and Carolina Tassel-Rue - *Trautvetteria caroliniensis*). The Fayette County Natural Heritage Inventory, completed by the Western Pennsylvania Conservancy (WPC), identifies only one significant natural place in the Rasler Run watershed, the Lower Indian Creek Biological Diversity Area (please reference Attachment J – Biological Diversity Areas Map).

The significant natural places are listed in the Fayette County Natural Heritage Inventory as Biological Diversity Areas (BDA) and Landscape Conservation Areas (LCA). A BDA includes "one of more occurrences of plants, animals or natural communities recognized as a state or federal species of special concern" and "high quality examples of natural communities of areas supporting exceptional native diversity." An LCA is described as "a large contiguous area, important because of its size, open space, habitats and/or inclusion of one or more Biological Diversity Areas." Although an LCA "includes a variety of land uses, it typically has not been heavily disturbed and thus retains much of its natural character." There is no LCA associated with the Rasler Run watershed.

The Lower Indian Creek BDA is the only BDA associated with the Rasler Run watershed (please reference Attachment J – Biological Diversity Areas Map). This BDA is of exceptional significance and contains several natural communities. The Lower Indian Creek BDA is also considered a Dedicated Area (DA). An area considered a DA is a property, possibly disturbed in the past, where the owner's stated objectives are to protect and maintain the ecological integrity and biological diversity of the property. This is usually done largely through a hands-off management approach, with intervention only when there are demonstrable threats to the ecology of the area. In this case, the property owner is the Municipal Authority of Westmoreland County (please reference Attachment H – Water Authority Land Map). The DA community is dominated by tuliptree (*Liriodendron tulipifera*), white oak (*Quercus alba*), red oak (*Q. rubra*), hemlock (*Tsuga canadensis*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*) and basswood (*Tilia americana*). The understory associates include smooth alder (*Alnus serrulata*), cucumber tree (*Magnolia accuminata*), rosebay rhododendron (*Rhododendron maximum*) and smooth azalea (*Rhododendron arborescens*). Some threats to the area are deer browsing and invasive species. The invasive species include Japanese knotweed (*Polygonum cuspidatum*) and multiflora rose (*Rosa multiflora*).

The information for the biologic section of the plan was taken from the following sources: Wildlife of Pennsylvania and the Northeast; the online PNDI Search and the Fayette County Natural Heritage Inventory. For a complete literature citation, please refer to the bibliography section of the plan.

Geologic

Rasler Run is located in the Allegheny Mountain Section of the Appalachian Plateau Province (please reference Attachment K – Geologic Map). This section lies between the Allegheny Front and the west flank of Chestnut Ridge. This is a plateau of strong relief where open folding of rocks and differential erosion has produced linear anticlinal ridges along with intervening synclinal valleys. Devonian, Mississippian and Pennsylvanian strata underlay the surface of the plateau. The older rocks are exposed along the anticlinal ridges and consist predominantly of the Pottsville, Mauch Chunk, Pocono and Upper Devonian strata. The valleys are floored with Allegheny, Conemaugh and in very few places Monongahela strata. There are three major anticlines in the section and they all extend northeast to southwest and run parallel to the Allegheny Front. The three anticlines are named, from east to west, Negro Mountain, Laurel Hill/Ridge and Chestnut Ridge. Rasler Run flows off of the eastern slopes of Chestnut Ridge into the Ligonier Syncline (please reference Attachment K – Geologic Map).

Rasler Run flows though several different rock strata (please refer to Attachment K – Geologic Map). These strata include rock from the Mississippian and Pennsylvanian ages. From the Mississippian age there is one strata within the watershed. This strata is rock from the Mauch Chunk Formation. The Mauch Chunk is composed of mostly grayish-red sequences of shale, siltstone, and some conglomerate. Includes the fossiliferous Wymps Gap Limestone, the Deer Valley Limestone and the highly crossbedded gray, siliceous Loyalhanna Limestone, which is at the base of the formation. The formation is 400 feet thick in southern Fayette County, thinning to 270 feet at the northern boarder of the county. Near the confluence of Rasler Run with Indian Creek, there is a reddish shale visible along the banks of the stream which creates a very noticeable contrast with the surrounding sandstone.

Strata from the Pennsylvanian age within the watershed include the Pottsville Group, Allegheny Group and the Glenshaw Formation of the Conemaugh Group. The Pottsville Group is described as gray to light-gray crossbedded sandstone, quartz-pebble conglomerate, and siltstone, dark-gray, carbonaceous clay shale and claystone; and thin nonpersistent coal. Massive beds of sandstone, up to 100 feet thick, are not uncommon. The group contains the Homewood Sandstone, Mercer coal and Connoquenessing Sandstone. The formation is thickest in the southern part of the county at 200 feet and decreases to 180 feet in the north.

The Allegheny Group is olive to dark-gray, nodular claystone; light-gray, thin- to massively bedded, fine- to coarse-grained sandstone containing stylolites; gray siltstone; nodules of limestone and siderite; local gray conglomerate; coal and clay. The group is divided into three formations: the Freeport Formation, which has its base at the top of the Upper Kittanning coal; the Kittanning Formation, which has its base at the bottom of the Lower Kittanning coal; and the Clarion Formation, which has its base at the bottom of the Brookville-Clarion coal. The total thickness of the group ranges from 280 to 300 feet. Coals incorporated in the Allegheny Group include the Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning and Brookville-Clarion.

Finally the Glenshaw Formation is the lower formation of the Conemaugh Group. It is olive- to dark-gray, thin-bedded, fossiliferous, marine limestone and clay shale; red claystone; locally massive, fine- to coarse-grained sandstone; minor amounts of freshwater limestone; and thin, but generally persistent, coal. It is common to find plant fossils in this formation, which has its base at the top of the Upper Freeport coal. The Glenshaw Formation is 340 to 360 feet thick.

The water-bearing properties of the underlying strata may be more important when it comes to well drilling within a certain rock but these properties may also give some insight into natural stream water conditions that can occur when the presence of abandoned mine drainage (AMD) is removed. We will now give some basic aquifer evaluations for the strata that occur in the Rasler Run watershed. The Mauch Chunk Formation usually yields water of the alkaline calcium type. The water however is of good quality in amounts adequate for domestic use. The outcrop occurs in steep and rugged terrain and it is unlikely that this aquifer would be used to a great extent. The Pottsville Group produces groundwater that is generally of the alkaline calcium type. The group should yield adequate amounts of water for domestic use but will probably have to be treated for iron and manganese. The Allegheny Group produces water of the calcium alkaline type but is a poor aquifer. The yields from this group are low and would require treatment to meet Pennsylvania's water quality standards. The Glenshaw Formation generally yields water of the alkaline calcium magnesium type and provides inadequate amounts of water for domestic use unless storage is provided. The water quality tends to be poor, with dissolved metals like aluminum and lead of particular concern.

Coal seams in the mountains (eastern half) of Fayette County are much less defined and consistent than the seam in the western lowland half of the county. Within the Rasler Run watershed, there are a number of mineable coal seams that have been tapped in the past for production. These coal seams include Brookville-Clarion, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport.

The Brookville-Clarion coal has a persistent occurrence along its line of outcrop and is generally of mineable thickness. The Brookville and Clarion coals are usually considered two separate coal seams but in Fayette County they are usually separated by only a short interval of intervening strata and sufficient information to differentiate the two beds is commonly lacking. The interval between the two beds averages approximately 6 feet along the outcrop and in many places it is only several inches of clay or shale. Because of this the two beds are considered one unit and are called Brookville-Clarion coal. The coal seam varies in thickness throughout the county from 3 inches to 9 feet but is only mineable when the depth is 40 inches or greater. Apparently, Brookville-Clarion Coal has been mined in the Rasler Run watershed (please refer to Attachment L – Coal Seams and Extent of Known Surface Mining Map).

The Middle Kittanning coal was observed to attain mineable thickness only in the gorges of Jacobs Creek and the Youghiogheny River through Brush Ridge (Fayette anticline). This information is from Geology and Mineral Resources of Fayette County, Pennsylvania but may not be entirely correct since it has been found that Middle Kittanning coal has been mined in the Rasler Run watershed (please refer to Attachment L – Coal Seams and Extent of Known Surface Mining Map).

Upper Kittanning coal has a fairly persistent occurrence in Fayette County where the Allegheny formation has its normal thickness. It has mineable proportions in the gorges of Jacobs Creek and the Youghiogheny River through Brush Ridge, where the bed is from 20 to 32 inches thick. In the Ligonier Valley the seam is locally mineable and ranges in thickness from 10 to 108 inches and is composed of two or three benches separated by 3 to 6 inches of shale or clay. It was not found that any mining of Upper Kittanning coal was performed in the Rasler Run watershed (please refer to Attachment L – Coal Seams and Extent of Known Surface Mining Map).

Lower Freeport coal lies at an average of 50 feet below Upper Freeport coal and has a fairly persistent occurrence. On the west slopes of Chestnut Ridge, the seam is mineable locally in Bullskin, Connellsville and northern Dunbar townships. In the Ligonier Valley, the bed is well developed in central Springfield and southern Saltlick townships, where it is 40 to 96 inches thick. There have been commercial mines that have operated in this bed along Indian Creek in central Springfield Township. Some mining of the Lower Freeport coal has been done in the Rasler Run watershed (please refer to Attachment L – Coal Seams and Extent of Known Surface Mining Map).

Finally, the Upper Freeport coal is the last seam found in the watershed and also has a persistent occurrence in Fayette County. It is normally from 2 to 9 feet thick and contains one or more persistent partings of shale or clay. Unusual thicknesses of a few inches to 16 feet were also observed but the thicker the seam the greater number of sizable partings. In the Ligonier Valley section, the Upper Freeport coal ranges between 1 and 9 feet in thickness and is usually mineable. In Saltlick and Springfield townships, the seam averages approximately 36 inches in thickness and was termed “block-slate” coal because of the persistent parting shale or bone coal that occurs near the middle of the bed. The Upper Freeport coal mined in these two townships is fairly clean. The seam was mined commercially during the World War 1 period and also in the coal boom of 1920-1921. Within the Rasler Run watershed, the seam was mined in certain areas (please refer to Attachment L – Coal Seams and Extent of Known Surface Mining Map).

Soils within the Rasler Run watershed fall into three main soil associations (please reference Attachment M – Soils Map). A soil association is a landscape that has a distinctive proportional pattern of soils. The association usually consists of one or more major soils and at least one minor soil and is named for the major soils. There is the possibility of the soils in one association occurring in another, but in a different pattern.

The First soil association within the Rasler Run watershed is the Dekalb-Hazleton-Cookport association, which makes up approximately 78% of the watershed. The association is described as moderately deep and deep, well drained and moderately well drained, moderately coarse textured and medium-textured, nearly level to very steep soils underlain by bedrock that is dominantly acid sandstone; on uplands. The soils of this association developed from the residuum of acidic rock and are very stony with it found mostly along Chestnut Ridge, Laurel Ridge and the Youghiogheny River. This soil association makes up approximately 25% of the county. About 50% of the association is Dekalb soils, 16% is Hazelton soils, 6% is Cookport soils and the remaining 28% is made up of minor soils. The Dekalb soils are moderately deep and well drained; mostly very stony and very steep; and have a low available moisture capacity and natural fertility. Hazelton soils are deep and well drained; nearly level to moderately steep soils; and have low to moderate available moisture capacity. The Cookport soils are deep and moderately well drained and are nearly level to sloping and usually very stony. The minor soils include the Gilpin, Weikert, Clymer, Andover and Buchanan series. Except for the Clymer soils, all the rest are steep, stony, or both. The Dekalb-Hazleton-Cookport association is well suited for trees but is not a good association for farming because of the limitations of restricted depth to bedrock of the Dekalb soils and the seasonal wetness of Cookport soils.

The second soil association within the Rasler Run watershed is the Gilpin-Wharton-Ernest association, which makes up approximately 21.5% of the watershed. This association is described as moderately deep and deep, well drained and moderately well drained, medium-textured, nearly level to very steep soils underlain by acid shale and some sandstone bedrock; on uplands. The Gilpin-Wharton-Ernest association occupies a wide V-shaped area that extends from Point Marion to Perryopolis and from Point Marion to Laurelville. This association makes up around 37% of the soil in the entire county. Of the Gilpin-Wharton-Ernest association about 43% is Gilpin soils, 17% is Wharton soils, 17% is Ernest soils and the remaining 23% is minor soils. Gilpin soils are on the upper, smooth slopes and are well drained and moderately deep. The Wharton soils formed on ridge tops and benches and are moderately well drained. The soils are also deep and have fine textured and moderately fine textured subsoils. The Ernest soils are usually on the lower slopes and have formed in colluvium and have a fragipan. The minor soils consist of Weikert, Cavode, Philo, Brinkerton and Armagh series. There are areas of mine spoils also within the watershed. The Gilpin-Wharton-Ernest association has some of the best farming soils in the county. The soils in this association have moderate to severe limitations to use as building sites. Springs and wells normally supply enough water for livestock and household use.

The third association within the Rasler Run watershed is the Upshur-Albrights association, which makes up only 0.5% of the watershed. This association is described as deep, well drained to somewhat poorly drained, gently sloping to very steep, reddish soils on uplands. The soils in this association are formed from weathered red shale, limestone and some sandstone. It occurs along the upper slopes of Chestnut Ridge and Laurel Ridge and is easily recognized by the red color of the soils. Trees grow in most of the association with a few farms in scattered areas of gently sloping and moderately sloping soils. The Upshur-Albrights association makes up only 7% of the county. Within the association, 65% is Upshur soil, 9% Albrights soil and the remaining 26% is minor soils mostly Weikert and Gilpan. Upshur soils are deep and well drained and form in place from red shale and limestone and have a clayey subsoil. It is not uncommon to have slips and slides on steeper Upshur soils. Albrights soils are deep and moderately well drained to somewhat poorly drained. They have a fragipan and formed in material accumulated on mid and lower slopes. The major soils in this association have moderate water holding capacity, natural fertility and are normally nonacid. The association is well suited to crops and trees but the major limitation to farming is wetness and erosion. There are also a few large stone quarries that produce road gravel related to this association.

The information for the geologic section of the plan was taken from the following sources: Geology and Mineral Resouces of Fayette County, Pennsylvania; the Soil Survey of Fayette County, Pennsylvania; the Groundwater Resources of Fayette County, Pennsylvania; and the Coal Resources of Fayette County, Pennsylvania: Part 1. Crop Lines, Mined-Out Areas, and Structure Contours. For a complete literature citation, please refer to the bibliography section of the plan.

Historical

As said before, Rasler Run flows into Indian Creek which was dammed to form Mill Run Reservoir. The reservoir is now used as an emergency back-up source of drinking water for the Municipal Authority of Westmoreland County. The reservoir has over 100 miles of distribution lines installed for potable water and fire protection for a population of nearly 7,500. At one time the reservoir was used as a source of water for the trains that ran the lines up and down the Youghiogheny River in the late 1800's and early 1900's. Many of these trains carried passengers from Pittsburgh and other cities to places like Ohiopyle, so people could get out and spend a day or two in the mountains.

Early in the 1900's commercial underground coal mining became popular in the Indian Creek Valley area and this mining continued until the 1960's. Most of these commercial underground mines were developed on the Middle Kittanning coal seam (please see Geologic section of the plan). In addition to the deep mining of Middle Kittanning coal, there were many commercial and non-commercial drift mines that extracted coal from the hill sides. Many of these operations mined coal of the Lower Freeport seam (please see Geologic section of the plan) and were used by local residents for home heating. Many of these mines were developed up-dip to help the water drain from the mine but this also helped to pollute Indian Creek and some of its tributaries. Mill Run Reservoir also received much of the mine pollution and in the early 1920's a lawsuit was brought against the mining companies by the Pennsylvania Railroad and water companies that used the reservoir as a water supply. In 1924 a diversion system was devised to carry the mine drainage away from the mines and discharge the collected mine water below the railroads intake point at the Mill Run Reservoir. As mining continued, the amount of mine discharge water started to overwhelm the diversion system or "flume" and discharges started to develop along outcrops. There were several attempts made to upgrade "the flume" without success so most the mine drainage water now flows into the main channel of Indian Creek between the village of Melcroft and Poplar Run.

In addition to deep and drift mining operations in the area, there have also been numerous surface mining sites. Early in the 1960's, most of these operations started as shallow contour mines along the coal outcrops. However, later mines have been able to go deeper and take out seams like Mahoning, Upper and Lower Freeport, Upper and Middle Kittanning and the Brookville-Clarion coal seam. The majority of the surface mining has been on the Upper Freeport and Middle Kittanning coal seams. Like much of the history of Fayette County, the history of the Rasler Run watershed is closely related to the mining of coal and the different techniques used to do so.

The information for the historical section of the plan was taken from the following sources: History of Indian Creek: Public Drinking Water Supply and the history of Ohiopyle State Park. For a complete literature citation, please refer to the bibliography section of the plan.

Archeological

According to the Pennsylvania Historical and Museum Commission (PHMC), there are no known archaeological sites in the Rasler Run watershed. Mr. Funk, a Historic Preservation Specialist for the PHMC, states that for planning purposes, "floodplains and benches above 3rd order or higher streams are high probability prehistoric archaeological areas as well as upland benches, saddles and hilltops."

Existing and Potential Value/Uses of Stream

Rasler Run was originally listed as having the potential to support cold water fishes (CWF), maintenance of propagation of fish species and additional flora and fauna which are indigenous to a cold water habitat. Local fishermen observed the presence of a native trout species as well as a non-native trout species in the waters of the stream both of which appeared to be naturally reproducing. After receiving these reports, the Pennsylvania Fish and Boat Commission (PFBC) completed a field survey in 1999 which confirmed the presence of naturally reproducing brook and rainbow trout (please refer to Attachment N – PFBC Survey). This confirmed discovery allowed Rasler Run to achieve a new elevated status as a High Quality – Coldwater Fishery (HQ-CWF). In addition, Rick Lorson, Areas Fishery Manager with the PFBC, informed us that Rasler Run is one of only 12 streams in the entire state classified as a Class A Wild Rainbow Trout Fishery. This means that rainbow trout can reproduce naturally in the stream and that no stocking will be done. The drop-pool nature of the stream is very dramatic and spectacular especially near the confluence of Rasler Run with Indian Creek. Due to relatively no public ownership and access to this stream, the recreation potential of the stream may not currently be as high as other cold water streams which cross public land. With some hard work, it may be possible to make arrangements with property owners to allow recreation activities along and in Rasler Run.

By conduction a Google (www.google.com) search on the internet, the FCCD was able to discover that Rasler Run is listed on web-site called SwimmingHoles.info. The website gives directions to the stream and describes it as having "several swimming places in Indian Creek and Rasler Run" and that "some are accessible only from private Indian Creek Campgrounds". It is also good to know that bathing suits are "required".

A Watershed Restoration Action Strategy (WRAS) was written for Sub-basin 19E (Upper Youghiogheny River Watershed). The WRAS compiled general information on the whole watershed area including geology/soils; land use; natural/recreational resources; and lists of Class A, Exceptional Value and High Quality streams (please refer to Attachment O – WRAS). Water quality impairment of the watershed was also described along with different restoration initiatives taken in the watershed. Public outreach was mentioned in the strategy and description of problem areas where additional funds are needed. In addition to all the previous information, a table lists each stream; their stream code; drainage area square miles; miles impaired; miles attained; and impairment causes/sources/comments. Rasler Run is listed as having 10 unnamed tributaries, a stream code of 38241, 7.00 sq miles of watershed, and 14.72 miles attained.

A walk trough of the Rasler Run watershed was conducted on March 25th of 2004 by two employees of the FCCD (Heather Fowler & Alex Genovese) and an Americorp intern for the Mountain Watershed Association (Jen Baer). The purpose of the walk through was to help the participants get a good idea of what is actually in the watershed and where some of the problems areas might be. The walk trough started at the confluence of Rasler Run with Indian Creek and continued up stream as far as possible to visually identify any problems. Due to large areas of privately owned property, the entire stream was not able to be walked but field pH's were taken at many locations where the stream was near a road. Each tributary of Rasler Run had at least one pH taken to help identify any problem areas up stream. For a more detailed description of the field pH findings please refer to section IV.1.C Abandoned Mine Drainage (Recommendations/Next Steps) and Attachment P - Watershed Survey Map and pH Table. Along with the field pH readings, many photographs were taken of the stream and surrounding watershed. Many of these photographs are dispersed throughout this plan.

As part of the deliverables for the Cold Water Heritage Grant, the FCCD was required to conduct 2 public meetings. The first meeting was held in conjunction with the Mountain Watershed Association regular meeting on September 27th, 2004. During the meeting, a PowerPoint presentation was given and a watershed survey was passed out. The survey was employed in order to get concerned residents opinions on what they think the main impact(s) are to the Rasler Run watershed. Public involvement is and will be very important when the time comes to following up on some of the recommendations mentioned later in this plan.

The survey was broken up into two main parts; the first part listed different types of problems and the people were to circle a number from 1 to 5 on how serious they think the problem is in the watershed. A score of five on the survey considered a "very serious problem" a score of 1 considered "not a problem" and the remaining scores indicating levels somewhere in between. The type of problems listed in this first part of the survey are as follows: abandoned mine drainage, abandoned mine land, acid precipitation, agricultural runoff, construction activities, illegal dumping, invasive species, logging, sedimentation, sewage, streambank erosion, commercial/industrial and others. The second part of the survey was a set of 4 questions with blank spaces left below for responses. The questions mainly dealt with the person's opinion of the top 3 most serious problems; what they would like to see happen in the future; and what they like the most and least about the watershed. To see the completed surveys, please reference Attachment Q - Surveys.

Confluence of Rasler Run with Indian Creek

Drop pool on Rasler Run

IV. WATERSHED POLLUTION PROBLEMS

Like most streams in Western Pennsylvania, the Rasler Run watershed is susceptible to many different pollution types. The nature of this plan was not to perform months of water sampling and stream habitat assessments so we do not have specific critical problem areas. However, a variety of existing and potential threats to this stream could be observed during our field visits.

In this section, we will focus on general aspects of different pollutants suspected to be negatively impacting the Rasler Run Watershed and the common technologies used to treat with them. At the end of each general pollution section, we will identify suspected problem areas as well as make some recommendations with regards to the specific pollution type. These "next steps" are intended to provide suggestions of possible courses of action for protection and preservation of the Rasler Run Watershed. The suggested courses of action were made by the FCCD staff and technical advisory committee after review of the background information and initial field visits.

IV.1 Abandoned Mine Drainage (AMD)

IV.1.A INFORMATION

Abandoned mine drainage can originate from several sources within a watershed; deep mines, surface mines and spoil piles. Deep mines that have been closed up for years can continue to produce large amounts of AMD when the mine fills up with groundwater and inevitably finds its way out of the void. Once the contaminated water from the mine comes into contact with oxygen, a reaction takes place producing AMD. In addition to deep mines, some reclaimed surface mines as well as spoil piles have groundwater and/or surface water percolating through the backfill which reacts with the pyrite (iron sulfide) associated with the coal seam mined. This reaction between pyrite, water and oxygen (when the water reaches the surface) produces two chemicals; sulfuric acid and iron hydroxide (Yellow Boy). Sulfuric acid lowers the pH in the abandoned mine water while the iron hydroxide forms an orange precipitate that forms on a streams substrate and smothers aquatic life.

Acid mine drainage can also leach certain metals out of the associated rock and clay strata including iron, aluminum, manganese and other heavy metals. These metals add to the pollution and cause a variety of harmful effects.

Abandoned mine drainage is not always acidic, it may also be alkaline. An alkaline discharge results when the AMD water comes in contact with a sufficient amount of limestone (calcium carbonate). This situation can be beneficial when it neutralizes the acid but the discharge will still carry other contaminants (i.e. heavy metals). Generally speaking, the affects of an alkaline discharge may not be as far reaching as those of an acid discharge.

IV.1.B TECHNOLOGY

By and large, there are two schools of thought with regards to AMD treatment; active treatment and passive treatment. The following sections will discuss the basics of each type of treatment including the pros and cons of each.

ACTIVE TREATMENT

Active treatment of AMD was once the most popular form of AMD treatment. Active treatment involves neutralizing acid polluted waters with alkaline chemicals. These chemicals may include limestone, hydrated lime, soda ash, caustic soda and ammonia. Not only are these chemicals expensive to use but the treatment facility itself is often expensive to construct and operate. We will now discuss some of the most popular types of active treatment systems. Our discussion is based solely on the chemicals used for treatment. It should be noted that the actual mechanical system which will mix the chemical with the AMD water varies greatly from design to design and is often based on a combination of the specific chemical used to treat the polluted water and the available site conditions and resources (i.e. proximity to electric, etc.).

Limestone (calcium carbonate)

When using limestone, the calcium content of the limestone should be as high as possible. Dolomite limestones tend to be less effective than other types of limestone. Some advantages of this method are the low cost of limestone and its ease of use. Also, there is the easy handling capability of the dense sludge that forms during the treatment of AMD. The treatment is slow to react to the polluted water, the limestone can be coated with iron precipitates thus losing efficiency, high ferrous-ferric ratio water is difficult to treat and the method has an in-effectiveness in treating water with high manganese content. The use of limestone is generally less effective when acidities exceed 50 mg/l.

Hydrated Lime (calcium hydroxide)

This chemical is usually the chemical of choice of coal operators because of its ease and safety of use, its effectiveness and its relative inexpensiveness. Some disadvantages include the voluminous sludge that is produced and the high initial cost of installing the necessary large scale treatment plant.

Pebble Quicklime (calcium oxide)

Quicklime is a highly reactive, economical, easy to handle and smooth feeding chemical. It raises the pH of water very quickly to approximately 9.0, which allows metals in the AMD to precipitate out when in settling ponds. Quicklime can be bought in 50 pound bags or in bulk if necessary. It has been shown that quicklime has a 75% cost savings over caustic systems and about 20% to 40% savings over ammonia systems. In addition, the AMD sludge generated with this type of treatment is denser and precipitates quicker than caustic-generated AMD sludge.

Soda Ash (sodium carbonate)

Soda ash usually comes in the form of briquettes and is especially effective in treating low flow AMD discharges. The major disadvantages include the higher cost relative to limestone and the poor settling properties of the sludge.

Caustic Soda (sodium hydroxide)

This type of active treatment is very effective in the treatment of low flow AMD discharges in remote locations and flows with high manganese content. Major disadvantages are its high cost, dangers involved in the handling of the chemical, poor sludge properties and freezing problems in cold weather.

Ammonia (anhydrous ammonia)

Ammonia is effective in treating AMD discharges with high ferrous iron and/or manganese concentrations. Ammonia costs less than caustic soda and has many of the same advantages as caustic soda. On the other hand, the chemical is difficult and dangerous to use and may pose a threat to biological conditions down stream from the treatment area. These threats may be toxicity to fish and other aquatic organisms, eutrophication and nitrification. Due to these reasons, ammonia is not permitted in all states and in states where it is permitted, there is additional monitoring required.

PASSIVE TREATMENT

Currently, passive treatment systems are the preferred method of remediating AMD. Passive treatment uses naturally occurring chemical and biological reactions to aid in the treatment of AMD. These reactions are intended to occur within the controlled environment of the treatment system and not in the receiving body of water. Passive AMD treatments have been used in some form since 1978. The first passive treatment systems used a natural *Sphagnum* wetland that could improve the water quality and did not cause damaging impacts to the ecosystem. The initial cost for a passive treatment system will most likely be more than the cost for an active treatment system but passive AMD treatments can be sustained at a much lower cost than active treatments since there is no need for energy to run treatment equipment, no chemicals are needed for the treatment and there is no need to have an employee/staff person man the system on a work week schedule. Other advantages of the passive treatment include less maintenance and operational requirements. We will now describe some of the most popular types of passive treatment systems.

Aeration

Aeration of abandoned mine discharges is a technique used to speed up the oxidation of dissolved metals in the water. The predominate metal is iron which, when oxidized, forms iron hydroxide $Fe(OH)^3$, also known as yellow boy, a slimy orange compound that frequently coats a stream's substrate. The process of oxidation, as defined by Webster's Dictionary, is "to change (a compound) by increasing the proportion of the electronegative part or change (an element or ion) from a lower to a higher positive balance: remove one or more electrons from (an atom, ion, or molecule)". The iron is changed from its ferrous (+2) state to its ferric (+3) state. Iron will not precipitate out unless it is in its ferric state.

Aeration of the mine water can be added before other passive treatment techniques, like aerobic wetlands, to achieve better metal dropping results and thus help to clean the water in less time. Aeration can be easily accomplished by allowing the mine water to cascade over rip-rap before entering the treatment system.

Aerobic/Constructed Wetland

An aerobic or constructed wetland is probably the simplest form of passive treatment. The wetland consists of a large surface area pond with surface flow and may be planted with cattails and other wetland species. These wetlands use soil- and water-borne microbes that are associated with the wetland plants to remove dissolved metals from the AMD. Initial construction costs may be significant but the wetland requires little or no continuing maintenance. The constructed wetlands are more efficient when the influent has a pH of greater than 5.5 and the water is net alkaline. These wetlands have seasonal variations that impact the amount of metal removal possible. Lesser amounts of metals are removed as the weather gets colder. The constructed wetlands are also more efficient in removing iron than manganese and appear to work best when the flows of the influent are low; maybe a few gallons per minute.

Anaerobic/Compost Wetland

An anaerobic or compost wetland consists of a large pond with a lower layer of organic substrate. The substrate may be piled higher than the open water to promote the flow of water through the substrate. This substrate is most likely made up of spent mushroom compost which contains around 10% calcium carbonate. There are other materials that may be used as substrate and they include peat moss, wood chips, sawdust and hay. These wetlands may also be planted with cattails or other vegetation. The compost wetland acts as a reducing wetland where the organic substrate promotes chemical and microbial processes that generate alkalinity and increase pH. These wetlands can treat discharges that contain dissolved oxygen (DO), Fe^{3+}, Al^{3+}, or acidity less than 300 mg/l.

Open Limestone Channel

Another simple design of a passive treatment system is the open limestone channel. This is essentially a ditch or the actual stream with limestone placed in it. The dissolution of the limestone by the acidic water adds alkalinity to the water and raises the pH. There is the need for large quantities of limestone to promote long-term success of the system. These types of systems tend to have the limestone armored or coated with Fe $(CO)_3$ and Fe $(OH)_3$ thus the need for large amounts of limestone. There is a preference for high flow and turbulence in this system to keep the precipitates in suspension thereby reducing the armoring of the limestone. At times, there may be a need to use an impervious liner under the limestone to prevent the AMD from entering the groundwater.

Limestone Ponds

Limestone ponds are a relatively new passive treatment where a pond is built around an upwelling of AMD. The limestone is placed on the bottom of the pond and the AMD discharge flows up through the limestone. The water in the pond would normally be 3 to 9 feet deep and there would be 1 to 3 feet of limestone placed in the bottom. The limestone pond is designed to retain water for 1 to 2 days and is recommended for AMD water containing low DO levels and no Fe^{3+} and Al^{3+}.

Limestone Sand Addition

Yet another simple type of passive treatment is the use of limestone sand. The limestone sand is dumped into an AMD stream at various locations. The limestone sand is picked up by the flow and is distributed throughout the affected stream. The limestone sand reacts with the acidic water to neutralize it. There can be some coating of the sand particles by iron oxides but the continual tumbling of the sand keeps unarmored surfaces available for the reaction.

Diversion Well

A diversion well is another fairly simple way to treat AMD discharges. The AMD is routed into a pipe and then diverted into a well or receptacle that contains a crushed limestone aggregate. The piped water is forced to flow through the limestone and the turbulence helps to prevent armoring of the limestone. After the water is treated, it is then piped back into its receiving stream. The diversion well does require frequent refilling of limestone to assure continued treatment.

Anoxic Limestone Drain (ALD)

An anoxic limestone drain (ALD) is essentially a limestone channel that is buried. The burying is done in such a way as to prevent oxygen from getting to the AMD and thus preventing oxidizing and precipitation of dissolved metals. Since there is no precipitation of metals, this stops the armoring of the limestone in the drain. ALD's only purpose is to produce alkalinity by changing net acid water into net alkaline water. An ALD can be considered a pre-treatment technique to increase alkalinity before the AMD enters an aerobic wetland. The life of an ALD can be reduced if the AMD has high concentrations of ferric iron, DO or aluminum.

Oxic Limestone Drain (OLD)

Along the same lines of the ALD is the OLD or oxic limestone drain. The construction of an OLD is essentially the same as an ALD except that there is no clay or plastic layer to prevent oxygen from reaching the AMD. In order to flush out any aluminum or iron from the system during operation, there may be piping installed during construction. Other piping may also be used to adjust the effluent pH levels if the full treatment is not needed at any time.

Vertical Flow Wetland (VFW)/Successive Alkalinity Producing System (SAPS)

One of the most widely used systems recently has been the vertical flow wetland (VFW) or successive alkalinity producing system (SAPS). This system combines the use of organic substrate and an ALD. The system was conceived to overcome the problems that ALD's have with elevated DO levels and the large area requirements of compost wetlands. If the AMD to be treated has a high level of DO, then the oxygen must be removed before it can be introduced to the anoxic limestone bed. This removal of oxygen is done by a layer of compost above the limestone. The water flows down from the surface through the compost layer where the DO is removed. The water can then be neutralized by the limestone layer and is discharged through pipes at the bottom of the system. The water will flow through all layers because of the hydraulic head produced by the 3 to 9 feet of standing water above. Any clogging of Fe and Al in the system can be removed by flushing the system. These systems increase alkalinity by limestone dissolution and bacterial sulfate reduction.

Bioremediation/Pyrolusite® Process/Sulfate Reducing Bacteria

A final passive treatment process is called bioremediation/sulfate reducing or a more specific technique is the Pyrolusite® Process. This technique uses microorganisms to convert contaminants into a less harmful product. These microorganisms can aid or accelerate metal oxidation reaction, cause metal hydroxide precipitation, promote metal reduction and aid in the formation and precipitation of metal sulfides.

The Pyrolusite® Process uses site-specific laboratory cultured microbes to remove iron, manganese and aluminum while other systems use sulfate reducing bacteria found in mammalian feces to reduce metals and aid in the formation and precipitation of metal sulfides. Each system consists of a shallow bed of limestone inundated with AMD. The microorganisms are then introduced into the limestone through inoculation ports and the microbes grow on the limestone and oxidize the metals in the AMD. The microbes also etch away the limestone and increase the alkalinity which in turn increases pH.

In conclusion, the use of passive treatment systems has, for the most part, been very successful and continues to be refined as time goes by. Some of the things that have been observed about passive systems include the need for adjustment of the system once the system is online and, in some cases, maintenance needs have been greater than originally thought. However, it has been noticed that once the "bugs" have been worked out, the systems have good success in treating AMD polluted waters. At this time, passive treatment systems are often the best way to deal with unwanted AMD discharges.

HYBRID TREATMENT

Maelstrom Oxidizer

The Maelstrom Oxidizer is an apparatus that uses low-pressure high volume air to oxidize and precipitate metals from abandoned mine drainage. The apparatus looks similar to a garbage dumpster that is partially buried in the ground directly where the iron-laden water empties out of the abandoned mine.

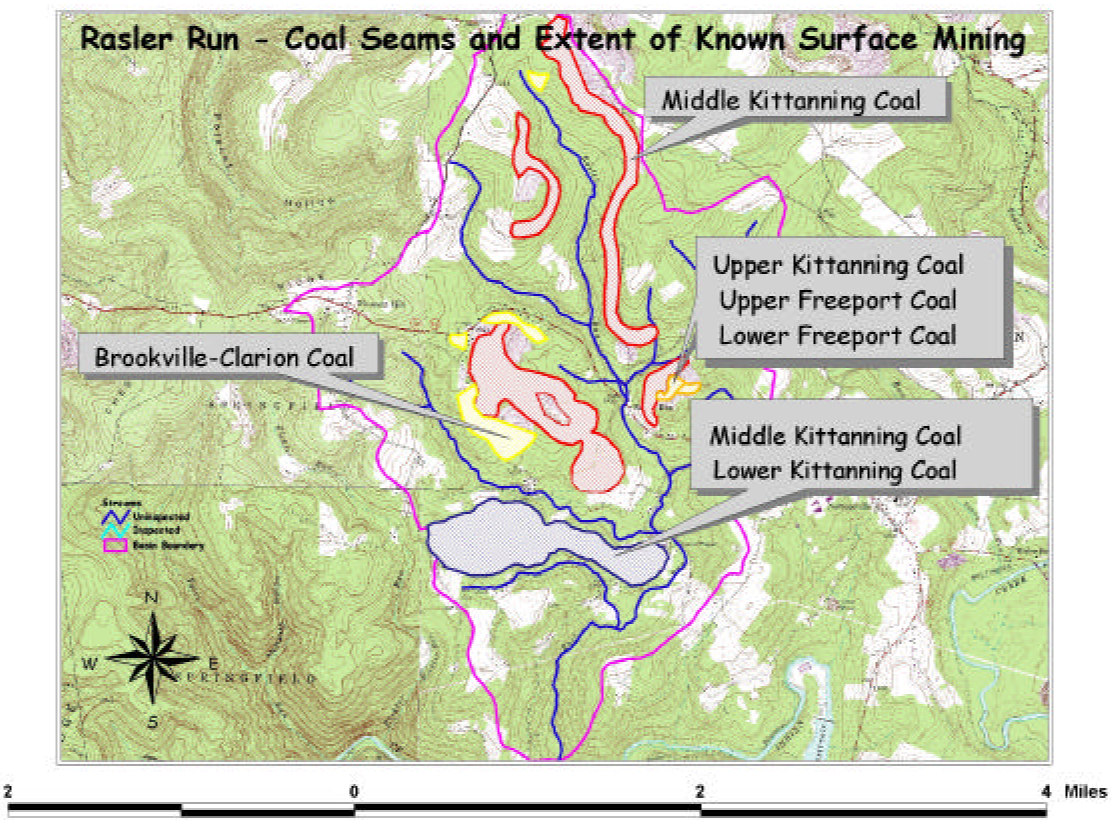
The device is made up of individual aeration modules contiguously aligned to allow gravity flow liquid to be permeated with oxygen repetitively as it passes through a successive series of reaction chambers. The turbulent action within the modules strips carbon dioxide, transfers oxygen, and oxidizes and precipitates the metals dissolved in the AMD. Much of the iron in the abandoned mine water is removed and drops or precipitates out to the bottom of the receiving wetland(s) where it can be pumped out and disposed of or stored onsite. The precipitated ferric hydroxide that is left can then be recycled for other uses, such as pigmentation for paints.

Unlike strictly passive treatments that need large sections of land for wetlands when treating large flows, the Maelstrom Oxidizer can treat large flows and limit the need for large complementing wetlands. This system is less expensive than chemical treatments and requires less wetland acreage than traditional passive treatment systems. When the life expectancy of the Maelstrom Oxidizer is compared to the life expectancy of a passive treatment system (approximately 25 years), it turns out to be over two times greater or 50+ years.

It should be noted that, as of the writing of this document, Maelstrom Oxidizers have been employed on only a modicum of sites for the past three to four years.

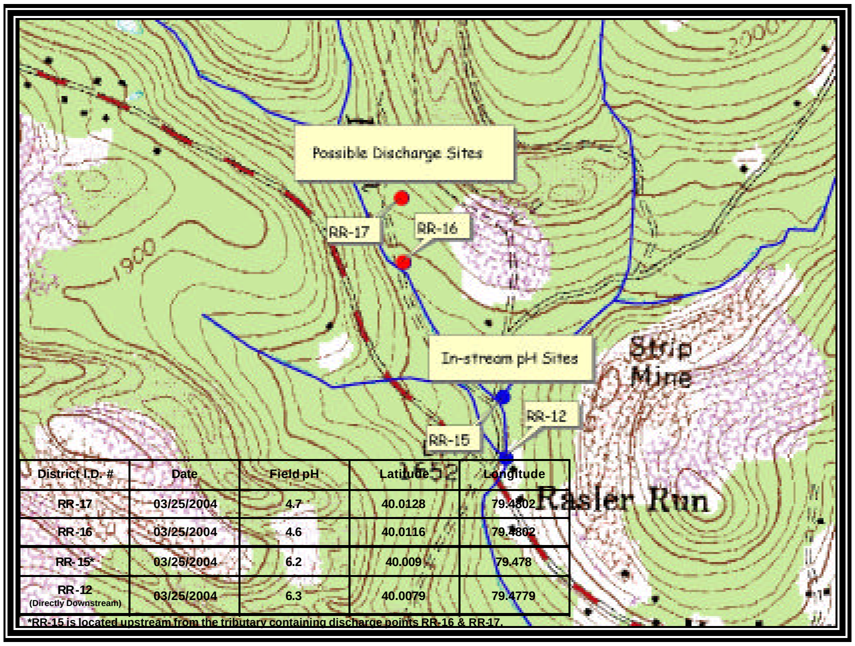
IV.1.C RECOMMENDATIONS/NEXT STEPS

A large portion of this relatively small watershed has been mined in the past. The following map shows the areas of the watershed which have been surface mined as well as what type of coal was likely to be removed.



As a result of this historic mining, several discharges have emerged in the northern end of the watershed. These discharges are impacting tributaries to Rasler Run but do not appear to be significantly impacting the main stem of the stream. This is evidenced by a visual inspection of the watershed during a walk through survey as well as with pH readings taken at various points along the main stem of Rasler Run (RR-15 & RR-12) and at identified discharge locations (RR-17 & RR-16). Please reference Attachment P - Watershed Survey Map for a complete map showing all field pH test locations and a table of pH readings for those points.

The walk through survey of the watershed was cursory. Therefore, a more complete field visit will be required to identify all AMD discharges that may be occurring within the watershed. Special attention should be made in and immediately surrounding known mine sites.



District I.D. #	Date	Field pH	Latitude	Longitude
RR-17	03/25/2004	4.7	40.0128	79.4802
RR-16	03/25/2004	4.6	40.0116	79.4802
RR-15*	03/25/2004	6.2	40.009	79.478
RR-12 (Directly Downstream)	03/25/2004	6.3	40.0079	79.4779

*RR-15 is located upstream from the tributary containing discharge points RR-16 & RR-17.

Map of Rasler Run Headwaters
Showing AMD Discharges & Closest Main Stem pH Test Points

After all known discharges have been properly identified and mapped, a sampling plan should be developed and implemented to gain an understanding of the "make-up" of each discharge as well as how the discharges are impacting the watershed.

Specific parameters to be tested for on a per sample basis should include pH, alkalinity, hot acidity, total suspended solids, sulfates, iron, manganese and aluminum. In addition, collecting flow data from the discharges and dissolved oxygen readings would also be wise.

Generally speaking, when trying to establish the impact of AMD discharges on a stream, it is helpful to collect data monthly for 13 months. This regiment helps to define the character of each discharge by tracking seasonal fluctuations over an entire year. In addition, 13 months of data is a typical standard when planning a design of a future treatment system. However, a less rigorous sampling plan could be implemented in order to save funds and resources if necessary. This plan should include no less than quarterly samples to document seasonal variations.

Another possible option would be to collect 13 months of data followed with a quarterly sampling plan to monitor any discharges over time. By implementing a full course of samples over 13 months, followed by quarterly sampling over the following years, one would be able to appropriately document the existing conditions of any existing discharges as well as notice any changes to the discharge that may occur over time due to a variety of factors (i.e. new/additional mining, large construction projects, etc.).

Sampling can be conducted by any responsible party interested in undertaking this project. Responsible parties could include the FCCD, the MWA or another non-profit group/association. It should be noted that while volunteers may be used to collect the samples, a rigorous sampling plan such as the one suggested is often best performed by those organizations with paid staff which can be supplemented with volunteer assistance. This collaboration ensures that sampling rounds will not be missed. Also, those individuals collecting the water quality samples should be trained, if they aren't already, in quality control and assurance measures prior to start of any sampling. If a non-profit group were to receive grant funding to conduct sampling, they may also wish to hire a consultant to complete the work and correlate the results for them.

Photos of discharges in northern end of Rasler Run

A list of the contacts for many of the larger property owners where past mining has occurred can be found in Attachment R – Property Owners & Tax Maps.

To learn more about the past mining activities within the Rasler Run Watershed, the PADEP's Greensburg District Mining Office may be contacted to schedule file reviews at (724) 925-5500. For a complete list of contacts, please refer to the contact information section of this plan.

For additional information regarding AMD, you can contact the Western Pennsylvania Coalition for Abandoned Mine Reclamation (WPCAMR) at (724) 837-4127 or review their web-site at www.amrclearinghouse.org. You may also contact the FCCD at (724) 438-4497.

The information for the abandoned mine drainage (AMD) section of the plan was taken from the following sources: AMD Treatment; The Science of Acid Mine Drainage and Passive Treatment; the Handbook of Constructed Wetlands: Volume 4 Coal Mine Drainage; an Overview of Passive Systems for Treating Acid Mine Drainage; and Treatment Techniques. For a complete literature citation, please refer to the bibliography section of the plan.

IV.2 Abandoned Mine Land

IV.2.A INFORMATION

Another problem that exists within the watershed is the occurrence of sediment pollution and AMD as a result of abandoned mine lands (AML). There are over 250,000 acres of abandoned mine land; refuse banks; old mine shafts and other relics of past mining in 45 of the 67 counties in the state. It is estimated that the cost of cleaning up all the pollution from abandoned mine lands in Pennsylvania would cost $15 billion but as time goes by that number gets larger and larger. It has also been estimated that, at the current rate, it may take 50 years to completely clean up all the AMLs across the state.

A certain amount of erosion and sedimentation takes place naturally but nature is able to incorporate these sediments readily and without permanent adverse effects. Under natural conditions, it can take thousands of years for rain to erode soils and cause sediment pollution but when there is an unreclaimed mine, the erosion can happen overnight. This accelerated erosion is the removal of the surface of the land through the combined action of human activities and natural processes at a rate greater than would occur from natural processes alone.

Sediment pollution is sometimes described as soil out of place. Soil in stream water can cause numerous problems. Excess amounts of sediment in the water can clog fish gills and cover fish eggs as well as the gravel nests they rest in. Excess sediment can also help to destroy the food supply of many fish species by covering and coating aquatic invertebrate habitat. The suspended sediment clouds water and deprives plant life of light needed for photosynthesis.

One of the problems common to the Rasler Run watershed, is the fact that eroded soils can carry other pollutants such as heavy metals, pesticides and excess nutrients. Excess nutrients may be from livestock waste or other fertilizers used on farmland as well as runoff of fertilizers and other chemicals from lawns and gardens. These other pollutants not only cause problems at the source but also downstream. Large sediment loads in waterways can result in eroded and unstable streambanks. The cost of drinking water treatment may increase because of amplified sediment loads or unfiltered drinking water supplies may be too harmful for consumption. Finally, the occurrence of large amounts of sediments in streams may necessitate the dredging of reservoirs or other bodies of water.

Treatment of AMD was discussed in the previous section but there are some specific techniques that are used to help prevent sediment pollution from leaving an AML site.

IV.2.B TECHNOLOGY

Sediment pollution from disturbed lands into stream waters can be dealt with in many ways. In fact, there are a number of publications where many of the techniques to follow are described in detail. These publications include the Pennsylvania Department of Environmental Protection's (DEP) *Erosion and Sediment Pollution Control Program Manual* and the *Pennsylvania Handbook of Best Management Practices for Developing Areas.* The latter was developed by the Pennsylvania Association of Conservation Districts, the Keystone Chapter, Soil and Water Conservation Society, the DEP and the Natural Resources Conservation Service (NRCS). Much of the following information is taken from these publications. Since the area to be focused on is an un-reclaimed surface mine, there are abandoned mine land (AML) specific techniques or best management practices that can be used to deal with the sediment pollution problem. The goal of these best management practices or BMP's is to inhibit the process of acid formation and/or heavy metal dissolution. If these controls can minimize or eliminate water from entering a mine or coming into contact with sulfide rocks, waste rocks or tailings, then they can be the best, most cost effective reclamation approach. This is because they eliminate the cause of the problem rather than treating the symptoms. This is not a definitive list of BMP's but gives a good basic idea of available techniques that may be used in similar projects.

Capping

Capping is the covering of waste rock or tailings by a protective layer of soil that is graded to promote runoff rather than infiltration into the reactive materials. Any erosion that occurs should not disturb the contaminated waste below. By doing this, the water quality downstream should be improved. The type of cap will depend on the toxicity of the material it is covering and the type of material available to be used on site. If the material to be covered is not very toxic then the cover can be soil obtained on site that is graded and planted with appropriate vegetation. A composite layer can be used to cover more toxic material and may consist of two different layers of soil. The one closest to the material would be a soil that is fine-grained, high density and of low permeability. This does not allow surface water to penetrate to the toxic material and generate AMD. The top layer would be a layer that is less dense and courser to promote plant growth. The final type of cover would be a complex cover used to cap highly toxic material. It would consist of inter-layered synthetic filter fabrics as well as fine and course material. This type of cap may also be combined with liners under the toxic material to keep any discharge in a controlled area. The maintenance needed for this type of BMP would include the occasional walk-through of the capped area to make sure that there are no erosion problems. If found, problem areas should be repaired as soon as possible not only to prevent sediment pollution but also to help to increase the effectiveness and lifetime of the BMP.

Critical-Area Planting

Critical-area planting consists of planting vegetation, such as trees, shrubs, vines, grasses or legumes, on highly erodible or critically eroding areas. This BMP does not include trees planted for wood products. Critical-area planting helps to stabilize the soil, reducing damage from sediment and runoff to downstream areas. It also helps to improve wildlife habitat and visual resources. This BMP should be used on highly erodible or critically eroding areas. These types of areas are usually not able to be treated using ordinary conservation treatments and managements, and if left untreated can result in severe erosion or sediment damage. Many considerations should be taken when looking to install critical-area planting. These include soil characteristics, landowner land-use objectives, maintenance level, soil loss and downstream sediment-deposition areas, soil nutrient levels and pH, pesticide needs and timing of establishment.

Diversions

A diversion is a channel constructed across a slope with a supporting ridge on the down-slope side. Its purpose is to divert excess water away form disturbed or sensitive areas. Sensitive areas may include mine waste, tailings or mine workings. The diversions are also used to reduce flow velocity by conveying runoff across the slope. This type of technique applies to sites where surface flow and shallow subsurface seepage flow may cause damage to down-gradient slopes; excessive runoff from up-gradient areas will interfere with the efficient operation of stormwater controls; runoff to construction areas or other temporarily disturbed sites will aggravate erosion and/or sedimentation problems and diversion of runoff from up-gradient areas can be used to reduce the size or cost of other stormwater BMP's. Diversions are not intended to be substituted for terraces on land that needs terracing for controlling erosion. Temporary diversions may be installed below high-sediment producing areas to control runoff and trap sediment when land is disturbed or land-treatment measures are established. There is a need for periodic inspection and maintenance to ensure the continued effectiveness of diversion ditches.

Interim Stabilization

Interim stabilization consists of stabilizing disturbed areas with erosion blankets, mulching or a temporary vegetative cover until permanent cover can be established. Its purpose is to temporarily stabilize disturbed areas to reduce erosion. The technique can apply in several situations including: disturbed areas that will be un-worked for 7 or more days; areas that will be re-graded before permanent vegetation is established and areas that will not be subjected to heavy wear by construction traffic. This type of BMP is a relatively inexpensive form of erosion control, but should only be used on sites awaiting permanent planting or grading. The vegetation and mulch will not only reduce erosion, but also will trap sediment laden runoff from other parts of the site. The most popular form of interim stabilization is mulching while the second most popular is erosion matting. If a disturbed area is to be un-worked for more than one month then the use of vegetative stabilization should be considered.

Lined Channel

Lined channels are channels that incorporate erosion-resistant linings on banks and bottoms to resist scour and erosion. The erosion-resistant material may include rip rap, gabion mattresses, interlocking paving blocks, concrete or synthetic fabrics. There should be some type of lining in all channels unless it is a temporary interceptor channel or diversion ditch. In most instances, vegetation is the preferable method for stabilizing channels and will be adequate for most situations. In many cases lined channels are used in combination with vegetated channels. The lined channels can be used at grade transitions, steep reaches or points of flow confluence to prevent scour and erosion. It is important that the velocity of flow in the channel not exceed the sheer stress numbers for the lining used. For example, rock-lined (rip rap) channels may be sized on the basis of the maximum permissible velocity and the following conditions: channel alignment is straight or gradually turning; channel side slopes are no steeper than 2H:1V (2 horizontal to 1 vertical); placement thickness is 1.25 times the maximum rock size; rock is crushed and has a unit weight of 165 lbs/cubic foot; a geotextile filter underlayment is provided and a filter rock layer is sized and installed. Lined channels are most commonly used on steep slopes or where high discharge rates are expected. Due to this, the use of energy dissipaters will generally be needed to transition flow to existing watercourses.

Permanent Vegetative Stabilization

Permanent vegetative stabilization consists of establishing perennial vegetative cover on disturbed areas. Like critical-area planting, permanent vegetative stabilization establishes permanent vegetation (such as grasses, legumes, trees and shrubs) as rapidly as possible to prevent soil erosion by wind or water, and to improve wildlife habitat and site aesthetics. In the case of abandoned mine lands, permanent vegetation that is planted on waste rock or tailings piles helps to contain the reactive material by protecting the pile from erosion and reducing the amount of water that can infiltrate into the pile. This BMP can be applicable to the following situations: disturbed areas that have been brought to final grade; channels to be lined with vegetation; wet ponds, dry ponds and bioretention areas and filter strips and buffers. Erosion is controlled by vegetation by reducing the velocity and the volume of overland flow and protecting the bare soil surface from the impact of rain. By having a well-established grass and ground cover, the development has an aesthetically pleasing and finished look. The most economical and common means of establishing permanent vegetative cover is by the seeding of grasses and legumes. Some maintenance issues and disadvantages include the potential for erosion before the plants are established, the need to reseed areas that do not become established, limited periods during the year to seed, a need for water and appropriate climatic conditions during germination.

Re-grading

Re-grading is the contouring of the land to help discourage the forces of erosion which include water, wind, frost and animal action. Generally, slopes with less than three feet horizontal to one foot vertical are stable from erosion and conducive to vegetation growth. When an area has been barren for a long time, it usually will become highly dissected by water erosion and may be susceptible to wind erosion and frost action. Areas like this will require re-grading to make the surface more uniform and gently sloping. Once an area is re-graded, it should be seeded or some sort of interim stabilization should be installed as soon as possible so erosion does not take place. Like many of these techniques, it needs to be combined with other BMP's to achieve the most efficient control measures.

Rock Construction Entrance

Rock construction entrances are just as they sound. The entrance to any construction/mine/reclamation site should have a rock construction entrance to help reduce the amount of sediment that leaves the site thus reducing the amount of sediment pollution in streams during precipitation events. A rock construction entrance should be a minimum of 50 feet long and a minimum with of 20 feet wide or the width of the access. The entrance should be constantly maintained to the specific dimensions by adding additional rock when needed. These entrances may also include a wash rack where the sediment can be washed from the equipment leaving the site. The rack should be 6 to 7 feet long and wide enough to cover the entire width of the entrance. The wash rack must be connected to a sediment removal facility, such as a vegetated filter strip or into a channel leading to a sediment removal device.

Sediment Basin

A sediment basin is a control measure that is used to reduce sediment pollution from disturbed sites. It does this by trapping the sediment runoff from disturbed sites in a ponded area that allows the water to slow and drop its sediment load. This reduces the sediment pollution in off-site streams, lakes and drainageways. Sometimes, sediment basins are needed where other erosion control measures are not adequate to prevent off-site sedimentation, particularly sediment traps which cannot be used for tributary drainage larger than 5 acres. There are some things to remember when planning for the installation of a sediment basin. These guides include: ensuring that the location of the basin allows access for the removal of sediment and disposing of it properly under typical weather conditions; make sure that the basin is located in the proper location for collecting concentrated sediment-laden flows from the area served; the location also needs to be planned properly so, if needed, it can be used for a permanent wet or dry pond in the future and finally the sediment basin should not exceed a life of 3 years unless it is to be used as a permanent basin. Maintenance for a sediment basin would include visual inspection of the embankments for any structural problems and periodic clean-out when the water capacity drops below 5,000 cubic feet per acre.

Sediment Trap

Sediment traps are temporary sedimentation control measures for reducing sediment pollution from small disturbed drainage areas. They work in the same way as the larger sediment basins. The trap has an embankment that impounds the water and an outlet structure to release the water in a controlled manner. Like the basin, the sediment trap helps to prevent the sedimentation of off-site streams, lakes and drainageways. It is important to remember that sediment traps are only acceptable to collect water from small drainage areas, less than 5 acres. If the natural drainage from a site is towards an established swale or drainageway and if constructing an impounding berm in the drainageway is convenient, then sediment traps are useful. Also, sediment traps are most effective if installed directly down-gradient from the disturbed area and if the area will be disturbed for a short period of time. Just as in the case of sediment basins, sediment traps should be cleaned out when storage capacity has been reached. In reference to a trap, that capacity is when the storage volume is less than 1,300 cubic feet per acre. One common problem with sediment traps is that the sediment will stay suspended in the water because of turbulent flow near the outlet or overflow. Because sediment traps have a small surface area and depth, compared to sediment basins, the efficiency of a trap to separate sediment from the water is questionable.

Silt Fence

Silt fence (also known as filter fabric fence) is a temporary barrier of entrenched geotextile that is stretched across and attached to supporting posts that is used to intercept sediment-laden runoff from small drainage areas. The silt fence intercepts sheet flows leaving the disturbed area. There are certain situations that a silt fence can and cannot be used. These situations include that the maximum allowable slope lengths contributing runoff to a silt fence are shown in table 1 below; the maximum drainage area for overland flow to a silt fence must not exceed 1 acre per 100 feet of fence; silt fences should not be installed in areas of concentrated flow; silt fence should not be installed where effectiveness is required for more than 6 months and the soil conditions should allow the bottom of the silt fence to be entrenched and for the trench to be backfilled. Silt fence should be placed as close to the contour as possible with the ends extending upslope and the area below should be undisturbed or stabilized. The fence should be inspected after each rainfall and during prolonged periods of rainfall. Also, if parts of the silt fence would become ineffective, then those parts or the whole fence should be replaced. Finally, sediment deposition behind the fence should be removed when it reaches one-half of the height of the fence.

Table 1: Slope Length above Silt

Percent Slope	Max. Slope Length in feet for an 18" high Fence	Max. Slope Length in feet for a 36" high Fence	Max. Slope Length in feet for Super Silt Fence
25	20	55	150
20	25	70	200
15	35	100	250
10	50	150	300
5	100	250	500
Less than 2	250	500	1,000

Straw Bale Barrier

Straw bale barriers are temporary barriers consisting of a row of entrenched and anchored straw bales or similar material. They are used to intercept sediment-laden runoff from small drainage areas of disturbed soil. The straw bale barrier will retain sediment load that is transported by sheet flow from disturbed areas. The straw bale barriers are applicable in the following situations: the slope lengths contributing to the runoff to the straw bales can be no more than those listed in table 2 below; the maximum drainage area for overland flow to a straw bale barrier should not exceed ¼ acre per 100 feet of barrier; like silt fence, straw bale barriers are meant to control sheet and rill flow not gully flow; straw bale barriers should not be installed in live streams or in swales where there is a possibility of a washout and the source of erosion will exist for no more than 3 months. The bales should be inspected after each rainfall and during prolonged periods of rainfall. Also, if parts of the straw bales would become ineffective then those parts of the barrier should be replaced. The sediment deposition behind the straw bales should be removed when it reaches one-third of the height of the barrier. Finally, the straw bale barriers should be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

Table 2: Slope Length above Straw Bale Barrier

Percent Slope	Max. Slope Length in feet
25	25
20	50
15	75
10	100
Less than 10	125

IV.2.C RECOMMENDATIONS/NEXT STEPS

Extensive surface mining has been conducted through-out the Rasler Run Watershed. In fact, many of the sites were abandoned long ago but a few including the Nicholson II site have recently been completed.

In the past, when surface mine sites were reclaimed, a diversity of plantings including trees and shrubs were not always included and in some instances little to no vegetative cover was ever established. This lack of cover where there once was forest land can create a myriad of problems including: accelerated erosion and sediment pollution, decreases in natural habitat for certain species of flora and fauna, interruption of scenic views and, when close to streamside, increases in water temperature (thermal pollution).

If left uncontrolled in a coldwater fishery, the diminishment of streamside cover and increases in thermal pollution can be deadly for fish populations, specifically trout species. Therefore, we would recommend that a survey of all abandoned mine lands within the watershed be conducted. This survey should evaluate the present state of vegetative cover and note any sources of pollution specifically; AMD discharges, erosion and sediment run-off and illegal dumping. The survey should also record the site's proximity to Rasler Run or any of its tributaries and assess any impact(s) to the water body.

Our initial surveys of the watershed showed that while there did not appear to be any AML sites located directly adjacent to the stream, there are a couple of sites of concern within the watershed. It should be noted that due to the limited scope of this project, the FCCD staff was unable to visit every mine site within the watershed.

Photo of AML Site in Headwaters of Rasler Run

The primary site of concern is located in the headwaters of the stream and can be seen in the adjacent photograph. The photograph reveals the rather typical look of an insufficiently covered AML site. Note the exposed areas and sparse low growing vegetation. The FCCD recommends that the landowners of this site and sites like it be contacted regarding the possibility of re-planting the site with a diverse range of trees and shrubs. Another option for consideration should be the discussion of creating wildlife management plans in addition to biodiverse planting plans for the AML sites. This would help to increase the presence of native wildlife in addition to providing the added benefits of controlling or eliminating a variety of pollution types.

In fact, these types of projects offer ample opportunity for groups, agencies and individuals to partner together to create watershed-wide improvements as well as landowner stewardship and education. A number of agencies may be able to assist in the replanting of AML sites including the Bureau of Abandoned Mine Reclamation, Office of Surface Mining, Partners of the Appalachian Regional Reforestation Initiative, the Pennsylvania Game Commission and others. Contact information for these agencies can be found in its own section at the end of the plan. It should be noted that the local watershed group, Mountain Watershed Association, would be an ideal partner for this type of project since they may have landowner contacts directly and may be able to muster a number of volunteers for actual planting. Included in Attachment S – CREP Tree & Shrub List is a list of recommended tree and shrub species for habitat plantings from the Conservation Reserve Enhancement Program.

A list of the current major AML landowners is located in Attachment R – Property Owners & Tax Maps along with their parcel information. Additional landowners may be present and after field identifying the AML sites another property owner search should be conducted to ensure total coverage.

Of note with regards to AML sites is the Nicholson II site which has just recently wrapped up mining and is currently going through Stage II Bond release. Amerikohl mining is responsible for this site and is initiating plantings which include the following tree species: Black Locust, Asiatic Crabapple and Northern Red Oak. These trees will be planted in addition to several grasses and ground cover species. Please see Attachment T for a list of their scheduled plantings. It should also be noted that due to the sensitive nature of the coldwater fishery, Amerikohl was required to install low discharge sediment ponds for stormwater control. These ponds capture stormwater runoff but instead of releasing the water through a single open pipe, the effluent water is run underground and slowly dispersed through a perforated pipe buried in limestone. The perforations in conjunction with their design and layout allow water to cool down before leaving the site and to disperse at a slower more diffused rate. Please see Attachment T for a diagram of the pond infiltration system.

The information and tables for the abandoned mine land section of the plan were taken from the following sources: Erosion and Sediment Pollution Control Manual; Pennsylvania Handbook of Best Management Practices for Developing Areas; and Best Practices in Abandoned Mine Land Reclamation: the remediation of past mining activities. For a complete literature citation, please refer to the bibliography section of the plan.

IV.3 Acid Precipitation

IV.3.A Information

Acid precipitation is a problem that affects all areas in the Northeastern United States. Acid precipitation is any form of wet or dry deposition including rain, snow, fog, dust, etc. Normal precipitation is identified to have a pH of 5.0 to 5.6 but precipitation pH readings from areas near Rasler Run are in the 3.5 to 4.5 range.

Acid precipitation is deposition that contains significant amounts of sulfuric or nitric acid. Sulfuric and nitric acid is formed when gasses (sulfur dioxide and nitrogen oxide) are emitted by industrial or transportation sources. The sulfur dioxide and nitrogen oxide are oxidized to sulfate or nitrate particles and, if water vapor is present in the atmosphere, the particles further become transferred into sulfuric and nitric acid. These particles can also be deposited in the form of dry particles on the ground surface and can be taken up when the next precipitation event happens.

In the Mid-Atlantic Highlands, there are over 1,350 steams that are acidic, mainly due to acid precipitation and the poor buffering capacity of the watershed soils. In addition to normal acid precipitation events, there is the possibility of episodic acidification events. Episodic acidification events are brief periods where pH levels decrease due to runoff of melting snow or heavy downpours. In the Mid-Atlantic Highlands, many additional lakes and streams become temporarily acidified during these episodic events. Just like AMD, acid precipitation can release metals from the soil. One particular metal is aluminum, aluminum is directly toxic to fish and can weaken fish to a point where they cannot compete for food and habitat.

Most of the acid precipitation in Southwestern Pennsylvania, including the Rasler Run watershed, is believed to be caused by emissions from coal-fired power plants in the Ohio River valley. These emissions are pushed here by the common western and southwestern winds. Acid precipitation is a real problem for much of the country and especially in areas where the buffering capacity of the soil is low, as in the Rasler Run watershed.

When pollutants (sulfur dioxide and nitrogen oxides) from human activities combine with water and powerful oxidants (ozone) in the atmosphere, they convert to form sulfuric and nitric acid which fall to the earth as rain, snow, sleet, hail, fog, dew or dust known as acid precipitation.

Acid precipitation is measured on the pH scale which ranges from 0 (very acidic) to 14 (very alkaline). A pH of 7 is considered neutral. Rain is considered to be naturally acidic with a pH of approximately 5.6. So, any precipitation below 5.6 on the pH scale is considered to be acid precipitation. It is important to note that the pH scale is logarithmic so a pH of 4.6 is ten times more acidic than a pH of 5.6 and a pH of 3.6 is one hundred times more acidic than a pH of 5.6. The pH of precipitation in the Rasler Run Watershed ranges from 3.5 to 4.5. Generally speaking, in surface waters with a pH of 4.2, fish cannot survive.

The damages of acid precipitation include the acidification of surface waters resulting in the loss of aquatic life, loss of forest soil productivity and erosion of buildings, statues, paint on vehicles, etc. Acid precipitation poses a serious threat in the northeastern United States and Eastern Canada including the Rasler Run Watershed.

IV.3.B TECHNOLOGY

Creation of tough emissions standards to reduce fossil fuel pollutants is the best available tactic for reducing acid precipitation. In 1970, the Clean Air Act mandated the improvement of air quality in the vicinity of fossil fuel burning plants then in 1990 amendments to the Act called for sulfur dioxide emissions to be cut 10 million tons below 1980 levels by the year 2000 and nitrogen oxide emissions to be cut by 2 million tons. Recent changes (December 31st, 2002) to the Clean Air Act threaten to weaken it by allowing industrial users to increase and prolong their pollution outputs. A consortium of environmental and public health groups (American Lung Association, Communities for a Better Environment, Natural Resources Defense Council and the Sierra Club) have recently filed suit (February 2003) against the government to have the changes reversed. More information regarding the pending law suit can be found on the American Lung Association's web-site at www.lungusa.org.

Some measures that an individual or groups of individuals can take to help reduce acid precipitation include making homes more energy efficient, carpooling and making legislators aware that reductions in greenhouses gases are important.

Monitoring

Monitoring of acid precipitation is a valuable way to assess the changes occurring within a specific area. The information gathered can help to evaluate whether current emissions standards are working effectively to reduce the pollution problem or whether the emissions standards need to be strengthened. Data collected from a monitoring program can also be useful to help correlate changes occurring in the environment with changes and trends in acid precipitation.

In a monitoring program, bulk precipitation is collected and measured on an event basis with the amount of precipitation and pH of precipitation recorded for each event. There are a number of different devices available to collect precipitation but generally speaking, rain is collected by a funnel with a polyethylene screen (1241 micron mesh) at its vortex. The precipitation then passes through a length of tubing until it reaches and is collected in a one gallon polyethylene jug. The collection device should be housed in a wooden box approximately one foot wide and four feet high. Snowfall can be captured in a five gallon polyethylene bucket and brought indoors to completely melt before the pH is measured. It is important that collection devices be located in open, flat areas away from roads, trees, overhead wires, heavily urbanized areas, agricultural areas and point sources.

Those who will be monitoring the collection devices should be uniformly trained and then routinely inspected (biannually) to ensure that measuring techniques are consistent for data collection. Any pH meters used in the monitoring should be calibrated with 4.00 and 7.00 buffers prior to each use and electrodes should be regularly checked for slow response or failure. Data recordation sheets should not only include pH and amount of precipitation but also type of precipitation, duration of precipitation event, time and date of analysis and presence of any visible contaminants. Collection devices should be thoroughly rinsed with distilled water three times after each precipitation event.

Acid precipitation may be created many miles from where it actually falls to the earth making this a difficult issue to tackle on a watershed scale and, in some instances, even on a regional or state basis. When planning to address this issue, it is therefore important to be aware of those entities creating large scale as well as small scale emissions. The location of pollution generators may be both within and outside of original planning areas creating the need for crossing watershed, municipal, regional and state boundaries.

IV.3.C Recommendations/Next Steps

Acid precipitation is a wide-spread and common problem in watersheds through-out the United States and the world. However, the extent of the impact it has on streams is often varied due to the stream's size and location. Bearing this in mind, we suspect that mountain streams like Rasler Run are especially susceptible to the affects of acid precipitation due to their relatively small size and low buffering capacities.

Precipitation readings taken from Laurel Hill State Park indicate that acid precipitation is indeed present in neighboring watersheds (please reference Attachment U – Laurel Hill State Park Acid Precipitation Data). Therefore, it is easy to surmise that Rasler Run is also being recharged by acid precipitation. The extent of the impacts to the watershed are not known so the institution of a monitoring program to assess the amount of acid precipitation entering the waterway along with monitoring of long-term trends in the stream itself may be of benefit. Especially when you consider the impacts that increased acidity levels could have on the existing wild rainbow trout fishery.

The information for the acid precipitation section of the plan was taken from the following sources: Fact Sheet: Acid Rain in Pennsylvania; Monitoring Program for Mercury in Precipitation in Indiana and Effects of Acid Rain: Lakes and Streams. For a complete literature citation, please refer to the bibliography section of the plan.

IV.4 Agriculture

IV.4.A INFORMATION

In most cases, farmers need to disturb earth in order to produce the food and fiber needed by our nation. These disturbances may vary greatly depending on the type of tillage, planting techniques and cultivation. Farmland or agricultural practices have the capability of producing large amounts of stream pollution if not properly handled. Agricultural Best Management Practices (BMP's) or conservation practices are different techniques used to help farmers deal with possible pollution problems associated with their farming practices. These conservation practices help to reduce soil erosion and enhance and protect water quality. The most common pollutant of our surface waters is silt. The control of sheet and gully erosion is the first step in reducing sedimentation of streams and improving the water quality of those streams.

IV.4.B TECHNOLOGY

Farmland or agricultural practices have the capability of producing large amounts of stream pollution if not properly dealt with. Agricultural BMP's (Best Management Practices) or conservation practices are different techniques used to help farmers deal with possible pollution problems associated with their farming practices. These conservation practices help to reduce soil erosion as well as enhance and protect water quality. The most common pollutant of our surface waters is silt. The control of sheet and gully erosion is the first step in reducing sedimentation of streams and improving the water quality of those streams. In this section, we will describe several conservation practices in use throughout the state. This is by no means a comprehensive list but will give a good summary of some of the most common agricultural BMP's.

Crop Residue Management

The first conservation practice is crop residue management. Crop residue management is the use of crop residue to protect the soil surface from erosion. This is one of the most cost effective conservation practices. Some of the crop residues that may be used include corn or soybean stalks, small grain straw or the residue from vegetables and other crops. Some of the benefits that come from the use of crop residues include increased water absorption; reduced volume and velocity of surface runoff; improved soil moisture from mulching effects and improved biological activity from populations of earth worms, night crawlers and other forms of soil life. When one talks of crop residue, there must be a mention of tillage. There is a direct relationship between the amount of tillage and the amount of crop residue left on the surface after planting. The most effective method to maximize surface residue is to use no-till planting. No-till planting is the planting of crops directly into existing crop residue or cover crops without using tillage (the act of plowing or sowing the land). If a continuous soil cover of 50-75% is maintained, then that tends to improve the effectiveness of no-till systems and soil quality.

Contour Farming

Another conservation practice widely used in Pennsylvania is the practice of contour farming. Contour farming involves conducting tillage, planting and harvesting operations around a hill or slope as near to the contour as is practical to reduce erosion. This practice is most effective on moderate slopes of 3-8% when there are measurable ridges left from tillage and/or planting operations. The ridges are usually only 1 to 3 inches high and serve as miniature terraces that slow runoff and increase water absorption. Terraces will be described later in this section. Contour farming is more effective where some form of tillage is used. The reason for this is that the tilling results in more numerous and larger ridges. This practice is typically used on moderate slopes when land is intensively cropped. The practice is most effective on shorter slopes or on longer slopes with cropland terraces. Some benefits of this conservation practice are the reduction of water runoff; increased moisture absorption into the soil; improved water quality and reduced soil erosion.

Contour Strip Cropping

The third conservation practice we will mention is the practice of contour strip cropping. This is the system of growing crops in strips or bands on or near the contour to reduce soil erosion. These contour strips are generally an even width apart although uneven strips may improve the 'farmability" in areas with rolling or irregular topography. These strips usually vary in width from 90 to 120 feet depending on the slope of the land and cropping system being used. In some situations, where the land is too irregular or rolling and contour strips cannot be used, either field strips or contour farming may be more appropriate. The benefits that are experienced with the use of contour strip cropping include reduced soil erosion; reduced water runoff; improved water quality and improved air quality.

Conservation Buffers

Conservation buffers are yet another conservation practice that is used to reduce the loss of soil into receiving streams. These conservation buffers are areas or strips of land maintained in permanent vegetation to help control pollutants and manage other environmental problems. Conservation buffers are permanent vegetation, which may include trees and shrubs. By removing sediments from the environment and providing wildlife habitat, a conservation buffer can enhance our environment. They also provide a natural and pleasing divider between agricultural and residential development. Benefits of a conservation buffer are improved water quality; stable and productive soils; improved wildlife populations; improved recreational opportunities, improved aesthetics and sustainable landscapes.

There are several types of conservation buffers, which include contour buffer strips, field borders, filter strips, riparian forest buffers, vegetative barriers and windbreaks. A contour buffer strip is a permanently vegetated strip, which is located between larger crop strips on sloping land. Field borders are bands or strips of permanent vegetation established at the edge of a cropland field. Filter strips are strips or areas of permanent vegetation used to reduce sediment, organic materials, nutrients, pesticides and other contaminants from runoff. Riparian forest buffers are areas of trees and/or shrubs located adjacent to streams, lakes, ponds or wetlands. Vegetative barriers are narrow permanent strips of stiff-stemmed, tall, dense perennial vegetation established in parallel rows perpendicular to the dominant field slope. A windbreak is a planting of single or multiple rows of trees and/or shrubs that are established to protect sensitive plants, livestock and structures, and to create or enhance wildlife habitat.

Crop Rotation

Crop rotations are planned sequences of different crops on the same field and are another conservation practice commonly used. These rotations may be a simple 2-year rotation of corn and soybean, or an 8-year rotation of 4 years of silage corn and 4 years of hay. Crop rotations are commonly used on most cropland in Pennsylvania. Some of the benefits include improved soil nutrient balance; improved soil quality; reduced threat of insects of disease; reduced soil erosion and reduced use of pesticides.

Cover Crops

Another conservation practice that is in wide use around the state is the use of cover crops. Cover crops reduce soil erosion and add organic matter to the soil. These cover crops are annual or perennial crops that protect the soil from erosion and offer the opportunity for additional forage production and an additional income source. Some benefits of cover crops include reduced soil erosion; improved water quality; reduced nutrient loss following primary crop harvest; reduced potential for weeds; increased soil organic matter and improved soil structure and porosity.

Good Soil Quality/Health

Soil quality or health is the ability of the soil, using its chemical, physical and biological properties, to support plant life and to maintain and/or enhance water and air quality. Some benefits to good soil quality include improved water quality; reduced soil erosion and sedimentation; improved soil moisture for plant growth; the conversion of carbon dioxide to organic carbon in the soil and increased profits from reducing inputs and/or increasing production. There is also a close link between soil quality and the effectiveness of continuous no-till planting systems. This link appears to be that the continuous maintenance of a high degree of soil covers which results in a successful no-till system as well as a soil that reflects the properties of a good quality soil.

Permanent Vegetation

Still another conservation practice used to prevent soil erosion is the establishment of permanent vegetation on areas subject to erosion. This practice is a commonly accepted practice in both agriculture and urban situations. The key to using vegetation is properly selecting the plant(s) and using proper techniques to establish them. Some benefits to this technique are reduced soil erosion; improved water quality; reduced sedimentation; reduced cost of treatment; enhanced wildlife habitat and improved aesthetics.

Integrated Pest Management (IPM)

Integrated pest management (IPM) is a “common sense” approach to managing pests that combines methods to provide effective, environmentally friendly control. This practice uses a combination of genetic, biological, cultural and/or chemical methods as well as current pest information to control pests. Integrated pest management depends on the regular inspection of fields during critical growth periods and the recording of observations and/or results of pest control actions taken. Benefits include increased profits from reduced costs; reduced buildup of resistance in target pests; improved knowledge of pest problems; healthy, safer environment and reduced use of pesticides.

Grassed Waterways

Grassed waterways are another conservation practice that is used to slow runoff water and guide it from a field preventing gully erosion. They are defined as natural or constructed swales where water usually concentrates as it runs off a field. The many benefits include improved water quality; reduced erosion; improved field conditions and provides an outlet for terraces or diversions.

Terraces and Diversions

Terraces and diversions, earthen channels that intercept runoff on slopes, are two other conservation practices. These types of conservation practices transform long slopes into a series of shorter slopes to reduce the rate of runoff and allow soil particles to settle out.

Terraces are cross-slope channels that control erosion on cropland. They are usually built so crops can be grown on the terrace. There are two types of terraces commonly used. Storage terraces are terraces that collect water and store it until the water can be absorbed into the soil or released to stable outlet channels or through underground outlets. Gradient terraces, on the other hand, are designed as cross-slope channels to collect runoff water and carry it to a stable outlet like a waterway.

Diversions are cross-slope channels that are permanently vegetated with grass. Diversions are used on steeper slopes where a terrace would be too expensive or difficult to build, maintain or farm.

Terraces and diversions reduce erosion; improve water quality; improve soil absorption and reduce runoff to structures below.

Pasture and Hayland Planting

Pasture and hayland planting is the successful establishment of forage selected to meet the producer's specific objectives. By establishing crops as part of crop rotations, one can provide feed for livestock as well as protecting soil from erosion and adding nitrogen to the soil base. Benefits of this practice are improved soil organic matter levels; improved soil health; reduced need for pesticides and fertilizers; disruption of disease, insect and weed pressure; reduced feed costs and improved water quality.

Grazing Management

Grazing management is a conservation practice that is widely used in Pennsylvania. Grazing management is the designed harvesting of forages by a grazing or browsing animal. This practice allows grazed pastures to rest and forages to replenish their energy reserves. A well-managed and maintained grazing system allows very little, if any, soil erosion. Benefits of grazing management include increased profits from reduced feed costs; improved quality of life; improved animal health and productivity; improved food and cover for grazing animals; improved water quality and quantity and reduced soil erosion and improved soil conditions.

Streambank Protection

Still another conservation practice is the use of streambank protection. Better water quality results from reducing the amount of nutrients, chemicals, animal waste and sediment entering the stream. Excluding livestock and establishing buffer zones or vegetation to filter runoff protects our streams. The fencing prevents cattle from trampling banks, destroying vegetation and stirring up sediment in the streambed. Stable crossings may be constructed to allow for movement across streams and access to water. The buffer zone of vegetation adjacent to the streambank filters runoff and may also absorb excess nutrients and chemicals. The streambanks should be covered with rocks, grass, trees, shrubs or other vegetation to reduce erosion. Benefits include improved water quality; improved animal health; reduced soil erosion and additional wildlife and aquatic habitat.

Nutrient Management

A popular conservation practice in use is the practice of nutrient management. Nutrient management is the planned use of organic and inorganic materials to provide adequate nutrients for crop production while protecting water quality. Nutrient management plans are developed to help producers apply the proper rate and type of inorganic and organic sources of nutrients at the proper time. Benefits of this conservation practice include maximized use of existing organic and inorganic nutrients for plant growth; reduced need and cost for some purchased nutrients; improved water quality and improved balance of soil nutrients.

Barnyard Runoff Control

The conservation practice of barnyard runoff control is just as it sounds. This practice reduces the amount of runoff water from a barnyard, feedlot or other animal concentration area and keeps it from infecting clean surface and/or ground water. In planning barnyard runoff control, the first step is to evaluate existing practices, including livestock management and manure handling and collection. Benefits of this practice are improved water quality; improved animal health; cleaner cows and easier manure management.

The most cost-effective action in correcting barnyard runoff is to "Keep clean water clean." Depending on the situation, there are several practices that may be appropriate. The first barnyard runoff control practice is diversions (see above section) and the second barnyard control practice is roof runoff management. Roof runoff management includes installing gutters or drip-line drains that connect to underground outlets and water control structures including storm drains, surface inlets or culverts or subsurface drainage to remove clean groundwater.

Manure Storage

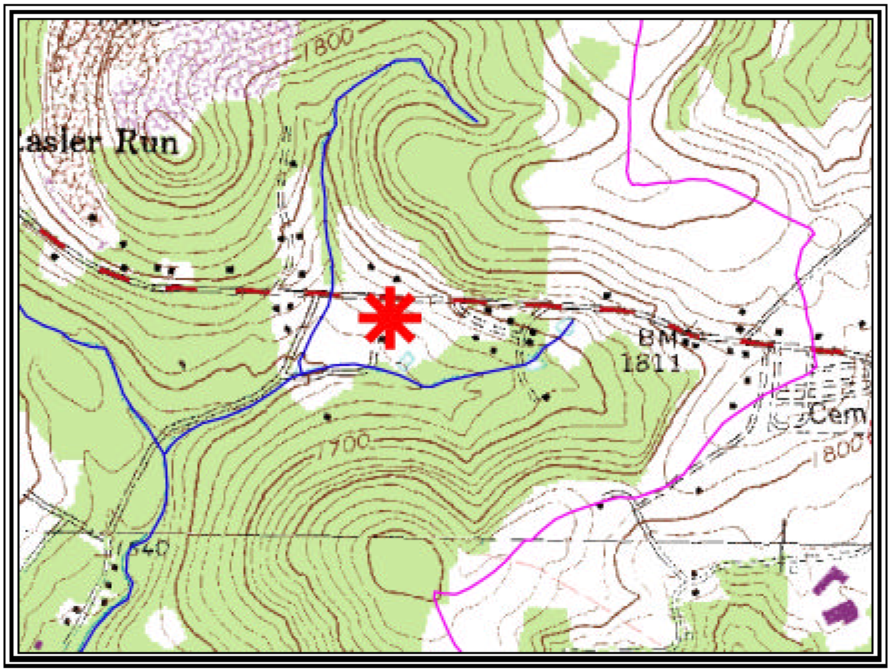
The final conservation practice we will mention is the practice of manure storage. A manure storage facility holds manure and wastewater until they can be used in a controlled manner. The storage of manure helps farmers make optimum use of manure nutrients while protecting water quality. Manure storage facilities should be designed by engineers and must meet state requirements as stated in the Pennsylvania Manure Management Manual. Benefits include improved water quality; improved animal health; better utilization of manure for crops; improved aesthetics and happier neighbors.

Additional conservation practices include ponds, wildlife habitat, wetlands, forestry or tree plantings and farmland preservation or conservation easements. All these conservation practices are meant to protect the natural resources while maintaining or improving the economic viability of the farmer.

IV.4.C RECOMMENDATIONS/NEXT STEPS

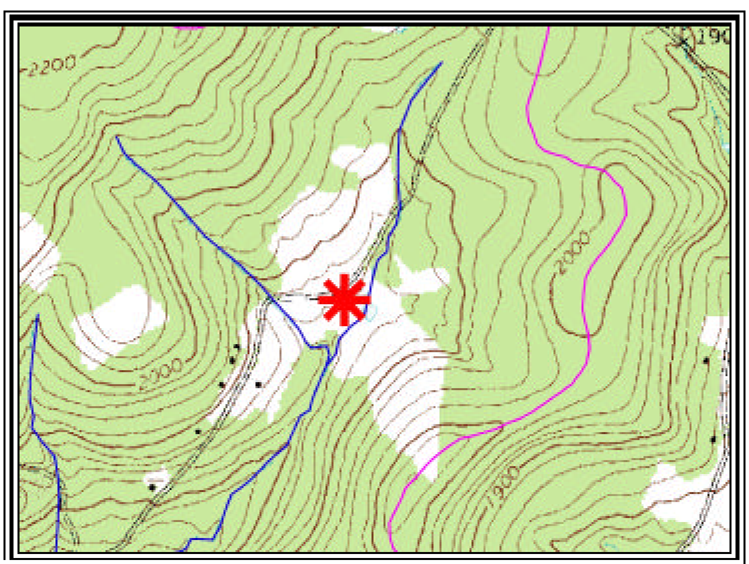
There are relatively few farms located within the Rasler Run Watershed. Two farms of note, to be specific.

The first farm is owned by Kenneth and Peggy Nicholson and is located directly off of Route 711 (please refer to Attachment R - Property Owners & Tax Maps).



Location of the Nicholson Farm

This farm currently has a small livestock population and has a conservation plan in place with the Natural Resources Conservation Service (NRCS). In coordination with the NRCS, efforts can continue to be made to educated the farm owners regarding current agricultural bmp's which can help reduce any pollution problems from the operation.



Location of the Striner Farm

The second farm is owned by Fred and Virginia Striner and is located directly off of Rasler Run Road. This farm is located in the headwaters of Rasler Run and appears to be used for livestock.

This farm is not currently listed as having a conservation plan with the NRCS. Efforts could be made to educate this farmer with regards to agricultural BMPs and the implementation of a conservation plan for the farm.

Above Photo: Nicholson Farm

Right Photo: Striner Farm

There is a third farm located in the watershed, however it is very small with only a few animals present and no crops. We have not identified the property owner yet, so this may be something to consider for future action. Although this farm is not likely to be contributing much in the way of typical agricultural pollution, it would be a good idea to include the farmer in any education efforts.

Photo of small farm in the watershed

The information for the agriculture section of the plan was taken from the following sources: Fact Sheet: Sediment and Erosion Control Requirement for Farming Operations and A Conservation Catalog: Practices for the Conservation of Pennsylvania's Natural Resources. For a complete literature citation, please refer to the bibliography section of the plan.

IV.5 Construction Activities

IV.5.A INFORMATION

Like many other land uses, in construction activities it is very common that large amounts of soil are exposed for long periods of time. This disturbance of the earth is subject to possible accelerated erosion that could result in pollution of streams, rivers, ponds, lakes and/or wetlands. This is why construction activities are required to implement best management practices (BMP's) or controls to help prevent pollution events.

IV.5.B TECHNOLOGY

Many of the BMP's used in construction activities have been described in previous sections. These BMP's include critical area planting, diversions, interim-stabilization, lined channels, permanent vegetative stabilization, rock construction entrances, sediment basins, sediment traps, silt fence and straw bale barriers. There are, however, a whole host of other techniques in use and we will describe them in the following section.

Energy Dissipater

Energy dissipaters are a class of structure that reduces high energy levels in flow to reduce or prevent erosion. The dissipaters reduce or prevent erosion by releasing flow energy in a protected area before discharging the flow to a natural channel. Energy dissipaters can be applied to two different situations: in channel reaches where flow transition from supercritical to subcritical flow and high-velocity discharges from outfalls. In the case of in channel structures, when there is a jump from supercritical flow regime to a subcritical flow regime, a jump forms and energy is released through turbulence. This turbulence is able to scour the banks and bottoms of a channel. The length and height of the hydraulic jump is dependent upon the flow quantity. The energy dissipater uses blocks, sills, or other roughness elements to impose exaggerated resistance to the flow. By exaggerating the resistance, the jump is stabilized and the length of the jump is shortened. In the case of outlet discharges different energy dissipaters such as impact basins, stilling basins and plunge basins are used to dissipate the high-velocity flows, which helps protect the downstream natural channel from erosion. Energy dissipaters should be inspected regularly and immediately after unusual flow events and any damage or erosion should be corrected as soon as possible.

Filter Bags

A filter bag is a large bag constructed of non-woven geotextile fabric that is filled with sediment-laden water to filter it. The bag is used during construction activities to retain sand, silt, and fines present in water that has been pumped from trench excavations, construction sumps, and other small projects. The bag will retain the materials while allowing the filtered water to pass through the fabric. Unlike other temporary sedimentation traps, which must be reconstructed as the project moves along, filter bags are portable. A filter bag is usually not suitable where runoff from and area larger that 1 acre must be treated. When used, a filter bag should be placed in a relatively flat area free of brush and stumps to avoid rupturing or puncturing the bag. The area where the bag rests should be well vegetated (grassy) and resistant to erosion. Finally, the bag should be replaced when it becomes approximately ½ full and other bags should be on-hand to take its place.

Outlet Protection/Stabilization Structure

An outlet protection is a physical device composed of rock, grouted rip rap, or concrete rubble that is placed at the outlet of a pipe. The outlet protection is to prevent scour of the soil caused by high pipe-flow velocities and absorb flow energy to produce non-erosive velocities. This technique will also reduce the effects of turbidity and sedimentation downstream. If flows are above 10 feet per second, then energy dissipaters should be considered (see above description). Outlet structures should be inspected after heavy rains to see if any erosion has taken place around or below the structure or if stones have been dislodged. If needed, the repairs should be done immediately to prevent further damage.

Rock Filter

Rock filters are structures that may be used to control runoff within constructed channels until the protective lining is installed. They may also be used below construction work within and existing stream channel while flow is being diverted past the work area. Rock filters, however, may not be used in lieu of a sediment basin. The filters may be able to control sediment originating within a channel, either during construction of the channel or during a temporary disturbance within the channel. The rock filter should not be used as a replacement for appropriate channel lining. These filters need to be in channels larger than 1 foot in depth and should be equal in height to ½ the total depth of the channel with a 6" depression in the center. The rock filter should be inspected weekly as well as after each runoff event. Any clogged filter stone should be replaced immediately. Sediment is to be removed from behind the filter when it reaches ½ the height of the filter. Once the channel is properly stabilized, then the rock filter should be removed.

Slope Drain/Pipe

A slope drain is a temporary pipe for draining the top of a slope and conveying the water to a stable discharge point at the bottom without causing gullies, channel erosion or saturation of slide-prone soil. A slope drain is applicable for construction sites where concentrated surface runoff can accumulate and must be conveyed down a slope in order to prevent erosion. Due to the lag between the time when slopes are graded and permanent storm water collection systems and slope stabilization measures are installed, temporary provisions for intercepting runoff are necessary sometimes. The slope drain may be a ridged pipe, such as corrugated metal, a flexible conduit or a membrane-lined open channel. The technique is typically used in combination with a diversion control, such as a temporary dike of swale at the top of the slope. The inlet and outlet points should be checked regularly, especially after heavy storms. The inlet should be free of undercutting and no water should go around the point of entry. The outlet should be free of erosion and installed with appropriate outlet protection.

Storm Inlet Protection

The purpose of storm inlet protection is to prevent sediment from entering storm drains during construction operations. This practice allows early use of the storm drainage system. There are three main types of inlet protection: block and gravel protection, excavated drain and filter bag protection. Block and gravel protection uses concrete blocks surrounded by gravel to filter the sediment laden water before it can enter the storm water system. An excavated drain is a type of inlet protection in which an area at the approach to the storm drain drop inlet or curb inlet is excavated. The excavated area collects the sediment and doesn't allow it to enter the storm drain. The final type is the filter bag protection in which a fabric insert is suspended inside the catchbasin to stop the sediment from entering the storm water system. Each type of protection differs in application depending on site condition and type of inlet and not all designs are appropriate in all cases. It is the responsibility of the user to use the proper protection for their needs. Inlet protections are designed for drainage from areas 1 acre or less. If the runoff is from more than one acre, then the water should be routed to a properly designed sediment basin or trap. All inlet protection devices should be inspected regularly and cleaned out when necessary.

IV.5.C RECOMMENDATIONS/NEXT STEPS

Marilyn Dugan is the Erosion and Sedimentation Pollution Control Technician for the FCCD. She handles all complaints regarding sedimentation that occur within Fayette County. If anyone notices sediment pollution from construction sites, they should contact Ms. Dugan at (724) 438-4497 to file a complaint.

The information for the construction section of the plan was taken from the following sources: <u>Erosion and Sediment Pollution Control Program Manual</u>; the <u>Fact Sheet: Minimizing Accelerated Soil Erosion and Preventing Sediment Pollution</u> and the <u>Pennsylvania Handbook of Best Management Practices for Developing Areas</u>. For a complete literature citation, please refer to the bibliography section of the plan.

IV.6 Illegal Dumping

IV.6.A INFORMATION

Illegal dumping is defined as disposal of large quantities of waste in un-permitted areas. Littering on the other hand is the disposal of mostly small items and is often scattered over a large area. The items illegally dumped are usually non-hazardous materials that are dumped to avoid disposal fees and/or the time and effort required for proper disposal. Some of the items illegally dumped include tires, household trash, appliances, bulky items (TVs, furniture, carpet, etc.), vehicle parts, construction debris, compost material and stolen items. Some items like tires, bulky items and yard waste may be dumped because they are not permitted in landfills or proper disposal can be costly. Some common areas where illegal dumping occurs include areas along rural roads, railways and abandoned surface mines. These areas attract dumping because of accessibility and lack of lighting. Illegal dumping most often occurs at night or in the early morning for obvious reasons and it's very common for illegal dumps, if not taken care of, to attract more dumping including the dumping of other types of materials including asbestos, household chemicals and paints, automotive fluids and commercial or industrial wastes.

Illegal dumping is an intentional act unlike a lot of littering. Some of the reasons that people dump illegally are that they missed collection day; it is too costly to dispose of the trash legally; the collector will not accept the material; the dumper is lazy and proper disposal is too inconvenient; others dump to hide evidence of other activities such as drug use and sale, theft or to make money by saying one operates a transfer station and/or are a recycler. There are many problems caused by illegal dumping including health risks, either from physical or chemical hazards, vector/pest attraction such as insects, rodents and other harmful vermin. It is well known that areas with scrap tires are breading grounds for mosquitoes and that mosquitoes can multiply 100 times faster than normal in the warm, stagnant water collecting in those tires. In addition, there is a fire risk with illegal dumps. Fires from illegal dumps have been known to cause evacuation of local residents and considerable property damage. Larger illegal dumps may interfere with proper drainage and make areas more susceptible to flooding and chemical runoff from illegal dumps may contaminate both well and surface water. Finally, in addition to the health and environmental concerns, illegal dumps decrease property values and make the community unattractive to future residential and business development.

IV.6.B TECHNOLOGY

Illegal dumpsites are often difficult and expensive to clean-up. They pollute ground and surface water, rainwater washes over trash and percolates into groundwater and trash is often tossed directly into waterways.

Dumps are often the site of many hazards which can cause illness and personal injury. Illegal dumpsites decrease property values, discourage new residents and businesses, decrease income (potential customers may avoid businesses near trashy areas), decrease community worth, attract other crime, spoil natural beauty, injure wildlife, damage equipment and/or cause accidents.

Clean-up

One of the first steps in any clean-up is to form a community team. Groups or teams of community members can clean-up an illegal dump efficiently and by getting a group together, most, if not all, of the necessary resources needed to conduct the clean-up will be available. In addition to actually cleaning-up the dump, forming a clean-up team from the community results in a sense of pride about oneself and ones community. Therefore, your volunteers are more likely to "patrol" the clean-up site to help prevent further dumping and/or report any individuals seen dumping.

Some important members/partners to any clean-up effort should include a coordinator or someone willing to organize the event (this person can be assisted by a PA CleanWays representative), volunteers or the people who will actually use their people power to remove the trash which does not require heavy equipment (anyone can be a volunteer but some popular groups to check with can include local watershed groups, boy scouts/girl scouts, high school/junior high school clubs, sporting/gaming clubs, service groups, etc.), the property owner the illegal site is on, government agencies (local municipal officials will often help with trash pick-up, PADEP sponsors River Sweep in June, etc.), local businesses, enforcement agencies, local media and potential funding sources (i.e. foundations, endowments, corporations, etc.). Another important place to check with is the local landfill. Local landfills will often drop off and pick up dumpsters for the event, give free or reduced costs for disposal and may even offer additional supplies (i.e. bags, vests, etc.).

Volunteers should wear safety vests, long pants and sleeves as well as boots and gloves, and be careful when handling items to be disposed of. Heavy machinery may be necessary to pull out large items or those items buried in the soil and chainsaws may be necessary to cut debris into manageable pieces.

Coordinators should be aware of items which require special disposal (tires, batteries, appliances, etc.) and make any necessary arrangements. The local landfill and/or PA CleanWays can help with this information.

Lots of photos should be taken and, if possible, a newspaper reporter should be contacted about the clean-up. Publicity will help with future maintenance of the project site and may get other individuals in the community involved.

Prevention

Prevention of illegal dumping is as important as the clean-up of the dumps themselves. Prevention includes creating a maintenance plan to keep the area clean, addressing problem disposal items and conducting comprehensive education campaigns.

Placement of a special sign indicating the area as a former dump with notation of the groups/individuals involved in the clean-up can help. Sometimes, special cameras can be installed to help catch the illegal dumpers in the act and community members agreeing to drive past the area on a regular basis can also help to reduce future dumping.

Be aware that there will always be illegal dumpers but with an effective plan and willing volunteers, a dumpsite can be kept clean with minimum effort.

Reporting Illegal Dumps

Illegal dumps should be reported to an enforcement agency as soon as possible. These agencies include local police, PA State Police, PA Fish and Boat Commission, PA Game Commission, PA Bureau of State Parks (in State Parks only) and PA Department of Environmental Protection – Bureau of Land Recycling and Waste Management.

Pertinent information to collect when you see someone dumping should include license plate number as well as description of vehicle (make, model, year, color and condition), number of persons involved as well as description(s) (gender, hair color, build, approximate age), date and time of incident, location of dump, ownership of site (public or private) if known and your name and telephone number (for any necessary follow-up).

IV.6.C RECOMMENDATIONS/NEXT STEPS

Illegal dumps can be found sporadically throughout the Rasler Run Watershed. Due to the highly rural nature of the watershed, people have scattered small dump sites in the more remote areas, like near where Rasler Run confluences with Indian Creek.

Photo of Illegal Dump near the mouth of Rasler Run

PA Cleanways of Fayette County can be contacted for information on surveying the illegal dumps as well as for tips on organizing clean-ups. Carl Williams of the Fayette County Chapter of PA Cleanways can be reached by e-mail at sdwilliams@access995.com. In addition, Mountain Watershed Association would be a good place to start if interested in gathering volunteers for a dump clean-up. The watershed association can be reached at (724) 455-4200.

In addition to actually cleaning up the dump sites, public education regarding the negative impact to the local community as a result of illegal dumping should be considered. In order to make any significant headway in preventing future dumping and correcting current activities, attitudes and understanding of local residents must be addressed. This is undoubtedly a difficult and long term task.

The information for the illegal dumping section of the plan was taken from primarily one source, the web site for PaCleanways. The titles of the articles include Working Together to Fight Littering & Illegal Dumping; Prevention and Cleanup. For a complete literature citation, please refer to the bibliography section of the plan.

IV.7 Invasive Species

IV.7.A INFORMATION

An invasive plant is a name for a species that has become a weed pest, a plant that grows aggressively, spreads, and displaces other plants. Invasive plants tend to appear on disturbed ground and the most aggressive can actually invade existing ecosystems. Invasive plants are generally undesirable because they are difficult to control and can easily escape from cultivation. These invasive plants can dominate whole areas. In short, invasive plant infestations can be extremely expensive to control, as well as environmentally destructive. A small number of invasive species are "native," meaning they occurred in Pennsylvania before settlement by Europeans but became aggressive after the landscape was altered. However, most invasive plants arrived from other continents and are often referred to as "exotic," "alien," introduced," or "nonnative" invasive species. An aggressive plant freed from its environmental, pest, and disease limits, can become an invader of other ecosystems. Invasive plants are noted for their ability to grow and spread aggressively. Invasive plants can be trees, shrubs, vines, grasses, or flowers and they can reproduce rapidly by roots, seeds, shoots, or all three. Invasive plants tend to:

- not be native to North America;
- spread, reproducing by roots or shoots;
- mature quickly; if spread by seed, produce numerous seeds that disperse and sprout easily;
- be generalists that can grow in many different conditions;
- and be exploiters and colonizers of disturbed ground.

In fact, second only to habitat loss, invasive species are a major factor in the decline of native plants. Plants like Kudzu, Purple Loosestrife and Garlic Mustard are displacing native plants and degrading habitat for native insects, birds, and animals. Endangered, rare, and threatened native species of plants and animals are especially at risk because they often occur in such small populations making them particularly vulnerable to competition. Another reason to avoid invasive species is that invasive plants, even when grown in a cultivated yard, can spread, escape, and cause landscape maintenance weeding problems for years to come. In urban and suburban areas, there is a good chance that the worst weeds on your property are escaped plants, like Japanese Honeysuckle, Multiflora Rose, Japanese Knotweed and Oriental Bittersweet. In yards, gardens, fields, and parks these plants are very expensive to control.

IV.7.B TECHNOLOGY

An invasive plant is a species that spreads on its own, after it has been moved from its native habitat to a new location. These species can reach high densities causing economic and environmental harm and, in some instances, may also be harmful to humans. The problems caused by these invasive species have increased considerably in the past decades partially due to the increased human population, increased international travel and globalization of world trade. There are many lists of invasive plant species including both federal and state lists. One of these lists is the Weed Science Society of America list, which names approximately 2,100 invasive plant species in the United States and Canada. There are 94 species recognized as Federal Noxious Weeds plus many other species on different state noxious weed lists. It is said that 8 to 47% of the total flora in the United States is comprised of invasive plant species. These high amounts of invasive species are estimated to cost $20 billion annually in the United States.

When invasive species become established, it is difficult to eliminate or even suppress them since the species often possess characteristics which favor their population increase. The characteristics may include early maturation, profuse reproduction by seeds and/or vegetative structures, long life of seed in the soil, adaptation for spread and production of biological toxins that suppress the growth of other plants. Also, many invasive plant species are free from attack in their invaded range by specialized insects or pathogens which allows the plant to shift resources from defense to growth and reproduction. Control of these invasive plant species can be a combination of control technologies called integrated invasive plant management. Integrated plant management includes biological, mechanical, chemical and cultural applications. Before the 1950's, the main focus was on chemical and mechanical tactics to deal with invasive species but starting in the 1940's an effort to use biological methods to control invasive plants began. From that point on, the use of biologic controls has been used increasingly more, and is now the most widely used form of control. Biological control is defined as the science of reconnecting invasive plants with the specialized natural enemies that often limit their density in their native ranges. Biological control is defined by Webster's as "attack upon noxious organisms by interference with their ecological adjustment". When there is an introduction of a species that is used as a control on an invasive plant species in the United States, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is responsible for controlling the introduction.

We will focus on four invasive plant species that have been observed in other watersheds in Fayette County. These species include Japanese knotweed (*Fallopia japonica var. japonica* [Houtt.] Ronse Decraene), multiflora rose (*Rosa multiflora Thunberg ex. Murry*), garlic mustard (*Alliaria petiolata* [M. Bieb.] Carvara and Grande) and bush honeysuckles (*Lonicera spp.*).

Japanese Knotweed – Fallopia japonica var. japonica

Japanese knotweed (*Fallopia japonica var. japonica* [Houtt.] Ronse Decraene) was originally introduced to North America as an ornamental plant in the late 19th century. Other common names include Japanese bamboo, Mexican bamboo, Japanese fleece flower, donkey rhubarb, Sally rhubarb, German sausage and pea-shooter plant. This plant has been a problem in the United Kingdom and Europe for some time and is regarded as the most insidious weed in the United Kingdom. Japanese knotweed grows extremely well along river and stream banks, roadside and railroad banks, utility right-of-ways and on surface mine spoils. Knotweed is very difficult and expensive to control. In the United Kingdom alone, the cost per year is estimated to be in the tens of millions of dollars to control the plant. Japanese knotweed can add 10% to total development costs, in order to cover removal and legal disposal of the topsoil contaminated with viable root material. Knotweed can also affect regional redevelopment plans and damage the tourism industry by obstructing roadside vistas and reducing access to rivers.

In the Unites States, the cost to control knotweed is similar to the United Kingdom. The costs include expenses associated with the application of herbicides to control the plant or direct damage to structures and the indirect damage associated with increased flooding and reduced amenity value of land occupied by Japanese knotweed. In order to be able to control the growth and spread of knotweed, there needs to be a concerted effort on a watershed basis. As the knotweed grows, it forms dense thickets that prohibit native species from growing and has little or no value to wildlife. The species also develops a large network of underground rootstock or rhizomes that helps the plant to achieve early emergence and great height. The mat of rhizomes can spread out for 50 to 65 feet and the plant can reach heights between 4 and 16 feet. The rhizomes can also spread very quickly through soil, as fast as 6 to 8 feet per year, which allows knotweed to spread extremely fast. Japanese knotweed can spread to new locations from the fragmentation and movement of rhizomes by water or man's activity and the dispersal of seeds by wind and water. After the knotweed dies in the fall, the mass of dead stems further inhibits native plant regeneration and leaves stream banks vulnerable to erosion. As stated before, flood waters help to spread the seeds further downstream to start new groups of plants.

Japanese knotweed has spread though out North America, as far north as Alaska and as far south and west as Louisiana and California and as far east as the Atlantic coast. The species can grow in a variety of soil types including silt, loam and sand. The soils will range in pH from 4.5 to 7.4 and the species will generally be found in moist, unshaded habitats. In shaded areas, Japanese knotweed growth and abundance are depressed. There has been some work done in the area of streambank restoration that has tried to plant larger saplings in order to shade the knotweed. It is not yet known if this practice is going to be successful.

In the area of natural enemies, there has not been any comprehensive survey done in the plant's area of origin but it has been discovered that some natural enemies to knotweed may include Lepidoptera and fungal pathogens. It has been observed in the United Kingdom that Japanese knotweed received damage from a green dock beetle (*Gastrophysa viridula* De Geer). To date, there have been no releases of suspected natural enemies of Japanese knotweed but future work may focus on the assessment of both arthropods and fungal natural enemies.

Along with biological controls, there have been experiments on mechanical and chemical methods to control the species. Mechanical methods of pulling, digging and mowing are largely ineffective and other approaches of covering with plastic for extended periods of time have also proven futile. One of the only effective methods in order to deal with Japanese knotweed is by herbicide treatment. This treatment is done in a series of foliar applications of herbicides containing the active ingredient glyphosate, which is found in Roundup. The applications should be done as follows: the first application is to be done in the spring when the plants are 1 to 2 feet tall; the second application is to be done in late August or early September of the same year; and then a third and final treatment may be needed the following spring to control any individual plants that may have survived the initial two applications. After the knotweed is eliminated, the area should be planted with native plant species to protect the area from erosion and prevent the reinvasion of Japanese knotweed or other invasive species.

Purple Loosestrife – Lythrum salicaria

Purple loosestrife (*Lythrum salicaria*) is a non-native weed originating from Asia and Europe. The weed was introduced to the northeastern United States and Canada in the early 1800s for ornamental as well as medicinal uses. Purple loosestrife has now invaded nearly every state of the United States with the exception of Florida and is listed on the noxious weed list in as many as 19 states. Although purple loosestrife creates a water flow reduction in irrigation systems of the western United States and may reduce the palatability of hay containing it, it is not considered to cause any significant, direct economic loss. This weed does, however, create indirect economic loss by reducing the number and kinds of waterfowl found in wetlands and limiting hunting opportunities.

Purple loosestrife is an erect perennial herb with a woody stem growing up to 10 feet high under certain conditions. The plant spreads by producing large quantities of seeds and distributing them via wind and water. In fact, a single mature plant may have between 30 and 50 stems arising from one rootstock and is estimated to produce 2 to 3 million seeds per year. This considerable seed production allows purple loosestrife to invade a variety of wetlands including tidal and non-tidal marshes, stream and river banks, ditches, reservoirs, pond and lake margins and wet freshwater meadows. This plant rapidly out competes native plant species replacing them with a dense monoculture thereby reducing biodiversity, providing little to no value to wildlife and endangering rare species of flora and fauna. In addition, the leaves of purple loosestrife decompose rapidly in the fall creating a nutrient flush at the wrong time of year (native species decompose in spring) which results in significant alterations of wetland function. It has been documented by *Schneider and Pence, 1992* and *Blossey et al., 2001a* that a variety of marsh birds avoid nesting and foraging in purple loosestrife. As with other invasive plant species, there are numerous ways to deal with the problem. These techniques typically include mechanical, chemical and biological methods.

Mechanical control of purple loosestrife generally consists of hand pulling small infestations of young plants before they set seed while chemical control of purple loosestrife generally consists of spot treating older plants with a glyphosate formulated for use near water. It should be noted that herbicide applications tend to be more effective done late in the season.

Biological control of purple loosestrife is generally considered the most effective way of controlling large infestations. The United States Department of Agriculture (USDA) has approved several imported beetle species for release including: *Galerucella calmariensis and Galerucella pusilla, Hylobius transversovittatus, Nanophyes marmoratus*.

Two species of beetles from the Chrysomelidae family are natural enemies to purple loosestrife populations throughout Europe; *Galerucella calmariensis and Galerucella pusilla.* Adults of this beetle overwinter in leaf litter emerging in early spring to feed on young plant tissue resulting in defoliation. Females of these species lay their eggs in batches of two on the leaves and stems of purple loosestrife from May to June. The larvae then feed on the leaf and flower buds moving on to feed on all aboveground plant parts in their later developmental stages.

Hylobius transversovittatus, a weevil from the Curculionidae family, emerges shortly after purple loosestrife begins to sprout in the spring. Nocturnal adults eat foliage and stem tissue while females lay their eggs in plant stems or in the soil next to the host plant. Larvae mine the root cortex and in later stages enter the central part of the rootstock feeding for up to two years with adults emerging between June and October. Adult foliage and tissue consumption does little harm to the host plant while larval feeding tends to be extremely destructive. In fact, larval feeding reduces seed output, shoot growth, plant biomass and may result in the plants mortality.

Another weevil from the Curculionidae family, the *Nanophyes marmoratus*, appears on purple loosestrife plants as an adult in mid-spring. The adults feed on the flower spikes with the female laying her eggs in the tips of the flower buds before the petals fully develop. The larvae consume the flower's reproductive parts and later pupate at the end of the buds. The next generation emerges in August and feeds on the remaining green leaves before overwintering in leaf litter.

All four beetle species have successfully been introduced in the United States and monitoring has confirmed that some release sites have experienced significant reductions in purple loosestrife stands. While the early results at some release sites show suppression of the invasive weed, it is not entirely clear what the replacement plant species will be. Some sites report that other invasive species have invaded including reed canary grass (*Phalaris arundinacea* L.) and phragmites (*Phragmites australis* (Cav.)) while other sites report that native species have started to return. In addition, the use of land management techniques on biologically controlled sites is being explored to accelerate the return of native plant species. These techniques may include controlled burns, mowing, flooding and disking.

Multiflora Rose – Rosa multiflora

Multiflora rose (*Rosa multiflora*, C.P. Thunberg) is a non-native, noxious shrub native to areas of East Asia, particularly Japan, Korea and eastern China. The shrub was introduced into North America in the late 1700's as a garden plant and for root-stock for ornamental roses. Multiflora rose was promoted as a live fence and erosion control by the U.S. Soil Conservation Service and the Pennsylvania Game Commission used the plant as cover and a food source for wildlife. Multiflora rose was even planted in highway median strips as a crash barrier and to reduce the glare from oncoming vehicle headlights. The shrub is now considered an invasive weed species because of its growth habits. Multiflora rose grows rapidly into dense thorny thickets that can invade many different areas including hillside pastures, fence rows, right-of-ways, roadsides, forest edges and the margins of swamps and marshes. With the invasion of multiflora rose in hilly pastures, there has been a great loss of pasture area in states with hilly terrain like West Virginia, Pennsylvania and others. This loss of pastures results in a significant reduction of potential beef production. It is estimated that multiflora rose now infests more than 45 million acres in the eastern United States and the shrub is now considered the highest priority agricultural problem in the state of West Virginia. It is estimated that herbicidal treatment of the plant in West Virginia would cost more that $40 million over a 10-year period.

Multiflora rose is also considered a noxious weed in Illinois, Iowa, Kansas, Maryland, Missouri, Ohio, Pennsylvania, Virginia and Wisconsin. The shrub is moderately winter-hardy, tolerant to many North American insects and diseases and, as said before, will grow into dense thorny thickets that are favorable for many types of wildlife. The copious fruit is good food for deer and birds plus the flowers produce large amounts of golden, sweet-tasting pollen that bees can harvest. Multiflora rose can spread rapidly throughout an area by several ways. The plant can produce large numbers of seeds

(17,500 per large cane or 500,000 seeds per plant annually). These seeds are eaten by birds and distributed over large areas. The seeds can also stay viable in the soil for up to 20 years, waiting for the proper conditions to grow. Multiflora rose can also spread by using a technique called layering. Layering occurs when a cane tip touches the ground and new roots grow from that cane, thus forming a new plant. As with other invasive plant species, there are numerous ways to deal with the problem. These techniques usually include mechanical, chemical and biological methods.

Mechanical control of multiflora rose is very time consuming due to the re-sprouting of the roots. Mowing of the plant can be effective if repeated three to six times during the growing season for two to four consecutive years. This is necessary because new plants may arise from root fragments and dormant seeds.

Chemical control of the plant can be done with several different types of herbicides. The herbicides include glyphosate, triclopyr, fosamine, dicamba, epcort and even water softener salt placed at the base of the plant, most can be effective chemical treatments if used appropriately.

Several agents accomplish biological control of multiflora rose. Four different agents have been found in the United States that show potential for biological control of the shrub. These agents include a native virus called rose rosette disease (RRD) that is spread by an eriophyid mite (*Phyllocoptes fruitiphilus*), a seed chalcid wasp (*Megastigmus aculeatus var. nigroflavus*) and a stem girdler (*Agrilus aurichalceus aurichalceus* Redtenbacher).

The rose rosette disease (RRD) is a native virus that is transmitted by an eriophyid mite, which produces fragments of double-stranded RNA in rose tissue. The symptoms of RRD are red, purplish or dark green venal pigmentation; production of bright red lateral shoots; enlarged stem and stipules; dense, yellowish, dwarfed foliage; and premature development of lateral buds producing many compact lateral branches forming "witches brooms." Moist climate conditions may result in a more rapid spread of RRD. One of the problems with the use of RRD as a biological control agent is the fact that the disease can infect ornamental roses. This fact has caused the American Rose Society and rosarians in general to oppose the release of RRD in fear that ornamental roses may be damaged.

The multiflora rose seed chalcid is a light, yellowish-brown, small torymid wasp that is about 2 to 3 mm long. Adult wasps lay eggs in immature rose hips around mid-June. The eggs hatch and develop in the ovules beginning in mid-August, consuming the seed and killing it. The larvae mature in late September and enter into diapause. By late May of the next year, the larvae have transformed into pupae. At about pedal fall, which is around mid-June, the adult wasp chews out of the seed, emerge, mate and begin oviposition into immature rose hips. This starts the process all over again.

The final possible biologic control would be the rose stem girdler beetle. This is a nonindigenous species form Europe that has been established throughout eastern North America. It is abundant in several sites in Delaware, Indiana, Maryland, Ohio, Pennsylvania, Virginia and West Virginia. These beetle's larvae kill the canes of multiflora rose by girdling (to kill by interrupting the circulation of water and nutrients) them. The plant tissue beyond the girdled area is killed, including developing rose hips and seeds. This insect is believed to have only a minor importance as a biological control agent of multiflora rose.

As far as biological agents are concerned, RRD seams to have the greatest ability to kill off multiflora rose. No multiflora rose has been found to be resistant to the disease. After the majority of the plants are killed off by RRD the remaining 90% to 95% of the plants are likely to be infected by the seed chalcid. In the future, it is expected that multiflora rose will be only an occasional plant in the environment and not the noxious weed it is today. It has been estimated that this great turnaround will happen within the next three to five decades. The only problem with the demise of multiflora rose is that when they are killed other invasive species tend to take their place. These species may include Tatarian honeysuckle (*Lonicera tatarica L.*), autumn olive (*Elaeagnus umbellate* Thunb.), Japanese honeysuckle and Japanese knotweed (*Polygonum cuspidatum*). If all other invasive species can be controlled then native species should return to the site.

Garlic Mustard – Alliaria petiolata

Garlic mustard (*Alliaria petiolata* M. Bieb.) is a cool-season, shade-tolerant obligate biennial herb. The plant is one of the most serious invaders in forested areas of the northeastern and Midwestern United States. Garlic mustard is a native plant of Europe, ranging from England to Sweden to the western regions of the former USSR, India and Sri Lanka and south to Italy and the Mediterranean basin. The plant was first recorded on Long Island, New York in 1868. Since this garlic mustard is shade-tolerant, it is one of a few non-indigenous herbaceous species that is able to invade and dominate the understory of North American forests. In most of the forests invaded by garlic mustard, the forest is said to have low diversity with garlic mustard being the cause. As garlic mustard becomes a permanent member of the understory, it progressively increases in its occurrence but may have large annual fluctuations.

Garlic mustard produces phytotoxic chemicals that interfere with growth of native species. This chemical may interfere by inhibiting mycorrhizal activity. Also, the presence of the garlic mustard interferes with the oviposition of certain rare native butterflies.

As far as biological control goes for garlic mustard, the most important groups of natural enemies are weevils, leaf beetles, butterflies and moths. After a study of host range enemies, it has been found that potential biologic control agents may include five weevils and one flea beetle. Two of the weevils are *Ceutorhynchus alliariae* Brisout and *Ceutorhynchus roberti* Gyllenhal which share a similar life history and niche. The adults feed on the leaves and the larvae develop in stems and leaf petioles of garlic mustard. The attack rates of these weevils observed in Europe range from 48 to 100%.

Another potential biological control agent is a root-mining weevil that occurs predominately in eastern Germany and eastern Austria but has also been reported in eastern France and Italy. The weevil is *Ceutorhynchus scrobicollis* Nerensheimer and Wagner, the adults feed on leaves for a short time while the larva feed in root crowns. After winter, they continue to feed on the plant. The larva leaves the plant in the spring to pupate in the soil. Attack rates vary from 50 to 100% of the plants in its home range.

The next weevil is *Ceutorhynchus constrictus* (Marsham) and is the most widespread of the weevil species describe here. It is found all over western and central Europe. The adults feed on the leaves of garlic mustard and larvae feed on developing seeds. The attack rate of garlic mustard seeds is low, only around 0.3 to 6.4%.

Ceutorhynchus theonae Korotyaev is the final weevil with potential to be used as a biologic agent on garlic mustard. The biology of this weevil appears to be similar to that of *C. constrictus* but appears to have a more damaging feeding pattern.

Phyllotreta ochripes (Curtis) is the flea beetle associated with garlic mustard. The beetle adults attack leaves and the larvae attack the roots of bolting garlic mustard. Little is known about the impact of the beetle on garlic mustard.

The attack by a single or multiple herbivores is anticipated to reduce the competitive ability of garlic mustard in North America. The management of garlic mustard and other invasive plant species aims to protect or restore native ecosystem properties.

Bush Honeysuckles – Lonicera spp.

The final invasive species are bush honeysuckles (*Lonicera spp.*), which are upright deciduous shrubs that out compete many native species. This species is native to Europe, eastern Asia and Japan and were introduced in the 1800's as ornamentals. Honeysuckles were also planted as wildlife food and cover. Two of the species commonly found in Pennsylvania are Tartarian honeysuckle (*Lonicera tatarica L.*) and Morrow's honeysuckle (*Lonicera morrowii* A. Gray). Bush honeysuckle species can grow up to sixteen feet tall and the non-native honeysuckle is easily distinguishable from native species. Native honeysuckle grows in dry and rocky sites but invasive honeysuckle prefers moister soils. Native honeysuckle also has yellow flowers while invasive honeysuckle leaf out one or two weeks before the native honeysuckle and hold their leaves later into the fall. Invasive honeysuckle will grow in numerous sites, which can include abandoned fields, along roadsides, near marshes, and in recently disturbed woodlots. The plant will grow in moderate shade but thrives is full sunlight and is typically spread by birds when they feed on honeysuckle berries. Like multiflora rose, honeysuckle seeds can survive in the soil for some time and wait for the right conditions to grow. Like many other invasive species, honeysuckle can spread very quickly and is extremely invasive.

Bush honeysuckle can be controlled several different ways. If the honeysuckle is removed by hand it is important to remember that all roots must be removed otherwise new sprouts will grow from the root system that is missed. When cutting honeysuckle, it needs to be cut in early spring and again in late fall for several years. This will eventually kill the plant by reducing the plant's nutrient reserves. It is important not to cut the bush in the winter because this will cause the plant to re-sprout vigorously.

The chemical control of herbicide treatment can also be an effective method in controlling honeysuckle. A glyphosate herbicide is to be applied to leaves of freshly cut stumps late in the growing season. Prescribed burns are another method of honeysuckle control. The burn needs to be done during the growing season and for several years in a row. It is important to replant native species after the invasive species have been eliminated to discourage any reinvasion of unwanted species.

The use of biological controls on invasive species seems to be the most popular method at the present time. But, environmental considerations may restrict future biological control practices because of increased concerns about possible damage to non-target native plants. The same environmental concerns may also help to expand the use of biological control through greater use against invasive weeds that threaten natural communities and their performance. It is important to plan the use of biologic controls. Targets of control programs should be ones that have fewer conflicts with native and economic plant relatives to reduce the cost of the programs and make the best use of the limited resources. The fact is that there are a large number of novel plants with invasive potential that continue to be purposely imported. This will continue until the current lenient policy towards plant importation is replaced by a more restrictive policy.

IV.7.C RECOMMENDATIONS/NEXT STEPS

Since the walk through of the watershed was limited, we did not spend a lot of time actively searching for the presence of invasive species. Three known plant species within the Rasler Run Watershed are listed as threatened/endangered. Invasive species are a real and significant threat to all native species especially sensitive species. Therefore, a survey of the riparian corridor to identify invasive species would be wise. If significant stands do not exist, their limited presence may be able to be controlled and/or eradicated before too much damage occurs. If significant stands are discovered, efforts could be implemented to help prevent their spread and hopefully begin a battle to control them. An invasive species survey could be included as a portion of a more detailed watershed assessment (please reference Section V – General Recommendations).

There are many resources available to learn more about invasive species. For starters, you may contact the Penn State Cooperative Extension Office at (724) 438-0111, the local forester at (724) 437-7983 or review web-sites such as www.invasive.org.

The information for the invasive species section of the plan was taken from the following sources: Pennsylvania Field Guide: Common Invasive Plants in Riparian Areas; Plant Invaders of Mid-Atlantic Natural Areas; many Penn State fact sheets on Invasive Weeds Multiflora Rose, Japanese and Giant Knotweed, Mile-A-Minute, Wild Grape, Oriental Bittersweet and Bush Honeysuckles; Biological Control of Invasive Plants in the Eastern United States and Invasive Plants of the Eastern United States: Identification and Control. For a complete literature citation, please refer to the bibliography section of the plan.

IV.8 Logging

IV.8.A INFORMATION

Timber harvesting is considered an earth disturbance activity because it disturbs the forest floor, exposed soil and may lead to sediment pollution. While the actual felling of the trees does not cause problems, the activities involved in moving the product from the stump to the mill may cause erosion and sediment pollution. Past examples have shown that much of the problems occur with the improper layout or construction of skid trails, logging roads and landing areas.

IV.8.B TECHNOLOGY

The BMP's used in logging operations may be very similar to or the same as the ones used in other operation that disturb the land. Some of the techniques used in logging operation that were already described in other sections include rock construction entrances, diversion ditches, permanent vegetative stabilization, silt fence and straw bale barriers. There are, however, a whole host of other techniques in use and we will describe more of them in the following section.

Broad-Based Dips

Broad-based dips are dips constructed in logging roads used to convey water across and off the road to prevent accelerated erosion. They are installed after the basic roadbed is constructed and can be used instead of culverts for cross-drainage where no intermittent or perennial streams are present. Broad-based dips can be used effectively on both skid roads and truck roads where grades do not exceed 10 percent. The dip should be at least 100 feet long and should be spaced according to the chart below (See Table 3). The dip should be constructed straight across the road and not at a 30 degree downhill like culverts also the dip should be out-sloped to ensure proper drainage.

Table 3: Broad-Based Dip Spacing

Road Grade (%)	Spacing (feet)
2	300
3	250
4	200
5	180
6	170
7	160
8	150
9-10	140

Cross Drains and Culverts

Cross drains and culverts are used to drain roadside ditches that collect water from insloping roads or from seeps. The culverts should be placed with a slope of 2 to 4 percent and placed across the road on a 30 degree downslope angle. By installing the culvert this way, it will help keep the culvert clean and ensure water flow. The recommended minimum size for a culvert is 12 inches and should be spaced according to the chart below (See Table 4). One other thing to remember is that the culvert/cross drain should be extended at least one foot beyond the fill bank and the soil below the outlet should be protected with stone riprap or similar material to dissipate the impact of the falling water. A "headwall" should also be constructed at the inlet of the structure to help prevent crushing.

There are four type of culverts commonly used in Pennsylvania. They include open-top box and open-top pole culverts, box culverts and pipe culverts. Open-top box and open-top pole culverts are usually installed on new roads after logging and on old roads that need culverts. There is a need for continuous maintenance to keep the culvert free of obstructions such as leaves, rocks and soil. Box culverts are an alternative to the more expensive pipe culverts but are not as durable and do not self clean as easily as pipe culverts. Pipe culverts are usually installed on permanent roads at the time of construction and are commonly used where vehicle traffic will be relatively heavy after logging activities. Pipe culverts are the most expensive type of cross-drain but they are very effective in controlling water. Different types of materials used include steel well casing, PVC or corrugated metal pipe.

Table 4: Recommended Distances for Culverts & Cross-Ditches

Road Grade (%)	Spacing (feet)
2	500
3	400
4	350
5-6	300
7-8	250
9-11	200
12-13	150
14+	100

Filter Strips

Filter strips are used to trap sediment and sediment-borne pollutants and to reduce imperviousness. In logging operations, where roads are located near streams, allow for an adequate filter strip. By having adequate filter strips, the sediment that may flow off of constructed roads is prevented from entering streams. The width of the filter strip depends on the slope between the road and the stream (see table 5). Soil disturbance is to be kept to a minimum in these filter strips but this does not mean that tree harvesting can not be done in the filter strips.

Table 5: Filter Strip Widths by Slope of Land between Roads & Perennial Streams

Slope of Land between Road and Stream (%)	Minimum Width of Filter Strip (feet)*
0	25~
10	45~
20	65
30	85
40	105
50	125
60	145
70	165

* Widths should be doubled when the harvesting activity is located on municipal water supplies.

~Disturbances within 50 feet of the stream may require a water obstruction permit from the county conservation district of DEP Regional Office.

Waterbars or "Thank-you-ma'ams"

Waterbars are 8 to 12 inch constructed bumps in logging roads used to control water runoff. They are sometimes used on logging roads where the volume of water is not expected to be great enough to wash them out. Waterbars are also good to control water on retired roads. In the case of a road that is constantly being disturbed, it is recommended that deeper dips are used. Waterbars should be placed with a slope of 3 percent and placed across the road on a 30 degree downslope angle and should be space according to the chart below (See Table 6).

Table 6: Waterbar Spacing for Roads & Skid Trails

Road Grade (%)	Waterbar Spacing (feet)
2	250
5	135
10	80
15	60
20	45
25	40
30	35
40	30

IV.8.C RECOMMENDATIONS/NEXT STEPS

Logging is a common practice through-out Fayette County and has occurred in and around the Rasler Run watershed. While we did not note any current logging practices, this could change quickly over time.

Marilyn Dugan is the Erosion and Sedimentation Pollution Control Technician for the FCCD. She handles all complaints regarding sedimentation that occur within Fayette County. If anyone notices sediment pollution from logging sites, they should contact Ms. Dugan at (724) 438-4497 to file a complaint.

The information and tables for the logging section of the plan was taken from the following sources: Controlling Erosion and Sediment from Timber Harvesting Operations and Controlling Erosion and Sediment Pollution from Timber Harvesting Operations: Professional Timber Harvesters Action Packet. For a complete literature citation, please refer to the bibliography section of the plan.

IV.9 Sediment Pollution

IV.9.A INFORMATION

Still another problem that exists within the watershed is the occurrence of sediment pollution. There is a certain amount of erosion and sedimentation that takes place naturally but nature is able to incorporate these sediments without permanent adverse effects. Under natural conditions, it can take thousands of years for rain to erode soils and cause sediment pollution but when there is unprotected earth, as in construction, land development activities and unreclaimed mines, the erosion can happen overnight. This accelerated erosion is the removal of the surface of the land through the combined action of human activities and natural processes at a rate greater than would occur from natural processes alone. Surface mining, poorly managed croplands, construction sites, urban/suburban stream banks and logging roads usually initiate the sediment pollution caused by accelerated erosion.

Sediment pollution is sometimes described as soil out of place. The soil in the stream water can cause numerous problems. One problem is the fact that fish gills can be clogged by excess amounts of sediment in the water and that this sediment can cover fish eggs and the gravel nests they rest in. Excess sediment can also help to destroy the food supply of many fish species by covering aquatic invertebrate habitat. The suspended sediment can cloud water and deprive the plant life of light needed for photosynthesis.

One of the problems common to the Rasler Run watershed, is the fact that eroded soils can carry other pollutants such as heavy metals, pesticides and excess nutrients. Excess nutrients may be from livestock waste or other fertilizers used on farmland as well as runoff of fertilizers and other chemicals from lawns and gardens. These other pollutants not only cause problems at the source but also downstream. Large sediment loads in waterways can result in eroded and unstable streambanks. The cost of drinking water treatment may increase because of amplified sediment loads or unfiltered drinking water supplies may be too harmful for consumption. Finally, the occurrence of large amounts of sediments in streams may necessitate the dredging of reservoirs or other bodies of water.

IV.9.B TECHNOLOGY

All of the technology or BMPs that are commonly used to deal with sediment pollution have been described in other sections of this plan. These sections include: **IV.2 Abandoned Mine Land**, **IV.4 Agriculture**, **IV.5 Construction Activities**, **IV.8 Logging** and **IV.11 Steambank Erosion**. Most of the BMPs listed in these sections are used to help prevent the discharge of sediment into the waters of the Commonwealth, thus protecting water quality.

IV.9.C RECOMMENDATIONS/NEXT STEPS

Sedimentation is the number one non-point source pollutant across the country. It poses many threats including clogging fish gills and covering over fish eggs. Excess sediment also contributes to the destruction of the food supply of many fish species by covering aquatic invertebrate habitat.

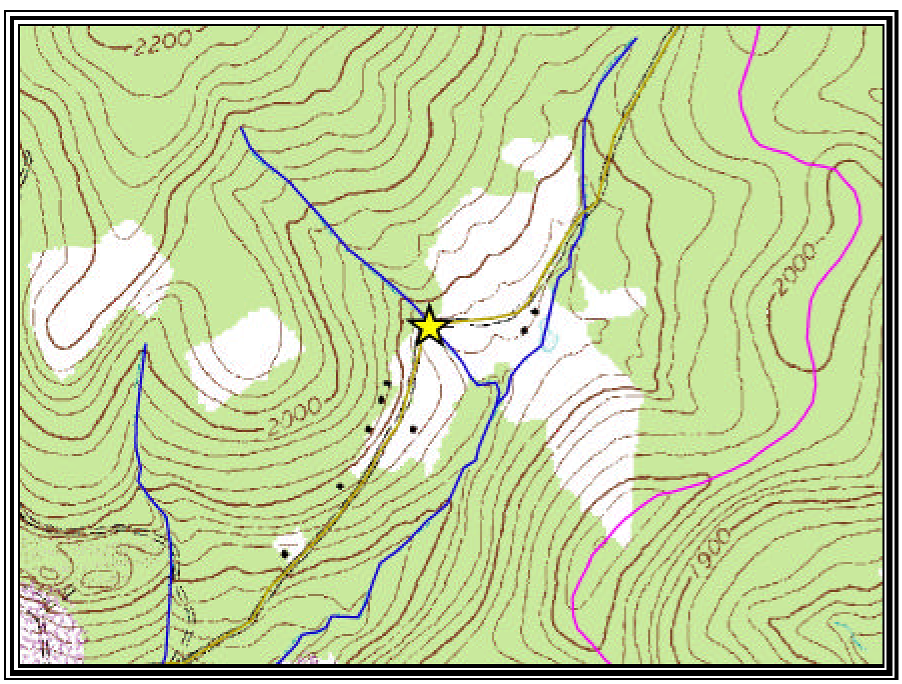
In addition to being 1 of 12 Class A Wild Rainbow Trout Fisheries in the state of Pennsylvania, Rasler Run also supports a small population of naturally reproducing Brook Trout. This species of fish is especially sensitive to sediment pollution so any efforts that can be made to reduce the sediment load entering Rasler Run should be made.

Photo showing where sediment can enter Rasler Run

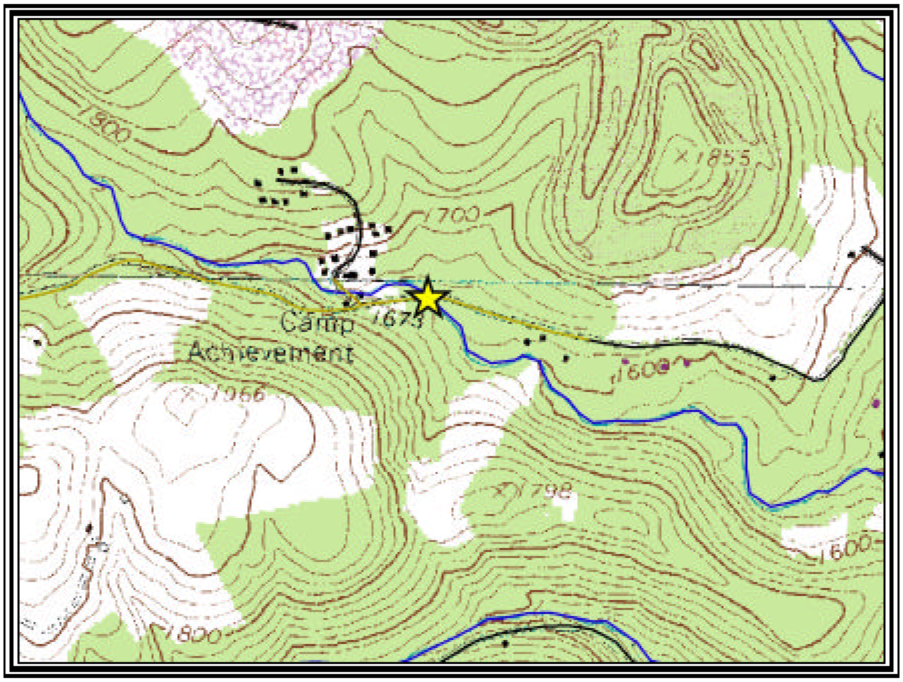
Efforts should include a thorough habitat assessment on its own or as a part of a complete and detailed watershed assessment (please reference Section V – General Recommendations). Areas where streambank erosion is occurring should be identified, mapped and studied as how to repair them. This would include looking for factors within the watershed which may be causing or contributing to the problem.

An additional measure to help reduce any sediment loading in Rasler Run would be the implementation of two dirt and gravel road projects.

The first of the two projects is located in Springfield Township along an unnamed tributary of Rasler Run. This project is located on Rasler Run Road where it crosses the unnamed tributary(ies).



Map of potential Dirt & Gravel Road Project
Rasler Run Road



The second dirt and gravel road project is also located in Springfield Township and is located along a major tributary to Rasler Run. This project is located on Camp Achievement Road where it crosses the tributary to Rasler Run.

Map of potential Dirt & Gravel Road Project
Camp Achievement Road

In each instance, the Springfield Township Supervisors should be contacted and encouraged to apply for money from the FCCD Office to implement dirt and gravel road improvements. The Springfield Township Supervisors can be reached at (724) 455-3015.

Marilyn Dugan is the Erosion and Sedimentation Pollution Control Technician for the FCCD. She handles all complaints regarding sedimentation that occur within Fayette County. If anyone notices sediment pollution, they should contact Ms. Dugan at (724) 438-4497 to file a complaint.

The information for the sediment pollution section of the plan was taken from the following sources: Fact Sheet: Minimizing Accelerated Soil Erosion and Preventing Sediment Pollution and the Pennsylvania Handbook of Best Management Practices for Developing Areas. For a complete literature citation, please refer to the bibliography section of the plan.

IV.10 Sewage

IV.10.A INFORMATION

Another potential problem within in the Rasler Run watershed is the occurrence of fecal coliform bacteria throughout portions of the streams length. This bacterium is often an indicator of the presence of human and animal waste into the stream. The Pennsylvania state water quality standards, as shown in Chapter 93 of the Pennsylvania Environmental Protection Code, Title 25, indicate that fecal coliform should be no higher than 200 per 100 milliliters (ml) from May 1 through September 30. For the remainder of year, the fecal coliform count can be no higher than 2,000 per 100 ml. Some of this is caused by the access of livestock to the stream and its tributaries as well as the dumping of human waste into the stream through straight piping (wildcat sewers) and failing septic systems. It is unknown by the FCCD what the fecal coliform count is in Rasler Run but there is the possibility of problems with some small farms and residences in the watershed. In Rasler Run, there are areas where trailers have been located and might possibly not have adequate septic facilities, this lack of sewage facilities combined with deficiencies in policing wildcat sewers and the often high cost of sewage and septic tank installation creates an environment where the easiest thing for the people to do is let there waste go straight into the stream.

The presence of improperly treated sewage in surface water (streams, rivers, ponds, etc.) and/or groundwater (aquifers and wells) supplies leads to an unhealthy environment for plants, animals and humans alike. Untreated or improperly treated sewage contains and transmits harmful bacteria, viruses and parasites known to cause human diseases such as diarrhea, dysentery and gastroenteritis.

In Pennsylvania, domestic sewage and wastewater are treated and disposed of by a variety of methods including community or individual on-lot disposal systems, also known as septic systems, to large municipally owned sewage treatment plants. Malfunctioning sewage disposal systems, whether individual, community or municipal, or the lack of any disposal system (straight piping or wildcat sewers) at all results in the pollution of both public and private water sources. Unfortunately, installation of new systems or repairs to existing systems can be a financial strain for affected homeowners and/or municipalities. Therefore, often nothing is done to correct the problem(s) which contributes to community apathy and the continued polluting of our water supplies.

In January 1966, the Pennsylvania Sewage Facilities Act (Act 537) was enacted to help correct existing sewage disposal problems as well as to prevent any future problems. Act 537 requires proper planning of all types of sewage facilities, permitting of individual and community on-lot disposal systems, and the adoption of uniform standards for the designing of on-lot disposal systems. This program is administered by individual municipalities or groups of municipalities, including county health departments, which receive technical as well as financial assistance and oversight from the Pennsylvania Department of Environmental Protection (PADEP). Some of the provisions of Act 537 include the following taken directly from PADEP Fact Sheet: An Overview of the Act 537 Sewage Facilities Program:

- All municipalities must develop and implement an official sewage plan that addresses their present and future sewage disposal needs. These plans are modified as new land development projects are proposed or whenever a municipality's sewage disposal needs change. PADEP reviews and approves the official plans and any subsequent revisions.

- Local agencies are required to employ both primary and alternate Sewage Enforcement Officers (SEO). After successfully completing training and being certified by a state board, an SEO* works for the local agency and is responsible for implementing the daily operation of that agency's on-lot disposal system permitting program. SEOs are <u>not</u> PADEP employees.

- Local agencies, through their SEO, approve or deny permits for construction of on-lot sewage disposal systems prior to system installation.

- PADEP provides grants and reimbursements to municipalities and local agencies for costs associated with the Act 537 planning and permitting programs.

- An Environmental Quality Board (EQB) must adopt regulations establishing standards for sewage disposal facilities. These regulations then apply throughout the Commonwealth.

- A Sewage Advisory Committee (SAC) reviews existing and proposed rules, regulations, standards and procedures then advises the Secretary of PADEP. This advisory committee is comprised of members representing many sectors of the regulated community.

* It should be noted that not all "local agencies" choose to employ their own SEO. They may, in fact, opt to work with a countywide SEO who would then be an employee of the county not the municipality or other local agency. There are two SEOs listed for Bullskin Township. They are Jeff Stepanic who can be reached at (724) 626-8147 and Dave Bukovan who can be reached at (724) 430-1210 ext. 207. Dave Bukovan is also the SEO for Springfield Township.

IV.10.B TECHNOLOGY

Those individuals who live in communities where municipal sewage systems are not likely to be installed rely on on-lot sewage disposal systems (septic systems) for the proper treatment of their wastewater.

Before we can discuss the different types of septic systems, we must first discuss how on-lot sewage disposal systems treat sewage.

First, sewage from household plumbing enters a treatment tank where primary treatment occurs. During primary treatment, heavier solid matter settles to the bottom of the tank, where microorganisms feed on and consequently break down the waste, while the lighter fats, oils and greases float to the top of the tank forming a layer known as scum. The primary treatment tank allows wastewater leaving the tank to be cleaner but it still contains disease causing bacteria and viruses as well as other contaminants. These bacteria, viruses and contaminants must therefore be further treated before being released into groundwater or surface water supplies.

After exiting the primary treatment tank, the partially treated sewage travels through a distribution system of piping and into a bed of gravel. The sewage flows over the gravel bed and percolates into the underlying soil. In a properly located system, additional sewage treatment is supplied by the soil. In fact, soils are the most important part of any on-lot sewage disposal system since they provide a barrier between untreated sewage and our water supplies.

Approximately four feet of "suitable" soil is required under the gravel bed to properly treat sewage. Suitable soil is considered to be relatively rock free and not saturated with water since it must allow liquid waste to pass through at a rate slow enough for microorganisms to feed on harmful material but fast enough to dispose of the total amount of liquid waste entering the absorption area. Clay soils treat sewage most effectively but the fine pores of clay soils slow the downward movement of sewage and may result in back-ups on the ground surface. Predominately sandy soils allow for the rapid downward movement of sewage but they often don't hold the sewage long enough for adequate treatment. Therefore, it is important to have the local SEO examine the site location as well as underlying soils for any proposed on-lot disposal system.

It is important to note that <u>not</u> every site or property is suitable for on-lot sewage disposal.

The following section will provide a brief description of two different anaerobic (without oxygen) septic systems.

Gravity Distribution Systems

A gravity distribution system contains a septic tank, a distribution box and an absorption area. Sewage flows into the septic tank for primary treatment where solid waste will settle to the bottom forming sludge and lighter material (scum) floats on top of a liquid known as effluent. The sludge and scum must be pumped out regularly while the effluent flows from the septic tank into the distribution box. Once in the distribution box, the sewage wastewater will be directed into an absorption field through the use of gravity flow. The absorption area will allow the effluent to travel through pipes into a gravel bed where it is then percolated through underlying soil for additional treatment.

Pressure Distribution Systems

A pressure distribution system has essentially the same components as the gravity distribution system except in place of the distribution box, it contains a dosing tank. Once again, sewage flows directly from the household into the septic tank for primary treatment. From here, the effluent flows into the dosing tank while the sludge and scum must be pumped out. The wastewater is directed into the absorption field through the dosing tank by using pressurized pipes. Within the absorption area, the wastewater once again travels through piping into a layer of gravel where it percolates into the underlying soil for additional treatment.

It is common for one of the abovementioned systems to be connected to a soil treatment system typically a drainfield, mound or at-grade system. There are many different variations of these systems available to property owners, all of which are based on individual site conditions and levels of usage.

The following is a general description of the basic categories of conventional soil treatment systems.

Drainfields/Land Drains

Drainfields or land drains are connected to the septic tank by an underground pipe and may consist of trenches or a seepage bed. The bottom of the drainfield or land drain should be three feet above the seasonally high water table or bedrock. If the seasonally high water table is within a few feet of the ground surface, the land drain or drainfield must be installed close to the surface with care exercised so that polluted water doesn't break through the ground surface.

In a drainfield or land drain, wastewater travels from the septic tank into perforated pipes buried in gravel filled trenches. The perforated pipes allow pathogens, nutrients and organic material to disperse into the gravel bed where they are neutralized as the liquid moves through the soil. In a trench system, the liquid effluent may flow into a series of drop boxes or manholes. As each set of trenches reaches its capacity, the drop boxes or manholes release liquids to the next set of pipes in the drainfield.

Seepage beds are gravel filled areas similar to a trench but greater than three feet wide. Seepage beds should be restricted to flat areas where space is extremely limited.

Mounds

Sewage treatment mounds are elevated soil treatment systems. Clean sand or small gravel is used to elevate the system to at least three feet above the seasonal high water table or bedrock. The mound's size, shape and height must be carefully designed to avoid failure of the system and to ensure even distribution of the liquid effluent throughout the mound. Sand mound designs must take into consideration lot dimensions, local topography, amount of sewage to be treated and the rate at which water flows through the soil.

Mounds receive liquid effluent from the septic tank in "doses" for treatment. A small pumping station or tank collects the effluent and pumps it under pressure into the sand mound for treatment. Mounds lend themselves well to landscaping and provide effective treatment when properly designed.

At-grade Systems

An at-grade system is an elevated sewage treatment system that uses drainfield rock as the distribution medium instead of sand. Sizing of an at-grade system depends on the amount of sewage to be treated and the rate at which water flows through the soil. These systems require a pumping tank to pressurize the system for proper sewage distribution across the soil for effective treatment.

Seepage Pits/Soakways/Cesspools

Seepage pits and soakways involve discharging septic tank treated sewage into a deep, cylindrical pit that is open on the sides and bottom (seepage pits use a septic tank while cesspools do not). Seepage pits are sometimes built using honeycombed brickwork or concrete manhole sections with perforations in the walls. The holes in the walls are frequently filled with large stones or gravel and a cover placed over the hole.

If the ground stratum for the whole depth of the pit is good and absorbs the effluent, seepage pits and soakways can be satisfactory but, if not, these systems can cause problems since the result will be a large hole filled with septic tank effluent. These types of systems are generally not considered acceptable under today's standards.

Alternative Systems

Alternative methods of sewage treatment may also be considered by individuals who need to install an on-lot sewage disposal system. Alternative systems can include elevated sand mound beds for large volume flows on slopes between 8 and 12 percent, non-infiltration, evapotranspiration beds contained within a greenhouse, graywater systems, leaching chambers, modified subsurface sand filters for fast percolation, shallow placement pressure dosed systems, etc. Each type of system has its advantages and its disadvantages, so it's best to speak with a local SEO for a list of approved alternative systems.

Septic System Maintenance

Even the best designed and properly installed on-lot sewage disposal system will still malfunction if the homeowner does not properly operate and maintain the system. Therefore, proper septic system maintenance is a vital component to the prevention of water pollution.

Perhaps the most important maintenance procedure is not to overload the system. If the capacity of a septic system is exceeded, it can result in surface discharges which create a health hazard on the property site as well as pollute nearby water sources. Homeowners can prevent overloading the system by conserving water and reducing wasteflow into the septic tank. In addition, roof drains, drain tiles, downspouts and sump pumps should not be connected to the system.

Another important maintenance step is to measure sludge and scum depths or routinely pump out the septic tank (at least once every three to five years depending on tank capacity and household size). Every septic tank needs pumped to reduce sludge and scum buildup. If the septic tank is not pumped out, solids may wash out of the tank and into the soil treatment system reducing and limiting its effectiveness.

Homeowners should avoid putting chemicals into the system. Septic systems are designed to treat normal household domestic sewage not materials like paint, paint thinner, solvents, pesticides, etc. These chemicals kill the bacteria that provide treatment in the septic tank and absorption area. Furthermore, these materials can flow through soil and contaminate surrounding groundwater making it unsafe to drink.

In addition, homeowners should avoid putting grease into the system, avoid disposing of bulky, slow decomposing wastes (cigarettes, paper towels, diapers, etc.) in the toilet, avoid using septic system cleaners or starters (they aren't needed and can harm the system) and be aware that using a garbage disposal requires a larger septic tank with compartmented walls as well as more frequent pumping. Heavy vehicles, equipment, livestock and walkways should be kept away from the septic system since these activities can compress the soil making it less effective. The septic tank, pipes and drainage field should be inspected annually and accurate records (design, installation, location, inspections, pumping, malfunctions, repairs, etc.) of the septic system should be maintained.

Signs that an on-lot disposal system is not functioning properly include sluggish toilet flushing, plumbing backups, gurgling sounds in the plumbing, mushy ground over the soil treatment area, odors inside or outside, illness often to household visitors, dosing tank runs continuously or not at all and low spots appear in the yard over soil treatment system.

IV.10.C RECOMMENDATIONS/NEXT STEPS

In this type of rural community, the presence of wildcat sewers or straight piping to the stream is common as is the presence of malfunctioning or improperly maintained septic systems. In order to determine the extent of its presence in the watershed, fecal coliform tests can be run on water samples collected during a detailed watershed assessment (please refer to Section V – General Recommendations).

Educational efforts on the effects of sewage entering the stream should be made and should also include information on the proper installation and maintenance of septic systems.

The information for the sewage section of the plan was taken from the following sources: Act 537 Official Plan Aging Southwestern Pennsylvania; Impact of the use of Subsurface Disposal Systems on Groundwater Nitrate Nitrogen Levels; Fact Sheet: Municipal Wasteload Management; Fact Sheet: Understanding Septic Systems; Fact Sheet: Understanding the Importance of Soils in Siting and Onlot System and Fact Sheet: Process for Resolving Complaints about Malfunctioning Onlot Sewage Disposal Systems. For a complete literature citation, please refer to the bibliography section of the plan.

IV.11 Streambank Erosion

IV.11.A INFORMATION

Streambank erosion occurs when soil and other materials are scoured from the bank and carried away by the flowing stream. Some of the causes of streambank erosion may include increased stream velocity, obstacles in the stream, floating ice and debris, wave action and direct rainfall. Human activity may be the cause of several of these erosion problems. Increased runoff, soil compaction, removal of vegetation and placing debris and obstacles in the stream are some of the activities that cause streambank erosion. Streambank failure, on the other hand, occurs when a large section of bank collapses into the channel. Some common causes of streambank failure include changes in channel shape due to erosion of the streambed and undercutting of the bank, increased load on the top of the bank and internal pressure from uneven water absorption. In urban and suburban areas, streambank erosion has become a major problem because of continued development. This development has increased pavement, rooftops and other impermeable surfaces, which prevent water from soaking down into the soil. State agencies are starting to propose a best management practice (BMP) approach that will minimize runoff by allowing this stormwater to soak back into the ground. By using this approach, there will be a reduction in stream pollution, a recharge of groundwater tables, and enhanced stream flow during times of drought and reduced threat of flooding and streambank erosion from heavy storm episodes. When streambank erosion has already occurred, there are a number of streambank restoration techniques that may be used to fix the problem. These techniques will be discussed later in the report.

Streambank erosion is a serious problem for many streams in Pennsylvania and around the country. Before we can talk about streambank erosion, however, we must mention streambank management. By having a program of streambank management, one can avoid costly renovation/reconstruction measures in the future and provide benefits for years to come to both the property owner and those property owners located downstream.

The benefits of streambank management fall under three categories: economic, aesthetic and flood protection. There are several benefits in each category but an example of economic benefit could include that streambank management can prevent the need for costly reconstruction measures. An aesthetic benefit could be that stable shorelines with healthy vegetation improve the image of your property and gives the owner a sense of pride in their property. When it comes to flood protection, stable streambanks and a healthy stream channel will not prevent flooding but will minimize damage from erosion to structures, roads and agricultural land near the stream. One of the goals of streambank management is to minimize the changes of the stream channel. Otherwise, any attempts to stabilize streambank erosion may prove to be futile.

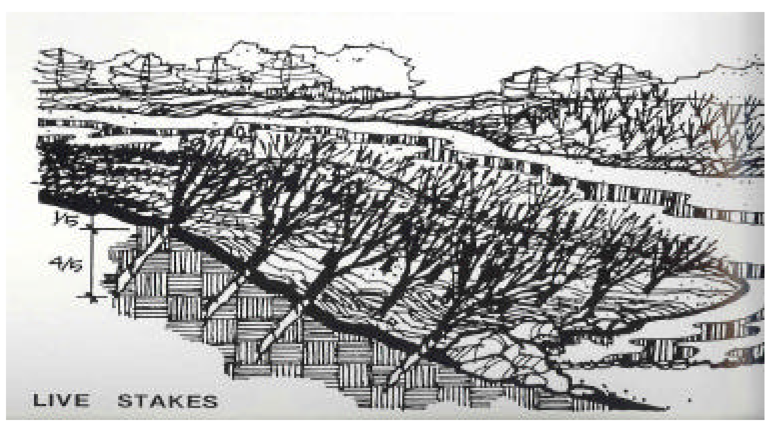
IV.11.B TECHNOLOGY

Streams are dynamic systems that seek a state of equilibrium with their site and climate conditions. The look and behavior of a stream is based on the geology of the area as well as the climate of the region. A youthful steam tends to be steep and straight with fast moving water that actively downcuts the V-shaped valley. A mature stream is normally flat and meandering. These streams have slow moving water and a broad valley with a well-established floodplain. The channel's shape is a result of the flow of the water, the sediment it carries and the composition of the bed and banks. When there are changes in stream flow, sediment load and erosion or depositions on the streambanks, it will cause the stream to seek a new balance. A youthful stream will have a rocky terrain and fairly straight streambanks composed mainly of stone. A mature stream, for the most part, has sinuous banks predominately comprised of soil and gravel. The rock of a youthful stream is very resistant to erosion while soil banks of a mature stream vary in their resistance depending on both the texture and cohesion of the existing soil type. Root structures of plants along streambanks will substantially enhance the erosion resistance of a streambanks. Due to the strength of rock in resisting erosion and the self repairing qualities of vegetation, both are utilized in restoration measures along actively eroding streambanks.

Before any restoration methods can be applied to an actively eroding streambank, it is essential to understand what is causing the erosion problem. Streambank erosion occurs when soil and other materials are scoured from the bank and carried away by the flowing stream. Some of the causes of streambank erosion may include increased stream velocity, obstacles in the stream, floating ice and debris, wave action and direct rainfall. Human activity may also be the cause of several erosion problems. These activities may include increased runoff, soil compaction, removal of vegetation and placing debris and obstacles in the stream. Streambank failure, on the other hand, occurs when a large section of bank collapses into the channel. Some common causes of streambank failure include changes in channel shape due to erosion of the streambed and undercutting of the bank, increased load on the top of the bank and internal pressure from uneven water absorption.

Streambank stabilization techniques should be used as soon as possible when a failure is observed. By taking steps to minimize damage one can prevent the need for major rehabilitation work later. Several methods will be covered from structural methods to those methods that rely on re-vegetation and natural organic material. Many of the techniques mentioned in the next several pages are primarily recommended for small to medium sized streams but may not be practical on large rivers and are not recommended for larger projects.

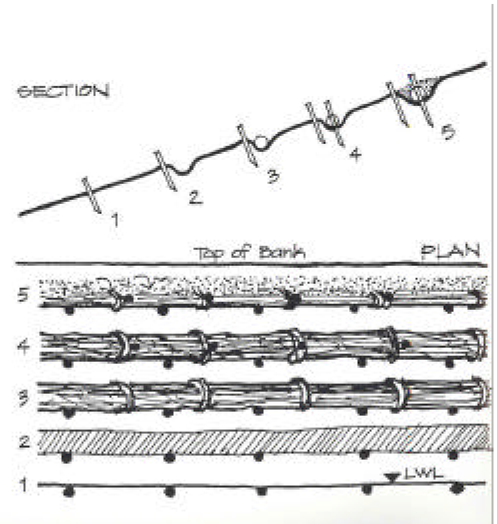
Live Stakes



The first method we will tackle is the method of live-stakes. Live-stakes are living woody plant cuttings capable of quickly rooting in the streamside environment. These stakes are usually dogwood or willow cuttings that will form a quick plant cover. This method is most useful on moderate slopes (4:1 or less); to be used in original bank soil not in fill; is most affective where soil erosion is light; is most effective where it is used in combination with other techniques and is applicable on all sizes of streams. This method is a very effective stabilization method once vegetation is established and works well when time is limited. It can also be an effective barrier to salutation and increase vegetation cover along a stream where existing vegetation is sparse.

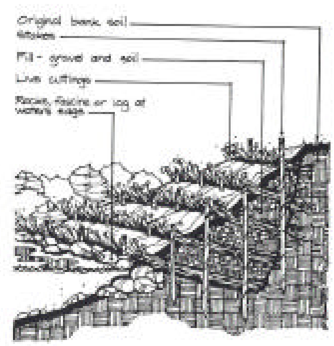
Live Fascines/Bundles

Method two is the live fascines or bundles method. Live fascines are log like bundles of live cuttings wired together and secured into the streambank with live or dead stakes. Fascines are often used in combination with other vegetative stabilization techniques such as brush layers, live stakes and transplants. They protect banks from washout and seepage, particularly at the edge of a stream, and where water levels fluctuate moderately. Live fascines are able to be used on all sizes of streams and all character types. This method offers some immediate erosion protection when properly installed and becomes a very effective technique once rooting has been established. Fascines, like live-stakes, are also effective in collecting sediment.



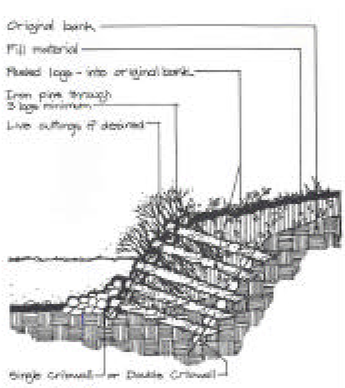
Branch Packing

The branch packing method consists of alternating layers of live branches and soil integrated into a washed out streambank. The branches located above the water line will root to form a permanent installation while the branches below the water line help with initial stability. This technique works well on banks that have had washouts and is useful in areas with fast moving water and moderate depth. Branch packing is effective by producing an immediate barrier which redirects water away from the washed out area and is one of the most effective methods for re-vegetating holes scoured in a stream bank.



BRANCH PACKINGS

Live Cribwall

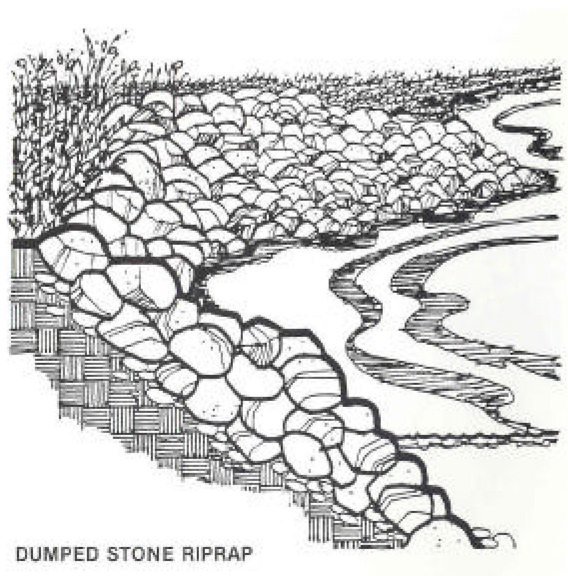


LIVE CRIBWALL

The next technique is called the live cribwall method. This method is a rectangular framework of logs, rocks and woody cuttings that can protect an eroding streambank or prevent the formation of a split channel. The live cribwall technique can be used on outside bends to main channels where strong currents are present. It can also be used in areas where an eroding bank will eventually form a split channel and is a method that can be applicable on all character types. The cribwall method is effective in controlling bank erosion on fast flowing streams but is not effective in streams where the stream bed is actively eroding since the undercutting will undermine the cribwall.

Stone Riprap

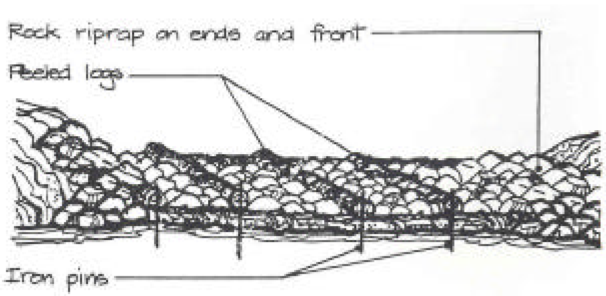
Another method is the stone riprap method, which is a technique that substitutes rock for earth on the banks of a stream. Riprap covers the banks with a layer of stone at an angle that approximates the natural slope of the streambanks. It is best used on small to medium size streams and can be useful in shaded areas where it could be difficult to grow woody vegetation. This technique can also be used in combination with cuttings to provide initial stabilization while the vegetation takes hold. Riprap is well suited to streams with water levels that fluctuate and on actively eroding banks at curves. Due to the rough texture of riprap, it will absorb some energy from a stream and decrease its velocity. Riprap will be very effective in stabilizing actively eroding streambanks and can also blend in with the landscape. In small areas, where machine access is difficult or where a more natural arrangement of stone is desired, hand placed stone may be preferred. An alternate method can include joint planting in placed riprap.



DUMPED STONE RIPRAP

Channel Block Method

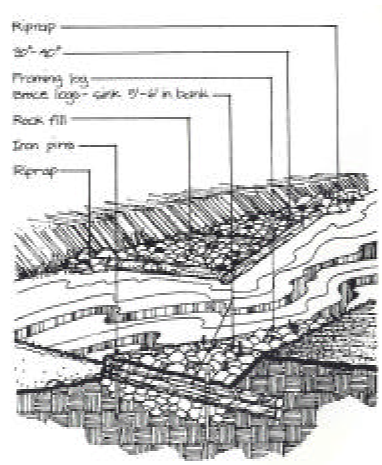
Still another method of streambank erosion control is the channel block method. The channel block is a rectangular framework of logs and rock, which is anchored to the streambed. It stops water from flowing through a newly formed channel or a recently abandoned channel. This method is applicable where one wants to keep a stream in the desired channel to protect the adjacent land from erosion or to block the mouth of an eroding side gully. This technique is useful on small to medium sized streams. The channel block method is effective in improving aquatic habitats.



CHANNEL BLOCK

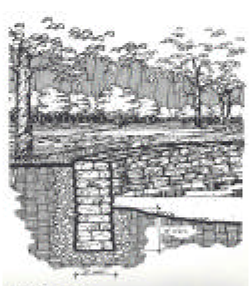
Log Frame Deflector

A popular method in use is the log frame deflector. The log frame deflectors are triangular shaped, rock filled structures anchored to the bank of a stream. They help to direct the flow of a stream away from eroding banks and where deepening of the channel is required. It is only useful on small to medium sized streams but care must be taken on small streams with high velocities as not to erode the opposite bank. Deflectors are also well suited to situations where improved fish habitat is also a goal and can be applied to a wide stream to narrow the channel and increase the velocity of the flow. Benefits of a log frame deflector include improving stream channel depth, removing silt from the streambed and enhancing the aquatic habitat. Alternate deflectors may include stone deflectors and gabion deflectors.



LOG FRAME DEFLECTOR

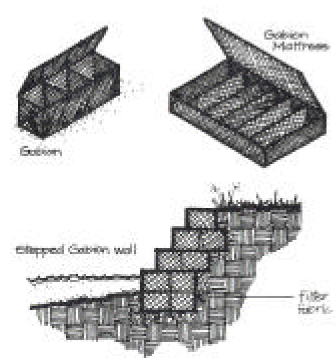
Dry Stonewall



The dry stonewall method consists of hand placed stones used as structural protection to stop eroding banks. Dry stonewalls can be constructed on vertical banks where space is limited or in streams near buildings, bridges or roads. These walls work well on small to medium sized streams and, where views of a stream are desirable, they will maintain open vistas. When properly constructed, a dry stonewall can be a very effective method for stabilizing actively eroding streambanks. This method is particularly good where space between the stream and adjacent uses is limited.

Gabions

The use of gabions has been a widely utilized method but which has fallen out of favor in the past few years due to the increase in more natural methods of streambank protection (which will be mentioned later). Gabions are wire baskets filled with rocks (riprap). The baskets are then wired together to form a wall or mattress for erosion control along a bank or channel. Gabions are useful in protecting steep banks where scouring or undercutting is a problem and works well for lining

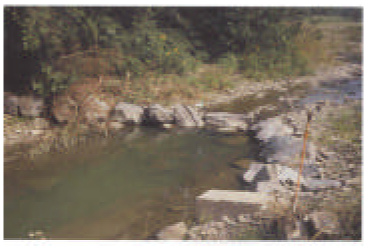


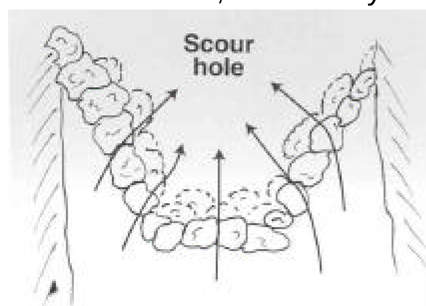
GABIONS

confined channels. The appearance of gabions may be too structural unless vegetation is installed. Gabions are fairly flexible and can follow the contours of a bank. Cuttings can be added to gabions to soften the man-made appearance and are useful on medium to large size streams. Gabions are very effective in stabilizing steep banks and do especially well when vegetation is installed.

Cross Vanes

Cross vanes are still another technique that may be used in stream restoration projects. They are rock structures that extend across a stream from bank to bank. The rock is keyed or embedded into the bankfull elevation in order to control the channel carving flow. The opposing vanes decline towards the center of the stream, where they meet and become one structure. These structures are used to keep stream flow centered in the channel but can be designed to favor one side of the stream or the other.





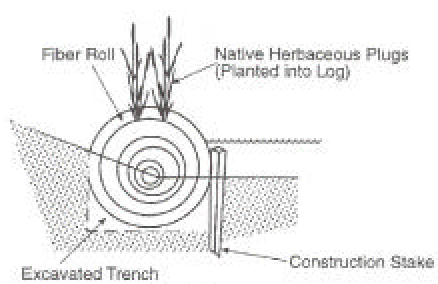
Cross Vane Top View

Erosion Control Mats/Blankets

Erosion control mats or blankets are another widely used product. They are made of a variety of materials but most likely, for bioengineering projects, the mats are made from woven coconut fibers. These mats are usually 6 to 8 feet wide and come in length of over 100 feet. The mats are suitable for covering a wide surface to provide soil erosion protection before vegetation has been established.

Fiber Logs/Coir Logs

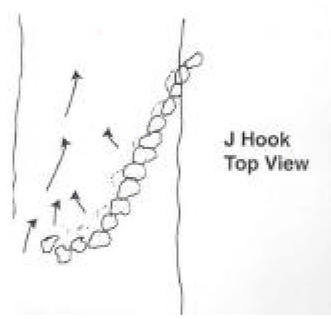
Another fairly new product used in stream restoration projects is fiber logs or coir logs. Filter logs are typically 10 to 20 feet long tubes of woven fiber stuffed with coconut or other fibers. Fiber logs are laid along side a stream to protect the bank toe, after which they fill up with fine sediment and are biodegradable. Different types of vegetation can be planted within the logs to further enhance the project.



Fiber Log

J Hooks/J Vanes

A method that has come into wide use in the past few years is the fluvial geomorphic technique of J hooks or J vanes. These structures are rock vanes that have a hook on the stream end to help center the flow rolling over it. The J hooks help to direct the bankfull flow away from stream banks and provide habitat by creating a scour. With the typical application of J hooks and rock vanes, they are placed on the curves of the stream to control the curvature of the stream flow.

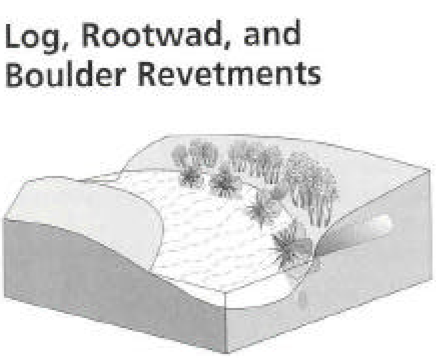


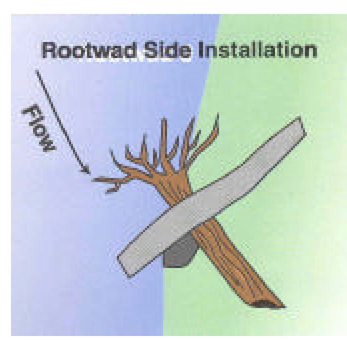
Rock Vanes

Rock vanes are another fluvial geomorphic technique that looks somewhat like a deflector, but does not function like one. Unlike a deflector, a rock vane does not physically block the stream's flow. The slope and shape of the rock vane reduces the velocity of the water as it flows up the vane and accelerates the flow as it rolls water away from the bank towards the center of the stream. The net effect is to protect the bank from erosion and to direct the force of the water into the center of the stream.

Rootwads

Finally, there is the technique of rootwad insertion. This is a bioengineering method that is used to reduce the force or impact of stream energy. Bioengineering is a blend of engineering and biological techniques that include a wide variety of materials, methods and techniques. When changes to the stream bank are integrated with the use of plantings, the term bioengineering can be used. The rootwad is a 20 foot or so length of





tree trunk with the root mass still intact at its base. The trunk is embedded in at trench in the bank and angled upstream with the root mass facing the flow. The rootwad will dissipate the stream's energy and fend off large debris and ice that could harm the bank.

The methods or techniques described in the past few pages are a good example of the technology, past and present, used to deal with the problem of streambank erosion. Not every one of the methods is used in every situation. The method used should fit the particular project site and should be customized to fix each unique problem. The science of streambank erosion restoration is a growing and changing discipline that will continue to progress in effectiveness as more is learned about stream dynamics and restoration techniques.

IV.11.C RECOMMENDATIONS/NEXT STEPS

Sedimentation is the number one non-point source pollutant across the country. It poses many threats including clogging fish gills and covering over fish eggs. Excess sediment also contributes to the destruction of the food supply of many fish species by covering aquatic invertebrate habitat.

Photo showing streambank erosion along Rasler Run

In addition to being 1 of 12 Class A Wild Rainbow Trout Fisheries in the state of Pennsylvania, Rasler Run also supports a small population of naturally reproducing Brook Trout. This species of fish is especially sensitive to sediment pollution so any efforts that can be made to reduce the sediment load entering Rasler Run should be made.

Efforts should include a thorough habitat assessment on its own or as a part of a complete and detailed watershed assessment (please reference Section V – General Recommendations). Areas where streambank erosion is occurring should be identified, mapped and studied as how to repair them. This would include looking for factors within the watershed which may be causing or contributing to the problem.

Marilyn Dugan is the Erosion and Sedimentation Pollution Control Technician for the FCCD. She handles all complaints regarding sedimentation that occur within Fayette County. If anyone notices sediment pollution, they should contact Ms. Dugan at (724) 438-4497 to file a complaint.

The information and photos for the streambank erosion section of the plan was taken from the following sources: A Streambank Stabilization and Management Guide for Pennsylvania Landowners and Stream Corridor Restoration: Principles, Processes, and Practices. For a complete literature citation, please refer to the bibliography section of the plan.

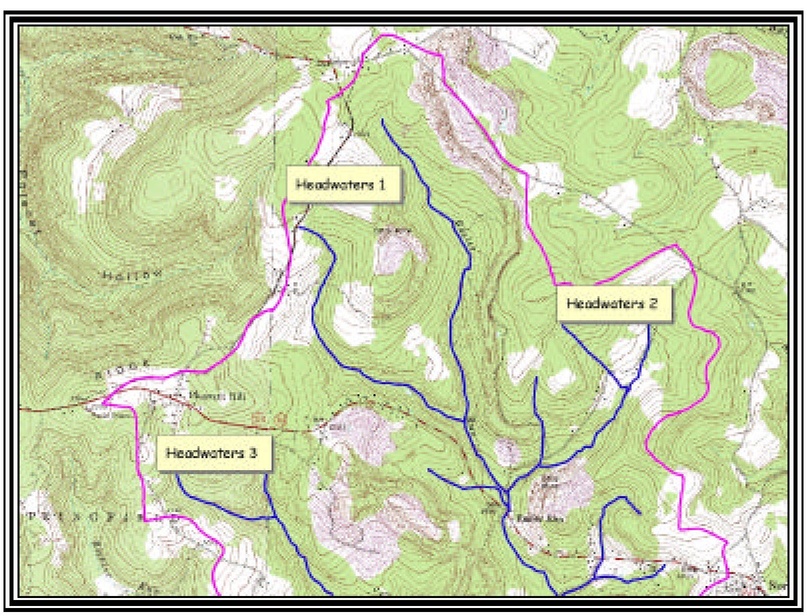
V. GENERAL RECOMMENDATIONS

Presently, there is no source of baseline water quality data for Rasler Run. Therefore, the most significant recommendation we can make with regards to the watershed is to conduct a full watershed assessment. A watershed assessment will establish not only the current condition of the watershed but also detail it's most significant environmental threats while outlining necessary corrective and/or protective measures.

This assessment should include a full 13 months of water quality sampling and the development of a more detailed restoration and/or protection plan. The watershed assessment should test for a broad range of parameters specifically:

- pH
- alkalinity
- sulfates
- iron
- manganese
- aluminum
- hot acidity
- total suspended solids
- dissolved oxygen
- specific conductance
- fecal coliform
- nitrate
- nitrite

Additional parameters may include ammonia nitrogen, phosphorus and kjeldahl nitrogen. Flow measurements should also be taken, especially at any known AMD discharge points, and critical areas should be outlined with regards to problem type(s), location, background, severity of problem, comparison of treatments, potential costs, potential sources of funding, potential partners, etc. The watershed assessment should also include a riparian corridor survey to identify the presence or absence of invasive species as well as existing streambank erosion problems.



Map Showing Identified Headwater Areas

Additional recommendations, which should be considered, include the identification of all headwater streams, specifically ones which could be placed into easements in order to safeguard the source waters of Rasler Run. Each headwaters area should be field visited and assessed. In order to offer a starting point, we have divided the headwaters areas on the adjacent map into three basic areas. We have also attached maps with the most central parcel in the area marked as well as its tax map number and landowner name included (please reference Attachment R – Property Owners & Tax Maps). These central parcels should offer a starting point for field visits as well as landowner identification and contact. Additional parcels and landowners can be found by accessing www.fayetteproperty.org.

Finally, we would like to recommend that an attempt be made to "develop" parcels of land in the watershed for fishing. By "develop", we are referring to providing access to the stream, creating parking areas, providing trash collection facilities during trout season and the identification of prime parcels with landowner names as well as landowner permission.

Currently there are no known efforts to establish stream access along Rasler Run. Organizations that may be interested in executing this type of project could include the FCCD but would likely be received best through local non-profit organizations such as the MWA, the local Trout Unlimited Chapter, etc. In an effort to expedite the process, we have identified 9 potential parcels near the mouth of the stream (please reference Attachment R – Property Owners & Tax Maps).

Table 7: Potential Fish Development Areas

Parcel #	Property Location
35090090	TR806 Hawkins Hollow Road
35090050	TR806 Hawkins Hollow Road
35090092	462 Hawkins Hollow Road
35090049	444 Hawkins Hollow Road
35090036	TR808 Hawkins Hollow Road
35130001	4396 Indian Creek Road
35090096	NR TR806 Hawkins Hollow Road
35090094	TR806 Hawkins Hollow Road
35090095	544 Hawkins Hollow Road

VI. CONCLUSION

The Rasler Run Watershed is an important natural resource not only within Fayette County but also in the state of Pennsylvania. The stream is one of only twelve Class A Wild Rainbow Trout Fisheries in Pennsylvania and one of only five in the southwest region. Rasler Run hosts a naturally reproducing wild Rainbow Trout population as well as a small population of naturally reproducing wild Brook Trout. Both species make this an invaluable coldwater fishery. In fact, only 2% of both number and miles of streams in the state support naturally reproducing Brook, Brown and/or Rainbow Trout.

In addition to the watershed hosting this exceptional coldwater fishery, it is home to six different threatened and/or endangered species of flora and fauna, boasts scenic views of the Indian Creek Gorge and has an established non-profit watershed group working locally; Mountain Watershed Association.

It is the opinion of the FCCD that the Rasler Run Watershed is a highly valuable resource within Fayette County and the state of Pennsylvania. We cannot stress enough the importance of protecting and preserving this watershed. Hopefully by implementing some or all of the recommendations from this plan, we can conserve this coldwater fishery for future generations.