pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Abandoned Mine Reclamation
Acid Mine Drainage Set-Aside Program

Program Implementation Guidelines

Revised Draft – July 15, 2009

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Preface

In December 2006 Congress passed comprehensive legislation reauthorizing the Abandoned Mine Land (AML) Program under Title IV of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The legislation extends federal AML fee collection authority to 2021 at reduced rates but authorizes funding from other sources to compensate for the reductions, and addresses a host of other provisions to the AML program. The new changes in federal law offer the potential of substantial increases in AML funding to states and tribes and sharpens the focus of AML reclamation on projects that benefit public health and safety and the environment. In addition, the law authorized continuation and expansion of the provision commonly known as the Acid Mine Drainage[1] (AMD) Set-Aside, which allows any State with an approved reclamation plan to receive and retain a portion of its annual grant to be expended for the abatement of the causes and the treatment of the effects of acid mine drainage. The provision now permits a maximum of up to thirty percent (30%) of a State's annual grant to be deposited into a set-aside account, an increase from the maximum of up to ten percent (10%) that was previously permitted.

The Pennsylvania Department of Environmental Protection (DEP), in conjunction with the Citizens Advisory Council and the Mining and Reclamation Advisory Board, held ten public town hall meetings in the coal regions of Pennsylvania in May, June and September of 2007. The purpose of the meetings was to receive comments on the revisions brought about by the re-authorization of SMCRA. Many of the comments received dealt with mine drainage issues. DEP then conducted focus group meetings as a second part of its public outreach efforts. The purpose of the focus group meetings was to examine selected issues that are important to the efficient operation of the abandoned mine reclamation program.

Previous to the public outreach effort, U.S. Office of Surface Mining Reclamation and Enforcement (OSM) and DEP began an initiative to evaluate passive treatment systems built with public funds by both government agencies and private entities. The primary purpose of these evaluations was to evaluate the performance (success) of each treatment system; to identify any operational problems; to target systems needing additional troubleshooting or evaluation work; to identify systems needing maintenance or rehabilitation work; to better define appropriate technologies for different classifications of discharges; and to identify applications of technology that may be problematic. In order to continue these evaluations and to address some of the comments received during the town hall meetings, a joint DEP and OSM workgroup was established to develop treatability criteria that would guide expenditures of funds provided under Title IV of SMCRA (the Set-Aside program) for the implementation of mine drainage treatment and/or abatement projects. The main objective of the workgroup is to develop guidelines that ensure the efficient and effective expenditure of AMD Set-Aside Program funding that achieves measurable restoration of watersheds impacted by abandoned coal mine drainage in accordance with the requirements of SMCRA.

The workgroup developed draft guidelines that were presented at a focus group meeting held in State College on June 10, 2008. Fifty-nine stakeholders attended: they represented participation from federal, state and local government; watershed and other environmental advocacy groups;

[1] *(NOTE: The term acid mine drainage (AMD) includes both net alkaline and net acid mine drainage)*

academia; consultants specializing in mine drainage treatment; and the mining industry. DEP accepted written comments until July 14, 2008, and received comments from 22 stakeholders. Many of the comments were in support of the guidelines but included several recommendations for the workgroup to consider. Some of the recommendations DEP has addressed in this version include: an upfront and more direct benefit-cost analysis, the development of an overarching program goal for the Set-Aside Program, application of the guidelines to entire watershed restoration plans instead of individual projects, revisions to the project evaluation and scoring procedures, and collection and review of data on many passive treatment systems constructed by watershed groups.

In order to facilitate the review of data from as many passive treatment systems as possible, DEP undertook a data collection effort beginning in late November 2008. Letters and project information forms were sent to 279 individuals or groups identified in a database developed by OSM of publicly-funded treatment systems. Approximately fifty percent (50%) of the forms were returned along with a great amount of additional data and information including monitoring data, as-built drawings, watershed plans, O&M plans, project photographs, and more. All of the information received was then converted to electronic format and, through a collaborative effort with the Western Pennsylvania Coalition for Abandoned Mine Reclamation, is being uploaded to a website that will provide public access: www.datashed.org.

All the public input and review of data for existing systems were used to develop the revised guidelines that are presented in their final form in this document. The *AMD Set-Aside Program Implementation Guidelines* will serve as the primary method for evaluating newly proposed watershed restoration plans and the abatement or treatment projects identified within these hydrologic units. The guidelines will also be used to evaluate expenditures for Operation, Monitoring, Maintenance and Replacement (O&M) of existing systems. However, the guidelines are not absolute and will not be the basis for every mine drainage project decision. There will also be a transition period where projects previously committed to by DEP will be completed.

Surface Mining Control and Reclamation Act

Language in the Act

Section 403 of the Federal Surface Mining Control and Reclamation Act (SMCRA) establishes the objectives of providing funding to address abandoned mine lands (AML) problems. As amended on December 20, 2006, Section 403(a) establishes three funding priorities: the protection of public health, safety, and property from extreme danger of adverse effects of coal mining practices; the protection of public health and safety from adverse effects of coal mining practices; and the restoration of land and water resources and the environment previously degraded by adverse effects of coal mining practices. It is the third priority, commonly referred to as Priority 3 reclamation, which SMCRA authorizes as the basis for setting the objectives for many of the water quality abatement projects funded under the Pennsylvania AML program.

As established under SMCRA Section 403(a)(3), qualifying project expenditures must provide for “the restoration of land and water resources and the environment previously degraded by

adverse effects of coal mining practices including measures for the conservation and development of soil, water (excluding channelization), woodland, fish and wildlife, recreation resources, and agricultural productivity." The phrase "restoration of land and water resources and the environment" implies that the proposed water abatement or treatment activities must return a water resource to a restored condition in a reliable and predictable manner. In addition, the inclusion of the term "environment" in the statutory language is an indication that, beyond addressing degraded water quality parameters, specific project objectives must also take into account the restoration of associated biological and hydrologic resources affected by the coal mining practices. The importance of achieving restoration beyond simple water quality improvements is further emphasized under Section 403(a)(3) which includes measures for the conservation and development of soil, woodland, fish and wildlife, recreation resources, and agricultural productivity in the definition of Priority 3 activity.

The restoration of water resources consistent with Priority 3 objectives is not only applicable to traditional AML reclamation projects, it is central to achieving the objectives of the AMD Set-Aside Program established under SMCRA 402(g)(6). Section 402(g) (6)(A) allows states to receive and retain up to thirty percent (30%) of annual grants to deposit into an AMD abatement and treatment fund. These amounts can be expended by the State "for the abatement of the causes and the treatment of the effects of AMD in a **comprehensive manner** within qualified hydrologic units affected by coal mining practices." The requirement to determine whether a given hydrologic unit is "qualifying," and then approaching the restoration of the hydrologic unit in a "comprehensive manner" will impact project selection.

Implementation of the AMD Set-Aside Program in Pennsylvania

Overarching Program Goals

The public and other resource agencies involved in stream restoration efforts submitted many valuable ideas to the workgroup. After considering this input, DEP concluded that an important component of the workgroup's effort would be to describe the overall direction of the program by developing overarching goals for the AMD Set-Aside Program. PA Code, Title 25, Environmental Protection, Chapter 93, Water Quality Standards (chapter 93) sets forth water quality standards for surface waters of the Commonwealth. The workgroup has looked to the standards defined in Chapter 93 to help in developing overarching program goals. This approach also aligns with the requirements in Section 403 of SMCRA. However, recognizing that there is not adequate funding to fully restore all AMD impacted streams in Pennsylvania, DEP has decided to use a two-tiered approach that relies on the level of biological restoration that can reasonably be achieved. The goal for the upper tier is to reach full biological attainment for aquatic life uses and remove the targeted stream or stream segment from DEP's Impaired Waters List. (The guidelines and criteria required to delist a stream have been developed by the DEP and can be accessed at the following weblink: http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1261&q=535902 under the Instream Comprehensive Evaluations (ICE) link). The goal for the lower tier will be a lesser level of biological recovery, focusing primarily on the attainment of a recreational fishery where applicable. Attainment will be determined through fish surveys. A more detailed discussion on each tier is presented below.

The upper tier requires a higher level of restoration. Watersheds with minor impairments due to a small number of AMD discharges or AML sites would be reasonable candidates for upper tier restoration goals. Headwater streams with no other sources of impairment are likely to be good candidates. An example of an upper tier watershed is Sterling Run, a tributary to the West Branch Susquehanna River, in Centre County. The single source of AMD to this remote, forested watershed was addressed with a passive treatment system that is operating very effectively. A recent biological survey has determined that macroinvertebrates meet DEP delisting criteria and the stream is supporting a reproducing brook trout population. The DEP has initiated the process to delist Sterling Run from the Impaired Waters List.

For the majority of watersheds, the lower tier is a more reasonable and cost effective goal. This goal will keep restoration costs lower in watersheds where there are many sources of AMD, as well as other conditions that will make full biological attainment extremely difficult. This goal will require improvements in in-stream water quality to a level that allows a diversity of fish and macroinvertebrates. Fish surveys will be used to determine if the goal of a recreational fishery has been met. A good example of a watershed meeting lower tier goals is the Stonycreek River in Somerset and Cambria Counties. Restoration activities have resulted in the establishment of a recreational fishery in over 20 miles of stream that were once too acidic to support life. However, the results of recent macroinvertebrate surveys have indicated that impairment remains and the stream cannot be delisted from DEP's impaired waters lists.

While the goals are appropriate levels of biological recovery, the water quality parameters are provided in order to assure the conditions for the appropriate levels of biological recovery, and in order to provide pollutant removal targets for stream modeling purposes. For upper tier goals, in-stream water quality conditions are expected to be met under all flow conditions. While there may be infrequent exceedances, water quality should be such that full biological recovery is not impaired. For lower tier goals, minor exceedances can be expected during some flow conditions, likely low-flow conditions when there may not be adequate assimilation of AMD discharges. However, the stream is expected to be of a quality that can support a fishery under normal flow conditions, and a diversity of macroinvertebrate life.

DEP and others attempting to restore watersheds must also consider any other sources of impairment in the watershed, both water quality and habitat, in evaluating the likelihood of a stream being able to meet restoration goals. For example, if the targeted stream or stream segment has significant agricultural impairments or has been channelized and has poor habitat value, it may not be possible to meet biological restoration goals. In these situations, there must also be plans in place, and known funding sources, to address the other sources of impairment. Otherwise, the stream may not qualify for Set-Aside funding because it will not be possible to meet restoration goals without addressing the other sources of impairment.

The specific overarching goals are as follows:

Upper Tier - The goal for the targeted stream or stream segment is to be delisted from DEP's Impaired Waters List. The following in-stream contaminant concentrations must be met, with infrequent, minor exceedances that do not adversely impact aquatic life: pH > 6.0,

alkalinity > acidity (unless in a naturally acidic headwater stream with a functioning biological community upstream of impairment), total Fe < 1.5 mg/l, total Al < 0.5 mg/l and TDS < 1,500 mg/l. Macroinvertebrate surveys must be completed to determine that the stream meets DEP delisting criteria (full attainment).

Lower Tier - The goal for the targeted stream or stream segment is to provide for biological restoration, including, where applicable, a recreational fishery. The following in-stream contaminant concentrations must be met during **normal** stream flow conditions: pH > 6.0, alkalinity > acidity (unless in a naturally acidic headwater stream with a functioning biological community upstream of impairment), total Fe < 1.5 mg/l, total Al < 0.5 mg/l and TDS < 1,500 mg/l. Where applicable, fish surveys will be necessary to determine if the recreational fishery criteria have been met. Macroinvertebrate surveys will also be used.

Existing Hydrologic Unit Plans and Development of New Qualified Hydrologic Units

Prior to the 2006 re-authorization, SMCRA required the development of Hydrologic Unit Plans (HUPs) as a condition for the expenditure of funds to restore watersheds. The HUP needed to be reviewed and approved by OSM prior to the expenditure of Set-Aside funds in that watershed. There are currently 26 approved HUPs throughout the Commonwealth (see Appendix A). The re-authorized SMCRA language calls for completing AMD work in a comprehensive manner within "qualified hydrologic units" (QHU) affected by coal mining practices (Section 402(g)(6)(A)). A qualified hydrologic unit means a hydrologic unit - (i) in which the water quality has been significantly affected by AMD from coal mining practices in a manner that adversely impacts biological resources; and (ii) contains land and water that are eligible for SMCRA funding and are the subject of expenditures by the State from either the forfeiture of bonds or other state programs to abate and treat mine drainage (Section 402(g)(6)(A)). The qualified hydrologic unit, or QHU, does not need OSM review and approval. BAMR staff has developed a form to document that a hydrologic unit is “qualified”. The completed form will be maintained in BAMR files and will provide documentation that set-aside expenditures are within QHUs.

Watershed Restoration Plans and/or Proposed Restoration Area

DEP intends to use existing watershed restoration plans to the greatest extent possible when evaluating and scoring watersheds proposed for new QHUs. Most active watershed groups have received funding from Growing Greener and other sources and have completed restoration plans for their watersheds. It may be necessary for DEP staff to supplement the existing plans with additional data collection, and/or to work with the group to further develop their restoration goals and stream modeling. However, the closer the existing plans match the scoring criteria in this document, the better the chances are for having a watershed approved as a QHU.

There may be situations in the future where there is an interest in developing a QHU for a watershed where no restoration planning has been completed. In those situations, DEP staff will work with interested parties to collect the data, develop goals, complete modeling, and ensure

that all other work needed is performed. Responsibilities will be determined on a case-by-case basis in those situations.

Watershed restoration plans that have been or are being developed by watershed groups, as well as restoration plans developed within DEP, must undergo an evaluation and scoring process to first determine whether the project has a benefit-cost ratio greater than 1.0, and second, to determine the "worth" of investing Set-Aside funds in the watershed. The Bureau of Abandoned Mine Reclamation (BAMR) will proceed with documenting that the watershed is within a Qualified Hydrologic Unit as defined by SMCRA if scoring shows a benefit-cost ratio that is greater than one (>1), and that restoring the watershed is of high or exceptional worth to the Commonwealth. (See the discussion under "Evaluation and Scoring of Restoration Plans, D. Restoration Plan Worth Determination" for an explanation of the use of the term "worth" in this document). The requirements outlined in SMCRA are summarized on the DEP's Qualifying Hydrologic Unit Form included in Appendix B. Existing restoration plan(s) will be used and will be amended where needed to document all necessary information. Once a Qualified Hydrologic Unit has been documented, the watershed will be eligible for the expenditure of Title IV AMD Set-Aside funds. BAMR will then proceed to work in conjunction with watershed partners to meet the defined restoration goals.

Operation and Maintenance of Existing Active and Passive Treatment Facilities

Operation and maintenance of treatment systems is a significant concern to both DEP and local watershed groups. The Set-Aside Program is currently the only source of funding for the continued operation of active AMD treatment plants constructed by DEP (see the Prioritization section below). In following current DEP policy, local watershed and volunteer groups, and/or local government, are expected to provide the routine operational needs of passive treatment systems constructed with public funds for watershed restoration. These groups generally look to DEP to fund more expensive maintenance needs. The Set-Aside fund can be looked upon to potentially meet these needs when the passive treatment systems are within approved HUPs or QHUs. Passive treatment systems that are not within approved HUPs or QHUs are not eligible for Set-Aside funding for any purposes. They will only become eligible if the watershed is determined to be of high or exceptional worth when scored by the process described later in this document, and a QHU is developed for the watershed. Those passive treatment systems that are within watersheds that have not been scored, or have been scored and determined to be of low or moderate worth, will not be eligible to receive funds from the Set-Aside program to address O&M needs. Groups will need to identify other sources of funding if major maintenance expenditures are required and determined to be necessary to prevent loss of restored stream miles. One such funding source available to watershed groups for the next few years is the Growing Greener funded Quick Response Program administered by the Western Pennsylvania Coalition for Abandoned Mine Reclamation (WPCAMR). Watershed groups seeking more information about this program should contact WPCAMR or the appropriate District Mining Watershed Manager.

Pennsylvania's AMD Set-Aside Program Priorities

Following from the discussion presented above, DEP has concluded that an appropriate prioritization of Set-Aside funded work is as follows:

1. Operate and maintain active treatment plants constructed by BAMR or operated by or on behalf of BAMR within approved HUPs or QHUs.

2. Evaluate existing HUPs and decide whether goals have been met, what additional work is needed, or whether these watersheds are no longer a priority of DEP. Proceed with completion of projects to accomplish restoration if the hydrologic units are still a DEP priority. Provide for O&M of passive systems already constructed and operating within these HUPs.

   The evaluation of existing HUPs is expected to be complete by the end of 2009. However, the implementation of identified actions and completion of projects will be ongoing and will continue through 2010 and beyond.

3. Develop QHUs, under the re-authorized SMCRA, for watersheds where DEP has already committed to funding projects. For example, staff is currently working on documentation of a QHU for the Upper West Branch Susquehanna River watershed due to commitments with the Susquehanna River Basin Commission (SRBC) to provide treated mine water during low flow periods. This work will also continue into 2010.

4. Develop QHUs that for high and exceptional worth watersheds, in accordance with these guidelines, where there are already restoration plans in place and already treatment systems constructed. The reasons for this are that work has already been done and resources already expended, and there is already an interest in and local support for restoration. In addition, in order for the existing treatment systems to receive future O&M monies from the AMD Set-Aside Program, the systems will need to be in Qualified Hydrologic Units. DEP intends to begin considering these new watersheds sometime in 2010, as BAMR staff resources allow.

5. Develop QHUs for "new" high or exceptional worth watersheds where there has not yet been a significant amount of activity. These new watersheds will not be evaluated to determine their worth until all watersheds with existing treatment systems have been evaluated.

To the extent practicable, BAMR will coordinate with other funding agencies and other watershed partners to complete watershed restoration. Other funding programs or agencies include but are not limited to DEP's Growing Greener and 319 Non-Point source programs, as well as federal agencies such as the Natural Resources Conservation Service (NRCS) and the Army Corp of Engineers (ACOE). Other watershed partners may include entities such as Trout Unlimited (TU), Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR), WPCAMR, the Foundation for PA Watersheds, Susquehanna River Basin Commission (SRBC), Delaware River Basin Commission (DRBC), other state agencies, and others.

Initial Benefit-Cost Analysis

A Benefit-Cost Analysis is often used in project evaluations to determine the benefit of a proposed project compared to its cost. The Initial Benefit-Cost Analysis determines a ratio between the net present values of the benefits to the net present value of the costs of restoring a watershed impacted by AMD. The analysis takes into account all the present and future benefits of restoring a watershed and compares them to the capital and annual O&M costs over time.

Restoration of a watershed can have many benefits. A very important benefit is restoration of aquatic resources, and, in particular, fisheries. As discussed under restoration goals, returning streams to a sustainable fishery is an overarching goal of the AMD Set-Aside Program. After the impacted watershed is restored, it is expected to generate local tax based income to business such as hotels, restaurants, and sporting goods stores. The Pennsylvania Fish and Boat Commission has developed estimates of the economic value that is lost because recreational opportunities are reduced or eliminated on AMD impacted streams throughout the Commonwealth. These values are located in Appendix C, Recreational Use Loss Estimates for PA Streams Degraded by AMD 2006. The tables list the miles of various impacted streams and the estimated Lost Value per year and are the primary basis for estimating the benefit value of a project. The basins used in the table correlate to the Pennsylvania State Water Plan (SWP). More information about the watersheds including an interactive map of the SWP basins can be found at following web address:
http://www.dep.state.pa.us/dep/deputate/watermgt/WC/Subjects/WSNoteBks/shedtable.htm.
When evaluating the length of stream miles being restored, the main stem of the watershed and all significant tributaries that are being restored should be included in the evaluation. If the main stem and the tributaries have different use classifications according to Pennsylvania Code, Title 25, Environmental Protection, Chapter 93, Water Quality Standards, the recreational use loss estimate should be adjusted to reflect those differences.

Other tangible benefits, with known values, can also be included, as applicable. Examples may include expected, calculated savings to municipal or industrial water supplies, the value of providing low-flow consumptive use water to the SRBC, providing increased water tourism on public lands, generating resources that could be used in other industries (resource recovery), generation of energy, increased property values, or the cost savings realized by the application of new or innovative technology. Land restoration projects can also have benefits that improve water quality in streams, provide permanent benefits for wildlife, or provide opportunities for outdoor recreation if on publicly accessible land.

Costs that are associated with restoring an AMD impacted watershed include the capital cost to construct a treatment system or abatement project and the anticipated annual O&M cost. Capital costs include the investments or expenditures necessary to construct a new treatment system or abatement project or fully refurbish/rehabilitate an existing system or facility. Capital costs may also include engineering costs, land access or acquisition costs, legal costs, and permitting fees/costs. O&M costs vary depending on the type of capital project constructed to restore the watershed. Some of these costs may include chemicals for active treatment, management of AMD sludge, or the flushing of passive treatment systems. Costs to be included in this analysis are only those costs being covered by public funding. All privately funded costs are exempt

from this analysis. For example, if a private company is establishing a trust fund to cover O&M costs for an active treatment plant, those O&M costs don't have to be included in the analysis.

In order to calculate the benefit-cost ratio, a net present value of the benefits and costs must be calculated. A watershed will be further analyzed and scored to determine its worth if the benefit-cost ratio is greater than or equal to one.

The net present benefit value of restoring a watershed should be based on a realistic and reasonable project life span and an inflation-adjusted discount rate. For projects involving passive treatment technologies, a 20-year project life would be typical and for large-scale active treatment facilities a 30-year or longer project life would be typical. There are many methods that could be used to develop a capital cost estimate for a project. These could include a detailed engineer's estimate, pertinent cost estimating guides, or cost estimation software. One such software package that is acceptable for developing the capital cost estimate for mine drainage treatment projects is AMDTreat. AMDTreat is available for download at the following web address: http://amd.osmre.gov/.

AMDTreat is a computer application for estimating abatement costs, part of a suite made available through OSM's Technical Innovation and Professional Services (TIPS). AMDTreat can assist a user estimate costs to abate water pollution for a variety of passive and chemical treatment types including vertical flow ponds, anoxic limestone drains, anaerobic wetlands, aerobic wetlands, bio reactors, manganese removal beds, limestone beds, oxic limestone channels, caustic soda, hydrated lime, pebble quicklime, ammonia, oxidation chemicals, and soda ash treatment systems. The AMD abatement cost model provides over 400 user-modifiable variables in modeling costs for treatment facility construction, excavation, revegetation, piping, road construction, land acquisition, system maintenance, labor, water sampling, design, surveying, pumping, sludge removal, chemical consumption, clearing and grubbing, mechanical aeration, and ditching.

AMDTreat also contains several financial and scientific tools to help select and plan treatment systems. These tools include a long-term financial forecasting module, an acidity calculator, a sulfate reduction calculator, a Langelier saturation index calculator, a mass balance calculator, a passive treatment alkalinity calculator, an abiotic homogeneous Fe^{2+} oxidation calculator, a biotic homogeneous Fe^{2+} oxidation calculator, an oxidation tool, and a metric conversion tool.

AMDTreat was developed cooperatively by DEP, the West Virginia Department of Environmental Protection and OSM.

Another resource for completing economic evaluations is the Federal Natural Resource Conservation Service (NRCS) economics website, http://www.economics.nrcs.usda.gov/. This website includes links to updated normalized prices, price indexes, and FY09 Federal Discount Rates. Also, the recently completed "An Economic Analysis for Abandoned Mine Drainage Remediation in the West Branch Susquehanna River Watershed, Pennsylvania" contains a section that focuses on the regional and statewide economic impacts generated from remediation project expenses. The complete report on the West Branch Susquehanna AMD remediation

economic benefit analysis can be found at http://www.wbsrc.org/plansandprojects.html or www.tu.org/westbranch.

The O&M cost value will be evaluated based on the treatment technique. For passive treatment systems, a previous O&M workgroup calculated an estimated annual O&M at four percent (4%) of the project capital costs. Annual O&M for active treatment projects should be estimated based on anticipated labor needs, chemical consumption requirements, power consumption, sludge management, etc.

In some instances treatment systems may be currently treating mine discharges within a watershed. In these cases only the annual O&M costs will be taken into consideration for calculating the net present value. The cost value will be calculated by using documented or anticipated O&M costs and discounting those costs to a net present value. The net present value will be calculated by using standard engineering economic practices.

All net present value project benefits within a watershed will be summed and divided by the sum of all net present values costs for the projects in the watershed yielding a Benefit-Cost Ratio for the watershed. The watershed may be further analyzed and scored if the ratio is greater than or equal to one (i.e.: benefits/costs > 1.0).

Benefit-Cost Analysis Example No. 1
(For a watershed being restored using passive treatment technology)

The Monastery Run Watershed, located in Unity Township, Westmoreland County in State Water Plan Basin 18-C, is impacted by three (3) AMD discharges within its Fourmile Run tributary. The discharges are to be treated with three aerobic wetlands simply identified as Wetland #1, Wetland #2, and Wetland #3. To determine the value of the benefits of restoring this watershed, the following information was obtained from the Appendix C Recreational Use Loss Estimates for PA Stream Degraded by AMD 2006.

Fourmile Run
State Water Plan: 18-C
Miles impaired: 2
Projected Use: Trout Stocked Fishery (TSF)
Use Rate: 1,100 trips/year
Valuation: $67.26/trip
Lost Value: 2 miles x 1,100 trip/year/mile x $67.26 trip = $147,972 per year.

The capital costs for treating the discharges are as follows:

Wetland #1	: $494,423
Wetland #2	: $162,000
Wetland #3	: $220,000
Total Capital cost	: $876,423

For this example, the capital costs shown are the actual capital costs that were incurred to construct the three passive mine drainage treatment systems and are assumed to be the present value capital costs.

The estimated annual O&M costs for the passive system are:

Using the previously discussed O&M Workgroup factor for estimating O&M of 4%, the estimated annual O&M costs would be as follows:

$876,423 x 0.04 = $35,057 per year.

Benefits:

The net present value (NPV) of the benefits can be calculated using the uniform series present worth equation:

$$NPV = A[\{(1+i)^n-1\}/ (i(1+i)^n)]$$

where A = annual calculated benefit or cost
i = inflation adjusted discount rate (compounded annually)
n = project life span
$[\{(1+i)^n-1\}/ (i(1+i)^n)]$ = uniform series present worth factor (USPWF)

Note: The uniform series present worth factor for a five percent (5%) inflation-adjusted discounted rate, compounded annually for 20 years is 12.4622.

A table with uniform series present worth factors for various interest rates and time periods is included in Appendix D.

The annual economic lost value of Fourmile Run is the basis of the project's NPV benefit evaluation. The lost value of Fourmile Run was identified above as $147,972 per year. The following parameters are applied to the NPV equation:

n = 20 years
I = 5 %
USPWF = 12.4622

Net Present Benefit Value = $147,972 x 12.4622 = $1,844,057

Costs:

The NPV of the costs are the capital costs of the project and the annual O&M costs.

Capital costs: The NPV of the capital costs
Wetland #1 : $494,423
Wetland #2 : $162,000
Wetland #3 : $220,000
Total Capital cost : $876,423

Note: Total capital cost = NPV capital cost

Annual O&M: The estimated annual O&M costs for the passive system is: $876,423 x 0.04 = $35,057 per year. The following parameters are applied to the NPV equation:

n = 20 years
I = 5 %
USPWF = 12.4622

Therefore, the project's NPV cost = NPV capital cost + NPV of the O&M
= $876,423 + ($35,057 per year x 12.4622)
= $876,423 + $436,887
= $1,313,310

Benefit-Cost Ratio:

Benefit-Cost Ratio = Total Benefit Value / Total Cost Value
= $1,844,057/$1,313,310 = 1.40
1.40 > 1.0 (Since the benefits outweigh the costs, watershed is okay to score)

Benefit-Cost Analysis Example No. 2
(For a watershed being restored using active chemical treatment technology)

The upper Bennett Branch Watershed, located primarily in Huston Township, Clearfield County and Jay Township, Elk County in State Water Plan Basin 8-A, is impacted by twenty-one (21) AMD discharges. These discharges degrade approximately 10.0 miles of the main stem of Bennett Branch, 1.6 miles of Mill Run, 1.2 miles of Tyler Reservoir Run, 0.2 miles of Fridays Run, 0.9 miles of Tyler Run, and 0.8 miles of Wasko Run. The discharges are all to be collected and conveyed to a centralized active chemical treatment plant to be located near the Village of Hollywood where they will be treated using a dense sludge, hydrated lime treatment process. To determine the value of the benefits of restoring this portion of the watershed, the following information was obtained from the Appendix C Recreational Use Loss Estimates for PA Stream Degraded by AMD 2006 and Chapter 93, Water Quality Standards of the DEP's regulations.

Bennett Branch
State Water Plan: 8-A
Miles impaired: 10.0 (Stream miles from mouth of Mill Run to mouth of Caledonia Run)
(Note: Significant benefits are expected below Caledonia Run within Bennett Branch but are not accounted for in this sample analysis)
Projected Use: Trout Stocked Fishery (TSF)
Use Rate: 1,100 trips per year
Valuation: $67.26 per trip
Lost Value: 10.0 miles x 1,100 trip/year/mile x $67.26 trip = $739,860 per year

Mill Run, Tyler Reservoir Run, Fridays Run, Tyler Run, and Wasko Run

Miles impaired: 4.7
Chapter 93 Designation: Cold Water Fishery (CWF)
Assumed Projected Use: Trout Stocked Fishery (TSF)
(Note: These tributaries are not included in the PFBC Recreational Use Loss Estimate Tables)
Use Rate: 1,100 trips per year
Valuation: $67.26 per trip
Lost Value: 4.7 miles x 1,100 trip/year/mile x $67.26 trip = $347,734 per year

Total Lost Value: $1,087,594 per year

The capital costs for treating the discharges are as follows:

Collection and Conveyance:	$ 3,800,000
Treatment Facility:	$ 8,200,000
Total Capital Cost:	$12,000,000

For this example, the capital costs shown are the estimated capital costs that were determined by the project design firm and are assumed to be the present value capital costs.

The estimated annual O&M costs for the passive system are:

The estimated annual O&M costs as determined by the project design firm are $360,000 per year and the estimated useful life of the treatment plant is 40 years.

Benefits:

As in the previous example, the net present value (NPV) of the benefits can be calculated using the uniform series, present worth equation or values extracted from the uniform series present worth value table.

The annual economic lost value of the upper Bennett Branch and tributaries is the basis of the project's NPV benefit evaluation. The lost value of Bennett Branch and tributaries was identified above as $1,087,594 per year. The following parameters are applied to the NPV equation:

n = 40 years
i = 5 %
USPWF = 17.159086

Net Present Benefit Value = $1,087,594 x 17.159086 = $18,662,119

Costs:

The NPV of the costs is determined by adding the capital cost of the treatment plant and the present value of the annual O&M costs over the 40 year life of the facility.

Capital costs: The NPV of the capital costs

Collection and Conveyance:	$ 3,800,000
Treatment Facility:	$ 8,200,000
Total Capital Cost:	$12,000,000

Note: Total capital cost = NPV capital cost

Annual O&M: The estimated annual O&M cost for the treatment plant is $360,000 per year. The following parameters are applied to the NPV equation:

n = 40 years
i = 5 %
USPWF = 17.159086

Therefore, the project's NPV cost = NPV capital cost + NPV of the O&M
= $12,000,000 + ($360,000 per year x 17.159086)
= $12,000,000 + $6,177,271
= $18,177,271

Benefit-Cost Ratio:

Benefit-Cost Ratio = Total Benefit Value / Total Cost Value
= $18,662,119/$18,177,271
= 1.03
1.03 > 1.0 (Since the benefits outweigh the costs, watershed is okay to score)

Evaluation and Scoring of Restoration Plans

A. Scoring the Hydrologic Unit Restoration Plan and Projects within the Plan

1. Local Support

Local support of watershed restoration is very important to overall success. Support by local government, environmental groups and businesses will be necessary to determine the goals, develop a good plan, implement the plan and ensure long-term viability of treatment systems. The ability of these local entities to provide this support will be evaluated largely by the abilities they have already shown in the above areas. In addition, regional or national entities such as Trout Unlimited (TU) and the Susquehanna and Delaware River Basin Commissions are also working on stream restoration and provide needed support. This support will also be considered in the scoring process. Input from other support groups such as the Eastern and Western Pennsylvania Coalitions for Abandoned Mine Reclamation and the Foundation for Pennsylvania Watersheds will also be

solicited and considered in the evaluation of the strength and viability of local grassroots groups.

2. Background Data

The data obtained in this section considers information relating to a restoration plan that describes the watershed, identifies the problem, and explains the project goal(s). A guide for developing restoration plans can be found on DEP's website http://www.depweb.state.pa.us/abandonedminerec/cwp/view.asp?a=1466&q=457803 .

Background data must be comprehensive enough to be able to clearly define the mine drainage and/or abatement problem and consequently the project goal(s). A determination must be made of what mine drainage restoration and/or abatement is needed so that adequate and applicable background data can be obtained.

A very important aspect of a restoration plan is an evaluation of stream contaminant levels and loadings, and a determination of the reductions needed to meet restoration goals. In addition, loadings from proposed projects sites must be determined in order to prioritize projects and determine appropriate abatement/treatment methodologies.

A project site assessment is paramount in collecting background data and should include basic site characteristics such as flow measurements, water samples, soil and/or refuse analysis, test borings, archeological and historical resources, and documented property ownership consent. Flow measurements must be collected using scientifically-based methods such as weirs, bucket and stop watch, current velocity meters, or continuous flow recorders. If available, continuous flow recorders are recommended. Measurements shall be collected over time durations that adequately define base flow and peak flow conditions. For example, if only two samples are collected and one happens to be taken after a rain event, then the rain event sample would not adequately define a peak flow measurement. Statistical summaries of flow measurements should include the minimum, maximum, median, and n-percentile values.

Water samples should be collected at the same time flow measurements are made. Samples should be collected, preserved, and analyzed in accordance with "Standards Methods for the Examination of Water and Wastewater" and/or "U.S. Geological Survey Protocol for Collection and Processing of Surface-Water Samples for the Subsequent Report 94-539." Minimum parameters to sample for should include: field pH, lab pH, total alkalinity (as $CaCO_3$ eq.), net acidity (as $CaCO_3$ eq.), total iron, aluminum, manganese, and sulfate.

Restoration plans should include the results of biological surveys to document the existence and extent of impairment. Surveys should follow standard, published protocols.

See http://www.depweb.state.pa.us/watersupply/lib/watersupply/PCice.pdf for DEP's current protocols.

Abatement-related projects such as coal refuse projects should include additional parameters such as total suspended solids and heavy metals for upstream and downstream points in order to evaluate the existing negative impacts and expected post-construction results. The collection of coal refuse samples is recommended: collection data should be descriptive enough to determine potential recoverable fuel value.

Abatement projects related to rerouting streams from abandoned deep mine openings or abandoned highwall pits should include upstream flow measurements and water quality data in addition to any associated down dip mine discharges.

3. Restoration Goals

The objective or goal of any AMD-related project is to restore land and/or water resources degraded by past mining activities. However, to successfully evaluate and prioritize numerous projects, a well-defined, measurable and comprehensive project treatment or restoration goal must be established. It is important that the restoration goals are well defined, measurable, reasonable, achievable, and permanent. The technological analysis scoring criteria focus on evaluating the likelihood that the proposed plan will consistently achieve the restoration goals by accurately predicting the water quality of the effluent.

The restoration goals need to be practical, tangible, and easily measured to facilitate an evaluation of whether treatment or restoration is being achieved after project implementation. A broad or vague restoration goal such as, "The goal of the project is to restore Laurel Run" is not acceptable as it does not provide a defined and tangible attribute that can be used to evaluate if restoration is being achieved.

While restoration goals will be specific to the watershed under consideration, they must also result in meeting either the Upper Tier or Lower Tier overarching goals as defined previously (see "Overarching Program Goals" section). This includes biological restoration, including a recreational fishery where applicable, or full biological attainment, whichever is appropriate and reasonable for that particular watershed.

Examples of well defined and measurable restoration goals include, but are not limited to, the following: (1) a numerically-based water quality based in-stream standard; (2) a biologically-based goal assigned to a specific stream reach using accepted biological indices; (3) a goal developed to restore a specific section of stream to a designated use; (4) a thermally-based standard to protect a cold-water fishery while eliminating the effects of AMD; or (5) a hydrology resource

restoration goal considering abatement or reduction of a discharge or pollution source. Watershed groups and other planners who are determining goals must keep in mind the overarching goals presented in this document. Local goals that closely support the appropriate overarching goal will be scored favorably.

4. Technological and Alternative Analysis for Individual Projects

a. Technological Analysis

Hydrologic units are likely to have a restoration strategy that includes numerous treatment systems and/or abatement techniques. The treatment systems or abatement strategies are likely to fit into one of six categories: (1) Active Treatment; (2) Passive Treatment of Net Alkaline discharges; (3) Passive Treatment of Net Acidic discharges using Anoxic Limestone Drain technology (total Al < 1.0 mg/l, total Fe^{3+} < 1.0 mg/l, and Dissolved Oxygen < 1.0 mg/l.), (4) All other types of Passive Treatment for Net Acidic discharges, (5) Innovative Technology, and (6) Abatement projects. It is difficult to develop a fully inclusive definition of passive treatment technology. However, passive treatment is typically not a treatment system that: (1) requires electrical or mechanical power; (2) requires frequent site visits to ensure successful operation; (3) requires frequent replenishment of chemical reagent, or (4) contains a chemical feed system. Passive treatment may include impoundments, structures, or other containers of alkalinity-producing treatment media. Passive treatment may also include manual, solar-operated, electrically-operated, or siphon-operated flushing or draining systems.

A technological, operational, and maintenance evaluation will be conducted on all treatment and/or abatement projects within the hydrologic unit to ensure the proposed project will achieve and maintain restoration. The technological evaluation focuses on evaluating whether the combination of the treatment/abatement scenario and the proposed technology is proven to provide consistent treatment. The operational evaluation focuses on evaluating all aspects of system operation, including the ease of operation and reliability of the system to consistently achieve the treatment goal. The maintenance evaluation focuses on evaluating all aspects of system maintenance, including the ability to maintenance the treatment system while still being able to achieve the treatment goal. Except for category (4), the overall score for an individual treatment project is the summation of the scores for the three evaluations.

Projects that fall within category (4), "All other types of Passive Treatment for Net Acidic discharges," will have the final score adjusted by applying the treatment risk analysis matrix (*see "Table 1" at end of this section*) to the proposed project. The overall technological analysis score

for a hydrologic unit is calculated by averaging all of the individual project scores. Passive treatment technologies designed to treat net acidic water in this category are subject to an additional evaluation since they do not afford the complete operational control mechanisms required to consistently achieve a defined treatment goal and because of the treatment performance of existing treatment systems. While some of these passive treatment systems have successfully treated to net alkaline conditions for over a decade, many systems have been plagued with treatment performance issues due to premature plugging, short-circuiting, and other causes. It appears that many of the performance issues are caused by metal hydroxide precipitate plugging the treatment matrix or from short circuiting, which may have been caused by plugging, design flaws, or construction issues. Some of the design and construction issues can be resolved by diligent construction oversight or by improved treatment technology. Attempts have been made to combat plugging caused by the precipitation of metal precipitates by incorporating flushing mechanisms or by routine mechanical agitation. Even with installed flushing mechanisms many systems still provide poor treatment or are prone to premature plugging. If metal precipitate plugging is causing performance issues with passive treatment on net acidic discharges, a reasonable approach is to promote passive treatment on low metal loading discharges. While placing a passive treatment system on a low loading discharge does not automatically guarantee successful treatment, the risk of having a premature plugging problem should be reduced.

A risk analysis matrix (*see "Table 1" at end of this section)* was developed as a way to limit the risk of premature passive treatment failure. The risk matrix is only used to adjust the overall treatability score of systems categorized as "passive treatment systems designed to treat net acidic discharges" (category 4). The matrix is not used to adjust the score of the other five treatment categories. The risk analysis matrix uses the design flow rate and chemistry for each treatment cell to assign a risk designation for the proposed system. The three risk designations are "Low", "Medium", and "High". The companion scoring sheet for this section uses the risk designation to adjust the treatability score. The risk analysis matrix is based on an evaluation of the treatment performance of fifty-four (54) limestone-based passive treatment systems that are treating net acidic mine drainage. A database that contains information on all publicly-funded passive treatment systems in Pennsylvania was used to create a list of systems that have been in operation for at least five (5) years. An evaluation team reviewed the latest performance data to determine if system discharges net acidic water, net alkaline water, or both types of water. The evaluation showed that all of the systems that were within the risk designation of "Low" produced net alkaline water after at least five years of operation and oldest treatment system has produced net alkaline water for eleven (11) years. The evaluation revealed the systems

within the category of "Medium" risk contained both net alkaline and net acidic treatment performance, however overall there were ~ 50% more alkaline sites than acidic sites. The evaluation showed that systems within the "High" risk category contained more systems that discharged net acidic water than net alkaline water. The risk matrix will act as a starting point for project selection and will be periodically reviewed and refined to reflect the treatment performance of systems built under these criteria using Set-Aside money.

Table 1 – Risk Analysis Matrix for Category (4) Passive Treatment Systems

Risk Analysis Matrix				
Summation of Fe and Al Concentration	Design Flow Rate for each treatment cell			
	< 25 gpm	≥ 25 < 50 gpm	≥ 50 < 100 gpm	≥ 100 < 200 gpm
< 5 mg/L	Low	Low	Low	Low
≥ 5 but < 15 mg/L	Low	Medium	Medium	Medium
≥ 15 < 25 mg/L	Low	Medium	Medium	Medium
≥ 25 < 50 mg/L	Medium	Medium	Medium	High
≥ 50 mg/L	High	High	High	High
Summation of Fe and Al Concentration	Design Flow Rate for each treatment cell			
	≥ 200 < 400 gpm	≥ 400 < 800 gpm	≥ 800 < 1600 gpm	≥ 1600 gpm
< 5 mg/L	Medium	Medium	Medium	High
≥ 5 but < 15 mg/L	Medium	High	High	High
≥ 15 < 25 mg/L	High	High	High	High
≥ 25 < 50 mg/L	High	High	High	High
≥ 50 mg/L	High	High	High	High

b. Alternatives Analysis

An alternative analysis must be completed for all proposed passive mine drainage treatment projects or mine drainage abatement projects with estimated capital costs in excess of $250,000. At a minimum, an assessment of at least one technologically appropriate passive treatment method and one appropriate active treatment method must be compared. For proposed abatement projects, at least one appropriate treatment option (active or passive) should be evaluated to demonstrate the proposed abatement project is cost effective. Both the initial capital cost and the required ongoing O&M costs should be determined for each alternative and compared on a common basis. The AMDTreat software is an acceptable tool for use in completing an alternatives analysis. New or innovative technologies or treatment processes can be evaluated; however, the new or innovative technology must be explained in detail.

The alternatives analysis should also include a discussion of potential treatment system operational issues or failures, the short and long-term

implications of a failure and what, if any, contingency plans could be developed to maintain the project goals and benefits in the event of an interruption or decline in performance of the treatment facility or system.

Finally, it is possible that some project sites do not lend themselves to more than one treatment alternative. For such sites, even if the cost is in excess of $250,000, no alternative analysis needs to be completed. However, the reason(s) for not completing the alternatives analysis should be adequately explained and documented.

c. Other Considerations

There are many other factors to be considered in evaluating the individual treatment/abatement plans for the discharges and sites of concern. These are factors that can stop a good project and prevent full implementation of the restoration plan. They include land availability and ownership issues, permitting issues, site geotechnical issues, and local resistance. The extent to which these issues have been addressed will be considered in scoring the restoration plan.

B. Scoring the Benefits of Implementing the Restoration Plan

1. Stream Miles Restored and Other Water Resource Benefits

Restoration of a watershed can have many benefits. A very important benefit is restoration of aquatic resources, and, in particular, fisheries. As discussed under the "Restoration Goals" section, returning streams to a sustainable fishery is an overarching goal of the AMD Set-Aside Program. As such, the number of miles of restored stream and the type of fishery restored carry significant weight in the scoring. Restoring water supplies and improving water-based recreational/tourism opportunities is also very important. Other benefits are less directly tangible and are discussed in the next section.

2. Other Benefits

This section covers items that would not normally fall into any of the previous sections; however, these items could have a positive or negative impact to the project selection. Other benefits may include resource recovery, energy generation, elimination of health and safety hazards, creation of new or improved recreational opportunities, or demonstration of new or innovative technology. This list is not inclusive and other benefits not listed will be considered.

C. Scoring the Costs

1. Capital Costs

Capital Costs include the investments or expenditures necessary to construct/install a new treatment system or facility, or fully refurbish/rehabilitate an existing system or facility. Capital costs may also include engineering costs, land access or acquisition costs, legal costs, and permitting fees/costs.

The evaluation of project capital costs includes only the capital cost to construct the mine drainage treatment system of facility. Ongoing costs such as O&M or the future cost of replacing the system or facility will be evaluated under the "O&M" Section. There are many methods that could be used to develop a cost estimate for a project. Methods include a detailed engineer's estimate, pertinent cost estimating guides, or cost estimation software.

2. Non-Title IV Match Money and Projects Completed by Others

Most mine drainage treatment systems are expensive to construct. Even though SMCRA authorizes states to use up to thirty percent (30%) of annual AML grant monies for mine water treatment, the potential maximum available funding falls far short of the amount needed to address all of the existing mine drainage problems in Pennsylvania. Additional funds from other sources can assist with the construction of mine drainage treatment systems and other projects needed to restore watersheds. Additional funds can be obtained from various sources; however, funding can be divided into two general categories: public match money and private match money. Public match money consists of additional funds that typically come from other governmental agencies. Private match money is generally from corporations, individuals, or non-profit groups that are not associated with any governmental agency. Match money from either public or private sources is usually provided at the beginning of a project and is applied to the initial or capital cost of the project. Match money demonstrates that there are other partners committed to restoring a watershed and allows Set-Aside money to fund work in a greater number of watersheds. As such, the availability of matching funds will be evaluated and scored.

In addition to match money, there are currently many watersheds where treatment systems have already been constructed using non-Title IV money. EPA 319 and PA's Growing Greener programs, as well as several smaller funding sources, have funded construction of numerous projects in watersheds across the Commonwealth. Certainly, there is a benefit in reduced costs to the Title IV program when working in Hydrologic Units where significant construction has already been funded. The scoring process will also reflect this benefit.

3. Operation, Monitoring, Maintenance and Replacement (O & M) Requirements and Costs

The treatment of AMD discharges, either passively or actively, requires that operational needs be addressed. O&M includes the activities and funding needed to provide for routine monitoring, routine operations, planned maintenance, unplanned minor and significant repairs, and the eventual one-time replacement of components of the system that must be replaced or replenished (for example, electric pumps or compost and lime). The level to which the O & M activities and funding are addressed by sources other than Title IV and other government funding is evaluated during scoring. Projects that do not depend upon government for day-to-day operation and funding of long-term OMR will be scored more favorably. This is especially the case with active treatment plants. Projects that abate or partially or entirely eliminate a discharge will be scored higher in this category since these types of projects will not have long-term needs.

D. Restoration Plan Worth Determination

Once a project has been completely evaluated and scored using all of the project selection criteria, a project worth can be assigned. The table included in Appendix E defines the relationship of a project's score to the overall project worth. Projects will fall into one of four worth categories, "Low Worth", "Moderate Worth", "High Worth", or "Exceptional Worth". **In most cases, DEP will not consider funding mine drainage projects in watersheds that are not determined to have either "High Worth" or "Exceptional Worth".**

Transitioning to the New "Acid Mine Drainage Set-Aside Program Implementation Guidelines"

The Mine Drainage Implementation Guidelines will be the primary method used to evaluate and select watersheds for mine drainage treatment or abatement projects using SMCRA Title IV funding. However, the guidelines are not absolute and will not be the basis for every mine drainage project decision. There will also be a transition period where projects that DEP has already committed to will be completed or re-evaluated. This includes several Hydrologic Unit Plans (HUPs) that were approved by OSM under Set-Aside criteria in place prior to re-authorization and several Qualifying Hydrologic Units currently in development.

APPENDICES

APPENDIX A

Map of Existing Approved Hydrologic Units within Pennsylvania

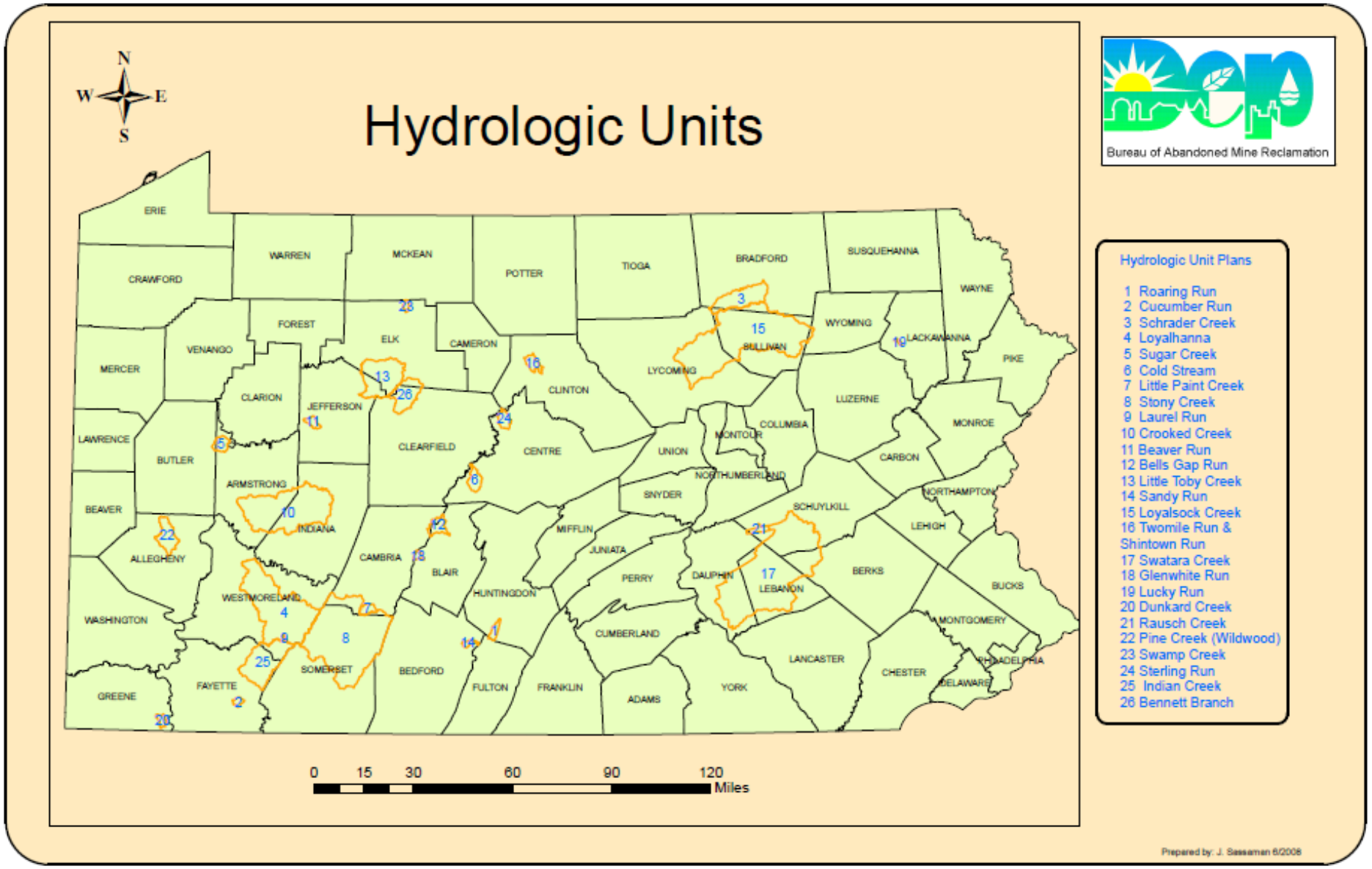

Figure – Map of Existing Approved Hydrologic Unit Plans within Pennsylvania

APPENDIX B

Qualifying Hydrologic Unit Form

Qualifying Hydrologic Unit Form

Watershed:_____ **Submitted by:** _____

HUC Code:_____ **Scored by:**_____

Questions:

Have abandoned mine drainage/abandoned mine lands significantly impacted biological resources in the receiving stream? ☐ Yes or ☐ No

Does the watershed contain land and water that are eligible for Title IV funding (abandoned prior to August 3, 1977? ☐ Yes or ☐ No

Does the watershed contain land and water that are the subject of expenditures by the State from the forfeiture of bonds or from other State sources to abate and treat abandoned mine drainage? ☐ Yes or ☐ No

The above questions must be answered affirmatively before continuing with scoring.

APPENDIX C

Recreational Use Loss Estimates for PA Streams Degraded by AMD 2006

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
SANDY RUN	02-A	MINING-AB	pH-METALS	0.1	WT	500	$56.95	$2,847.50
POND CREEK	02-A	MINING-AB	pH	7	WT	500	$56.95	$199,325.00
SANDY RUN (UNT)	02-A	MINING-AB	pH-METALS-SULFATES	0.4	WT	500	$56.95	$11,390.00
NESSQUEHONING CREEK	02-B	MINING-AB	pH	1.7	TSF	1100	$67.26	$125,776
NESSQUEHONING CREEK	02-B	MINING-AB	pH-METALS	4.3	TSF	1100	$67.26	$318,140
BLACK CREEK	02-B	MINING-AB	pH-METALS	4.7	WT	500	$56.95	$133,832.50
HAZEL CREEK	02-B	MINING-AB	pH-METALS	1.9	WT	500	$56.95	$54,102.50
BUCK MOUNTAIN CREEK	02-B	MINING-AB	pH-METALS	4.4	WT	500	$56.95	$125,290.00
LEHIGH RIVER	02-C	MINING-AB	METALS	30.2	TSF/WT	800	$67.26	$1,625,002
SAUCON CREEK (SOUTH BRANCH)	02-C	MINING-AB	OTHER	1	TSF/WT	800	$67.26	$53,808
LITTLE SCHUYLKILL RIVER	03-A	MINING-AB	pH-METALS	25.7	TSF	1100	$67.26	$1,901,440
MILL CREEK	03-A	MINING-AB	pH-METALS	5.5	TSF	1100	$67.26	$406,923
PANTHER CREEK	03-A	MINING-AB	pH-METALS	5.7	WT	500	$56.95	$162,307.50
SCHUYLKILL RIVER	03-A	MINING-AB	pH-METALS	31.7	WWF	306	$50.53	$490,151.11
WEST BRANCH SCHUYLKILL RIVER	03-A	MINING-AB	pH-METALS	9	WWF	306	$50.53	$139,159.62
TIOGA RIVER	04-A	MINING-AT	pH-METALS	4	TSF	1100	$67.26	$295,944
MORRIS RUN	04-A	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
FALL BROOK	04-A	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
TIOGA RIVER	04-A	MINING-AB	pH-METALS	1	WWF	306	$50.53	$15,462.18
SCHRADER CREEK	04-C	MINING-AB	pH-METALS	9	TSF	1100	$67.26	$665,874
LONG VALLEY RUN	04-C	MINING-AB	pH-METALS	1.6	WT	500	$56.95	$45,560.00
ROARING BROOK	05-A	MINING-AB	pH-METALS	4	WT	500	$56.95	$113,900.00
POWDERLY CREEK	05-A	MINING-AB	pH-METALS	1.9	WT	500	$56.95	$54,102.50
COAL BROOK	05-A	MINING-AB	pH-METALS	1.9	WT	500	$56.95	$54,102.50
WILSON CREEK	05-A	MINING-AB	pH-METALS	0.6	WT	500	$56.95	$17,085.00
LACKAWANNA RIVER	05-A	MINING-AB	pH-METALS	2.6	WWF	306	$50.53	$40,201.67
NEWPORT CREEK	05-B	MINING-AB	pH	4.8	WT	500	$56.95	$136,680.00
NANTICOKE CREEK	05-B	MINING-AB	pH	3.6	WT	500	$56.95	$102,510.00
SOLOMON CREEK	05-B	MINING-AB	pH	2.4	WT	500	$56.95	$68,340.00
SUSQUEHANNA RIVER	05-B	MINING-AB	pH-METALS	20	WWF	306	$50.53	$309,243.60
BLACK CREEK	05-D	MINING-AB	pH-METALS	25.5	WT	500	$56.95	$726,112.50
LITTLE NESCOPECK CREEK	05-D	MINING-AB	pH	9.2	WT	500	$56.95	$261,970.00
LITTLE NESCOPECK CREEK	05-D	MINING-AB	pH-METALS	5.5	WT	500	$56.95	$156,612.50

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
LITTLE NESCOPECK CREEK (UNT)	05-D	MINING-AB	pH-METALS-SULFATES	0.3	WT	500	$56.95	$8,542.50
CATAWISSA CREEK	05-E	MINING-AB	pH-METALS	14	TSF	1100	$67.26	$1,035,804
CATAWISSA CREEK	05-E	MINING-AB	pH-METALS	4	TSF	1100	$67.26	$295,944
TOMHICKON CREEK	05-E	MINING-AB	pH	6.3	TSF	1100	$67.26	$466,112
CATAWISSA CREEK	05-E	MINING-AB	pH-METALS	23.5	WT	500	$56.95	$669,162.50
TOMHICKON CREEK	05-E	MINING-AB	pH	4.3	WT	500	$56.95	$122,442.50
SUGARLOAF CREEK	05-E	MINING-AB	pH	5.5	WT	500	$56.95	$156,612.50
MAHANOY CREEK	06-B	MINING-AB	pH-METALS	26.8	TSF	1100	$67.26	$1,982,825
MAHANOY CREEK	06-B	MINING-AB	pH-METALS	25.4	TSF	1100	$67.26	$1,879,244
NORTH MAHANOY CREEK	06-B	MINING-AB	pH-METALS	5.5	TSF	1100	$67.26	$406,923
SHAMOKIN CREEK	06-B	MINING-AB	pH-METALS	34.7	TSF	1100	$67.26	$2,567,314
ZERBE RUN	06-B	MINING-AB	pH-METALS	5.8	WT	500	$56.95	$165,155.00
CRAB RUN	06-B	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
SHENANDOAH CREEK	06-B	MINING-AB	pH-METALS	5	WT	500	$56.95	$142,375.00
CARBON RUN	06-B	MINING-AB	pH-METALS	3.7	WT	500	$56.95	$105,357.50
COAL RUN	06-B	MINING-AB	pH-METALS	3	WT	500	$56.95	$85,425.00
QUAKER RUN	06-B	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
LOCUST CREEK	06-B	MINING-AB	pH-METALS	1.6	WT	500	$56.95	$45,560.00
NORTH BRANCH SHAMOKIN CREEK	06-B	MINING-AB	pH-METALS	4.6	WT	500	$56.95	$130,985.00
WICONISCO CREEK	06-C	MINING-AB	pH-METALS	3.2	TSF	1100	$67.26	$236,755
WICONISCO CREEK	06-C	MINING-AB	pH-METALS	13.5	TSF	1100	$67.26	$998,811
RATTLING CREEK	06-C	MINING-AB	pH-METALS	2.2	TSF	1100	$67.26	$162,769
WEST BRANCH RATTLING CREEK	06-C	MINING-AB	pH-METALS	5.2	TSF	1100	$67.26	$384,727
EAST BRANCH RATTLING CREEK	06-C	MINING-AB	pH-METALS	3.8	TSF	1100	$67.26	$281,147
RAUSCH CREEK	06-C	MINING-AB	pH-METALS	1.7	TSF	1100	$67.26	$125,776
WEST BRANCH RAUSCH CREEK	06-C	MINING-AB	pH-METALS	3.5	TSF	1100	$67.26	$258,951
EAST BRANCH RAUSCH CREEK	06-C	MINING-AB	pH-METALS	1.9	TSF	1100	$67.26	$140,573
DOC SMITH RUN	06-C	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
SHALE RUN	06-C	MINING-AB	pH-METALS	0.8	WT	500	$56.95	$22,780.00
STONE CABIN RUN	06-C	MINING-AB	pH-METALS	1.8	WT	500	$56.95	$51,255.00
NINE O'CLOCK RUN	06-C	MINING-AB	pH-METALS	0.6	WT	500	$56.95	$17,085.00
BEAR CREEK	06-C	MINING-AB	pH-METALS	4.4	WT	500	$56.95	$125,290.00
HANS YOST CREEK	06-C	MINING-AB	pH	1	WT	500	$56.95	$28,475.00

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
SWATARA CREEK	07-D	MINING-AB	pH-METALS	5.2	TSF	1100	$67.26	$384,727
SWATARA CREEK	07-D	MINING-AB	pH-METALS	4.2	TSF	1100	$67.26	$310,741
SWATARA CREEK	07-D	MINING-AB	pH-METALS	9.8	TSF	1100	$67.26	$725,063
BAIRD RUN	07-D	MINING-AB	pH-METALS	1.4	WT	500	$56.95	$39,865.00
WEST BRACH FISHING CREEK	07-D	MINING-AB	pH-METALS	3.6	WT	500	$56.95	$102,510.00
LOWER RAUSCH CREEK	07-D	MINING-AB	METALS	3.9	WT	500	$56.95	$111,052.50
LORBERRY CREEK	07-D	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
STUMPS RUN	07-D	MINING-AB	METALS	0.2	WT	500	$56.95	$5,695.00
MIDDLE CREEK	07-D	MINING-AB	pH-METALS	1.1	WT	500	$56.95	$31,322.50
GOOD SPRING CREEK	07-D	MINING-AB	pH-METALS	5.8	WT	500	$56.95	$165,155.00
POPLAR CREEK	07-D	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
COAL RUN	07-D	MINING-AB/AT	pH-METALS	1.6	WT	500	$56.95	$45,560.00
GEBHARD RUN	07-D	MINING-AB	pH-METALS	1.9	WT	500	$56.95	$54,102.50
PANTHER CREEK	07-D	MINING-AB	pH-METALS	1.8	WT	500	$56.95	$51,255.00
BENNETT BRANCH SINNEMAHONING CREEK	08-A	MINING-AB	pH-METALS	4.8	TSF	1100	$67.26	$355,133
BENNETT BRANCH SINNEMAHONING CREEK	08-A	MINING-AB	pH-METALS	24	TSF	1100	$67.26	$1,775,664
BENNETT BRANCH SINNEMAHONING CREEK	08-A	MINING-AB	pH-METALS	8.8	TSF	1100	$67.26	$651,077
WEST CREEK	08-A	MINING-AB	pH-METALS	3	TSF	1100	$67.26	$221,958
WEST CREEK	08-A	MINING-AB	pH-METALS	9	TSF	1100	$67.26	$665,874
DENTS RUN	08-A	MINING-AB	pH	6.5	WT	500	$56.95	$185,087.50
TROUT RUN (UNT)	08-A	MINING-AB	pH-METALS	1.2	WT	500	$56.95	$34,170.00
SPRING RUN	08-A	MINING-AB	pH-METALS-SULFATES	7.7	WT	500	$56.95	$219,257.50
SINNEMAHONING CREEK	08-A	MINING-AB	pH-METALS	6.7	WWF	306	$50.53	$103,596.61
SINNEMAHONING CREEK	08-A	MINING-AB	pH-METALS	9.1	WWF	306	$50.53	$140,705.84
MONTGOMERY RUN	08-B	MINING-AB	pH-METALS	1.9	TSF	1100	$67.26	$140,573
MONTGOMERY RUN	08-B	MINING-AB	pH-METALS	0.7	TSF	1100	$67.26	$51,790
ANDERSON CREEK	08-B	MINING-AB	pH-METALS	10.3	TSF	1100	$67.26	$762,056
MONTGOMERT CREEK (UNT)	08-B	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
WOODS RUN	08-B	MINING-AB	pH-METALS	3	WT	500	$56.95	$85,425.00
MONTGOMERY CREEK (UNT)	08-B	MINING-AB	pH-METALS	1.7	WT	500	$56.95	$48,407.50
MONTGOMERY CREEK (UNT)	08-B	MINING-AB	pH	0.5	WT	500	$56.95	$14,237.50
NORTH BRANCH MONTGOMERY CREEK (UNT)	08-B	MINING-AB	pH	0.9	WT	500	$56.95	$25,627.50

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
TINKER RUN	08-B	MINING-AB	pH	0.7	WT	500	$56.95	$19,932.50
MONTGOMERY CREEK (UNT)	08-B	MINING-AB	pH	1.5	WT	500	$56.95	$42,712.50
HARTSHORN RUN	08-B	MINING-AB	pH-METALS-SULFATES	3	WT	500	$56.95	$85,425.00
KRATZER RUN	08-B	MINING-AB	pH-METALS	5.1	WT	500	$56.95	$145,222.50
IRVIN BRANCH	08-B	MINING-AB	METALS	1.5	WT	500	$56.95	$42,712.50
LITTLE ANDERSON CREEK	08-B	MINING-AB	pH-METALS	5.7	WT	500	$56.95	$162,307.50
WILSON RUN (UNT)	08-B	MINING-AB	pH	1.8	WT	500	$56.95	$51,255.00
WILSON RUN (UNT)	08-B	MINING-AB	METALS HWC	0.8	WT	500	$56.95	$22,780.00
NORTH CAMP RUN	08-B	MINING-AB	METALS HWC-SULFATES	2.8	WT	500	$56.95	$79,730.00
ROCK RUN	08-B	MINING-AB	pH-METALS	3	WT	500	$56.95	$85,425.00
BEAR RUN	08-B	MINING-AB	pH-METALS	2.9	WT	500	$56.95	$82,577.50
SOUTH BRANCH BEAR RUN	08-B	MINING-AB	pH-METALS	5.3	WT	500	$56.95	$150,917.50
WEST BRANCH SUSQUEHANNA RIVER	08-B	MINING-AB	pH-METALS	6.8	WWF	306	$50.53	$105,142.82
WEST BRANCH SUSQUEHANNA RIVER	08-B	MINING-AB	pH-METALS	72.9	WWF	306	$50.53	$1,127,192.92
LICK RUN	08-C	MINING-AB	pH-METALS	3.7	TSF	1100	$67.26	$273,748
CLEARFIELD CREEK	08-C	MINING-AB	pH-METALS	27.7	TSF	1100	$67.26	$2,049,412
LITTLE MUDDY RUN	08-C	MINING-AB	METALS	1	TSF	1100	$67.26	$73,986
BRUBAKER RUN	08-C	MINING-AB	pH-METALS-SULFATES	2	TSF	1100	$67.26	$147,972
ALDER RUN	08-C	MINING-AB	pH-METALS	10.7	WT	500	$56.95	$304,682.50
SANDY CREEK	08-C	MINING-AB	pH-METALS-SULFATES	4.2	WT	500	$56.95	$119,595.00
BIG RUN	08-C	MINING-AB	pH	1	WT	500	$56.95	$28,475.00
DEER CREEK	08-C	MINING-AB	pH-METALS	5	WT	500	$56.95	$142,375.00
SURVEYOR RUN	08-C	MINING-AB	pH-METALS	4	WT	500	$56.95	$113,900.00
LITTLE SURVEYOR RUN	08-C	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
TROUT RUN	08-C	MINING-AB	pH	5	WT	500	$56.95	$142,375.00
TAYLOR SPRINGS RUN	08-C	MINING-AB	METALS HWC	0.4	WT	500	$56.95	$11,390.00
PINE RUN	08-C	MINING-AB	pH	2.2	WT	500	$56.95	$62,645.00
FORK RUN	08-C	MINING-AB	pH-METALS	3.8	WT	500	$56.95	$108,205.00
SANBOURN RUN	08-C	MINING-AB	pH-METALS-SULFATES	3.3	WT	500	$56.95	$93,967.50
NORTH BRANCH UPPER MORGAN RUN	08-C	MINING-AB	pH-METALS	2.7	WT	500	$56.95	$76,882.50

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
LITTLE MUDDY RUN	08-C	MINING-AB	pH	4.5	WT	500	$56.95	$128,137.50
BLUE RUN	08-C	MINING-AB	METALS HWC	1.2	WT	500	$56.95	$34,170.00
CLEARFIELD CREEK	08-C	MINING-AB	pH-METALS	44.2	WWF	306	$50.53	$683,428.36
MOSQUITO CREEK	08-D	MINING-AB	pH-METALS	6	TSF	1100	$67.26	$443,916
MOSHANNON CREEK	08-D	MINING-AB	pH-METALS	26.2	TSF	1100	$67.26	$1,938,433
BLACK MOSHANNON CREEK	08-D	MINING-AB	pH-METALS	1	TSF	1100	$67.26	$73,986
COLD STREAM	08-D	MINING-AB	pH-METALS	1	TSF	1100	$67.26	$73,986
LAUREL RUN	08-D	MINING-AB	pH-METALS	5.4	TSF	1100	$67.26	$399,524
BIRCH ISLAND RUN	08-D	MINING-AB	pH-METALS	6.2	WT	500	$56.95	$176,545.00
LITTLE BIRCH ISLAND RUN	08-D	MINING-AB	pH-METALS	4.3	WT	500	$56.95	$122,442.50
AMOS BRANCH	08-D	MINING-AB	pH-METALS	1.6	WT	500	$56.95	$45,560.00
STERLING RUN	08-D	MINING-AB	pH-METALS	7.2	WT	500	$56.95	$205,020.00
SALTLICK RUN	08-D	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
CURLEYS RUN	08-D	MINING-AB	pH-METALS	1.2	WT	500	$56.95	$34,170.00
GRIMES RUN	08-D	MINING-AB	pH-METALS-SULFATES	2.3	WT	500	$56.95	$65,492.50
PINE CREEK	09-A	MINING-AB	pH-METALS	4	TSF/WWF	447	$67.26	$120,261
OTTER RUN	09-A	MINING-AB	pH-METALS	3.8	WT	500	$56.95	$108,205.00
LEFT FORK OTTER RUN	09-A	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
RIGHT FORK OTTER RUN	09-A	MINING-AB	pH-METALS	0.4	WT	500	$56.95	$11,390.00
BABBS CREEK	09-A	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
BABBS CREEK	09-A	MINING-AB	pH-METALS	22	WT	500	$56.95	$626,450.00
WILSON CREEK	09-A	MINING-AB	pH-METALS	2.3	WT	500	$56.95	$65,492.50
COOKS RUN (BASIN)	09-B	MINING-AB	pH-METALS	6.8	TSF/WT	800	$67.26	$365,894
COOKS RUN	09-B	MINING-AB	pH-METALS	3.3	TSF/WT	800	$67.26	$177,566
LICK RUN	09-B	MINING-AB	pH	3.7	WT	500	$56.95	$105,357.50
TANGASCOOTACK CREEK	09-B	MINING-AB	pH-METALS	8.4	WT	500	$56.95	$239,190.00
DRURY RUN (BASIN)	09-B	MINING-AB/AT	pH	14.6	WT	500	$56.95	$415,735.00
STONY RUN	09-B	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
WOODLEY DRAFT RUN	09-B	MINING-AB	pH-METALS	1.7	WT	500	$56.95	$48,407.50
SANDY RUN	09-B	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
TWO MILE RUN	09-B	MINING-AB	pH-METALS	1.9	WT	500	$56.95	$54,102.50
MIDDLE BRANCH TWO MILE RUN	09-B	MINING-AB	pH-METALS	2.1	WT	500	$56.95	$59,797.50

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
CROWLEY HOLLOW'	09-B	MINING-AB	pH-METALS	3.1	WT	500	$56.95	$88,272.50
CAMP RUN	09-B	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
ROCK RUN	09-B	MINING-AB	pH-METALS	1.2	WT	500	$56.95	$34,170.00
WEST BRANCH SUSQUEHANNA RIVER	09-B	MINING-AB	pH-METALS	50.6	WWF	306	$50.53	$782,386.31
KETTLE CREEK	09-B	MINING-AB	pH-METALS	3	WWF	306	$50.53	$46,386.54
BEECH CREEK (BASIN)	09-C	MINING-AB	pH-METALS	26	TSF/WT	800	$67.26	$1,399,008
MIDDLE BRANCH BIG RUN	09-C	MINING-AB	pH-METALS	1.1	WT	500	$56.95	$31,322.50
MIDDLE BRANCH BIG RUN	09-C	MINING-AB	pH-METALS	4.9	WT	500	$56.95	$139,527.50
EAST BRANCH BIG RUN	09-C	MINING-AB	pH-METALS	4.7	WT	500	$56.95	$133,832.50
LOGWAY RUN	09-C	MINING-AB	pH-METALS	0.8	WT	500	$56.95	$22,780.00
NORTH FORK BEECH CREEK	09-C	MINING-AB	pH-METALS	5.9	WT	500	$56.95	$168,002.50
LITTLE SANDY RUN	09-C	MINING-AB	pH-METALS	2.7	WT	500	$56.95	$76,882.50
CHERRY RUN	09-C	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
RED RUN	10-A	MINING-AB	pH-METALS	3.9	WT	500	$56.95	$111,052.50
LOYALSOCK CREEK	10-B	MINING-AB	pH-METALS	6	TSF	1100	$67.26	$443,916
LOYALSOCK CREEK	10-B	MINING-AB	pH-METALS	7.4	WT	500	$56.95	$210,715.00
WEST BRANCH SUSQUEHANNA RIVER	10-D	MINING-AB	pH-METALS	3	WWF	306	$50.53	$46,386.54
BEAR LOOP RUN	11-A	MINING-AB	pH-METALS-SULFATES	1.2	WT	500	$56.95	$34,170.00
BEAVER DAM BRANCH	11-A	MINING-AB	pH-METALS	4.5	WT	500	$56.95	$128,137.50
SUGAR RUN	11-A	MINING-AB	pH-METALS	6.3	WT	500	$56.95	$179,392.50
BURGOON RUN	11-A	MINING-AB	pH-METALS	3	WT	500	$56.95	$85,425.00
KITTANNING RUN	11-A	MINING-AB	pH-METALS	4.2	WT	500	$56.95	$119,595.00
GLENWHITE RUN	11-A	MINING-AB	pH-METALS	3.2	WT	500	$56.95	$91,120.00
MILLER RUN	11-D	MINING-AB	pH	1.2	WT	500	$56.95	$34,170.00
SIXMILE RUN	11-D	MINING-AB	pH	3.8	WT	500	$56.95	$108,205.00
BREWSTER HOLLOW	11-D	MINING-AB	pH-METALS	2.3	WT	500	$56.95	$65,492.50
SNADY RUN	11-D	MINING-AB	pH	6	WT	500	$56.95	$170,850.00
LONGS RUN	11-D	MINING-AB	pH	4.9	WT	500	$56.95	$139,527.50
GLADDENS RUN	13-A	MINING-AB	pH-METALS	11.8	TSF	1100	$67.26	$873,035
WEST BRANCH BLUE JAY CREEK	16-E	MINING-AB	METALS	7	WT	500	$56.95	$199,325.00
WALLEY RUN	16-F	MINING-AB	pH-METALS	1.9	WT	500	$56.95	$54,102.50
WALLEY RUN (UNT)	16-F	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
RICHEY RUN	16-G	MINING-AB	DISS SOLID	3.6	TSF	1100	$67.26	$266,350

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
LITTLE SCRUBGRASS CREEK	16-G	MINING-AB	METALS HWC-SULFATES	7.5	TSF	1100	$67.26	$554,895
SCRUBGRASS CREEK	16-G	MINING-AB	pH-METALS-SULFATES	10.8	TSF	1100	$67.26	$799,049
LOCKARD RUN	16-G	MINING-AB	pH-METALS	2.3	WT	500	$56.95	$65,492.50
SOUTH FORK LITTLE SCRUBGRASS CREEK	16-G	MINING-AB	METALS HWC	1.8	WT	500	$56.95	$51,255.00
LITTLE TOBY CREEK	17-A	MINING-AB	pH-METALS	8	TSF	1100	$67.26	$591,888
ELK CREEK	17-A	MINING-AB	METALS	6.3	TSF	1100	$67.26	$466,112
ELK CREEK	17-A	MINING-AB	METALS	9.8	TSF	1100	$67.26	$725,063
CURRY RUN	17-A	MINING-AB	METALS	1.8	WT	500	$56.95	$51,255.00
JOHNSON RUN	17-A	MINING-AB	METALS HWC-SULFATES	3.9	WT	500	$56.95	$111,052.50
ELK CREEK (NORTH BRANCH)	17-A	MINING-AB	METALS	0.8	WT	500	$56.95	$22,780.00
DAGUSCAHONDA RUN	17-A	MINING-AB	pH-METALS	6	WT	500	$56.95	$170,850.00
IRON RUN	17-A	MINING-AB	METALS	1	WT	500	$56.95	$28,475.00
ELK CREEK-SOUTH BR (UNT)	17-A	MINING-AB	METALS	3.6	WT	500	$56.95	$102,510.00
CLARION RIVER	17-B	MINING-AB	METALS	4.3	TSF	1100	$67.26	$318,140
TURKEY RUN	17-B	MINING-AB	METALS	7.1	TSF	1100	$67.26	$525,301
LICKING CREEK	17-B	MINING-AB	pH-SULFATES	5.5	TSF	1100	$67.26	$406,923
LICKING CREEK	17-B	MINING-AB	pH-METALS	6.3	TSF	1100	$67.26	$466,112
CHERRY RUN	17-B	MINING-AB	METALS HWC-SULFATES	7.4	TSF	1100	$67.26	$547,496
DEER CREEK	17-B	MINING-AB	METALS	10.7	TSF	1100	$67.26	$791,650
PINEY CREEK	17-B	MINING-AB	pH-METALS	2.9	TSF	1100	$67.26	$214,559
PINEY CREEK	17-B	MINING-AB	METALS-SULFATES	11.8	TSF	1100	$67.26	$873,035
REIDS RUN	17-B	MINING-AB	METALS	3.4	TSF	1100	$67.26	$251,552
ANDERSON RUN	17-B	MINING-AB	pH-METALS-SULFATES	3	WT	500	$56.95	$85,425.00
LITTLE LICKING CREEK	17-B	MINING-AB	METALS HWC-SULFATES	2.9	WT	500	$56.95	$82,577.50
BRUSH RUN	17-B	MINING-AB	pH-METALS-SULFATES	7.6	WT	500	$56.95	$216,410.00
BRUSH RUN (UNT)	17-B	MINING-AB	pH	1.1	WT	500	$56.95	$31,322.50
GATHERS RUN	17-B	MINING-AB	METALS HWC-SULFATES	1.8	WT	500	$56.95	$51,255.00
MILL CREEK	17-B	MINING-AB	METALS	6.1	WT	500	$56.95	$173,697.50

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
WHITES RUN	17-B	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
DOUGLAS RUN	17-B	MINING-AB	pH-METALS	4.5	WT	500	$56.95	$128,137.50
JONES RUN	17-B	MINING-AB	pH-METALS	3.5	WT	500	$56.95	$99,662.50
LITTLE MILL CREEK	17-B	MINING-AB	pH-METALS	20	WT	500	$56.95	$569,500.00
PARKS RUN	17-B	MINING-AB	pH	1	WT	500	$56.95	$28,475.00
MCGOURVEY RUN	17-B	MINING-AB	pH-METALS-SULFATES	1.9	WT	500	$56.95	$54,102.50
CLARION RIVER	17-B	MINING-AB	pH-METALS	4	WWF	306	$50.53	$61,848.72
REDBANK CREEK	17-C	MINING-AB	pH-METALS-SULFATES	2	TSF	1100	$67.26	$147,972
LEATHERWOOD CREEK	17-C	MINING-AB	METALS HWC-SULFATES	5.9	TSF	1100	$67.26	$436,517
FIVE MILE RUN	17-C	MINING-AB	METALS HWC-pH	3.5	TSF	1100	$67.26	$258,951
WEST FORK LEATHERWOOD CREEK	17-C	MINING-AB	METALS HWC-SULFATES	3	WT	500	$56.95	$85,425.00
LONG RUN	17-C	MINING-AB	SULFATE-METALS	3.1	WT	500	$56.95	$88,272.50
LEISURE RUN	17-C	MINING-AB	SULFATE-METALS	5.1	WT	500	$56.95	$145,222.50
TOWN RUN	17-C	MINING-AB	METALS HWC	5.5	WT	500	$56.95	$156,612.50
PINE CREEK	17-C	MINING-AB	METALS HWC	3.2	WT	500	$56.95	$91,120.00
LITTLE SANDY CREEK	17-C	MINING-AB	pH	2	WT	500	$56.95	$56,950.00
CLUTCH RUN	17-C	MINING-AB	METALS HWC	3.6	WT	500	$56.95	$102,510.00
HADDEN RUN	17-C	MINING-AB	METALS HWC	1.9	WT	500	$56.95	$54,102.50
BEAVER RUN	17-C	MINING-AB	SULFATE-METALS	6	WT	500	$56.95	$170,850.00
WELCH RUN	17-C	MINING-AB	pH-METALS-SULFATES	3.5	WT	500	$56.95	$99,662.50
LUTHERSBURG BRANCH	17-C	MINING-AB	pH-METALS-SULFATES	3.8	WT	500	$56.95	$108,205.00
NARROWS CREEK	17-C	MINING-AB	METALS	5.5	WT	500	$56.95	$156,612.50
NORTH BRANCH BEAR CREEK	17-C	MINING-AB	pH-METALS-SULFATES	6	WT	500	$56.95	$170,850.00
SOUTH BRANCH BEAR CREEK	17-C	MINING-AB	pH-METALS	2.4	WT	500	$56.95	$68,340.00
FOWLER RUN	17-C	MINING-AB	pH-METALS-SULFATES	2	WT	500	$56.95	$56,950.00
WEST FORK (UNT) (02)	17-C	MINING-AB	METALS	0.6	WWF	126	$50.53	$3,820.07
WEST FORK (UNT)	17-C	MINING-AB	METALS	0.7	WWF	126	$50.53	$4,456.75
KYLE RUN (UNT)	17-C	MINING-AB	METALS	1.4	WWF	126	$50.53	$8,913.49
KYLE RUN	17-C	MINING-AB	METALS	0.4	WWF	126	$50.53	$2,546.71

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
PINE RUN	17-D	MINING-AB	pH-METALS-SULFATES	5.2	TSF	1100	$67.26	$384,727
PINE RUN	17-D	MINING-AB	pH-METALS-SULFATES	1.7	TSF	1100	$67.26	$125,776
PINE RUN	17-D	MINING-AB	METALS	2.4	TSF	1100	$67.26	$177,566
LITTLE MAHONING CREEK	17-D	MINING-AB	pH-METALS	2	TSF	1100	$67.26	$147,972
NORTH BRACH MAHONING CREEK	17-D	MINING-AB	pH-METALS	3.7	TSF	1100	$67.26	$273,748
NYE BRANCH	17-D	MINING-AB	METALS	3.7	WT	500	$56.95	$105,357.50
CAYLOR RUN	17-D	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
FOUNDRY RUN	17-D	MINING-AB	pH	1.1	WT	500	$56.95	$31,322.50
BREWER RUN	17-D	MINING-AB	pH-METALS	1.7	WT	500	$56.95	$48,407.50
BEECH RUN	17-D	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
EAST RUN	17-D	MINING-AB	pH-METALS	3.3	WT	500	$56.95	$93,967.50
NICELY RUN	17-D	MINING-AB	pH-METALS	1.4	WT	500	$56.95	$39,865.00
EAST BRANCH MAHONING CREEK	17-D	MINING-AB	METALS	8	WT	500	$56.95	$227,800.00
LAUREL BRANCH RUN	17-D	MINING-AB	pH-METALS	2.8	WT	500	$56.95	$79,730.00
STUMP CREEK	17-D	MINING-AB	METALS	0.8	WWF	126	$50.53	$5,093.42
STUMP CREEK	17-D	MINING-AB	METALS-SULFATES	2.5	WWF	126	$50.53	$15,916.95
STUMP CREEK	17-D	MINING-AB	METALS	1.2	WWF	126	$50.53	$7,640.14
LIMESTONE RUN	17-E	MINING-AB	SULFATE	5.2	TSF	1100	$67.26	$384,727
SOUTH BRANCH SOUTH FORK PINE CREEK	17-E	MINING-AB	pH-METALS	2.5	TSF	1100	$67.26	$184,965
SUGAR RUN	17-E	MINING-AB	pH	0.6	WT	500	$56.95	$17,085.00
CRAIG RUN	17-E	MINING-AB	SULFATE	1	WT	500	$56.95	$28,475.00
MCKEE RUN	17-E	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
HUSKINS RUN	17-E	MINING-AB	SULFATE	2.6	WT	500	$56.95	$74,035.00
CROOKED CREEK	17-E	MINING-AB	pH	1.1	WWF	306	$50.53	$17,008.40
CROOKED CREEK	17-E	MINING-AB	pH-METALS	1.6	WWF	306	$50.53	$24,739.49
COAL BANK RUN	17-E	MINING-AB	pH	0.5	WWF	126	$50.53	$3,183.39
NORTH BRANCH PLUM CREEK	17-E	MINING-AB	pH	1.1	WWF	126	$50.53	$7,003.46
PLUM CREEK	18-A	MINING-AB	pH-METALS	3.1	TSF	1100	$67.26	$229,357
LITTLE PLUMB CREEK	18-A	MINING-AB	pH-METALS	4	WT	500	$56.95	$113,900.00
LITTLE DEER CREEK	18-A	MINING-AB	pH-METALS	5.1	WT	500	$56.95	$145,222.50
ALLEGENY RIVER	18-A	MINING-AB	pH-METALS	1.5	WWF	126	$50.53	$9,550.17
BEAVER RUN	18-B	MINING-AB	pH-METALS	2.5	TSF	1100	$67.26	$184,965

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
THORN RUN	18-B	MINING-AB	pH-METALS	0.7	WT	500	$56.95	$19,932.50
UNT THORN RUN	18-B	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
KISKIMINETAS RIVER	18-B	MINING-AB	pH-METALS	13.5	WWF	306	$50.53	$208,739.43
LOYALHANNA CREEK	18-C	MINING-AB	pH-METALS	11.5	TSF	1100	$67.26	$850,839
FOURMILE RUN	18-C	MINING-AB	pH-METALS-SULFATES	2	TSF	1100	$67.26	$147,972
CONEMAUGH RIVER	18-C	MINING-AB	pH-METALS	2.9	TSF	1100	$67.26	$214,559
HANNAS RUN	18-C	MINING-AB	pH-METALS-SULFATES	4	TSF/WT	800	$67.26	$215,232
GETTY RUN	18-C	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
MC CUNE RUN	18-C	MINING-AB	pH-METALS	1.4	WT	500	$56.95	$39,865.00
UNION RUN	18-C	MINING-AB	pH-METALS	3.2	WT	500	$56.95	$91,120.00
SAXMAN RUN	18-C	MINING-AB	pH-METALS	4.7	WT	500	$56.95	$133,832.50
MONASTERY RUN	18-C	MINING-AB	pH-METALS	0.8	WT	500	$56.95	$22,780.00
CONEMAUGH RIVER	18-C	MINING-AB	pH-METALS	114.5	WWF	306	$50.53	$1,770,419.61
CONEMAUGH RIVER	18-C	MINING-AB	pH-METALS	1.7	WWF	306	$50.53	$26,285.71
CONEMAUGH RIVER	18-C	MINING-AB	pH-METALS	7.9	WWF	306	$50.53	$122,151.22
TWO LICK CREEK	18-D	MINING-AB	pH-METALS	1.4	TSF	1100	$67.26	$103,580
YELLO CREEK	18-D	MINING-AB	pH-METALS	3	TSF	1100	$67.26	$221,958
ELK CREEK	18-D	MINING-AB	pH-METALS-SULFATES	7	TSF	1100	$67.26	$517,902
SOUTH BRANCH BLACKLICK CREEK	18-D	MINING-AB	pH-METALS	3	TSF	1100	$67.26	$221,958
FERRIER RUN	18-D	MINING-AB	pH-METALS	1.4	TSF/WT	800	$67.26	$75,331
PENN RUN	18-D	MINING-AB	pH-METALS-SULFATES	3.8	TSF/WT	800	$67.26	$204,470
ROARING RUN	18-D	MINING-AB	pH-METALS	2.4	WT	500	$56.95	$68,340.00
REEDS RUN	18-D	MINING-AB	pH-METALS	3.4	WT	500	$56.95	$96,815.00
TEARING RUN	18-D	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
FREEMAN RUN	18-D	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
STONY CREEK	18-E	MINING-AB	pH-METALS	22.7	TSF	1100	$67.26	$1,679,482
BENS CREEK	18-E	MINING-AB	pH-METALS	1.3	TSF	1100	$67.26	$96,182
SOUTH FORK BENS CREEK	18-E	MINING-AB	pH-METALS	4.7	TSF	1100	$67.26	$347,734
PAINT CREEK	18-E	MINING-AB	pH-METALS	0.7	TSF	1100	$67.26	$51,790
BENS CREEK	18-E	MINING-AB	pH-METALS	1	TSF	1100	$67.26	$73,986
SHADE CREEK	18-E	MINING-AB	pH-METALS	7.7	TSF/WT	800	$67.26	$414,322

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
SHADE CREEK	18-E	MINING-AB	pH-METALS	2.7	TSF/WT	800	$67.26	$145,282
DARK SHADE CREEK	18-E	MINING-AB	pH-METALS	2.7	TSF/WT	800	$67.26	$145,282
QUEMAHONING CREEK	18-E	MINING-AB	pH-METALS	1.9	TSF/WT	800	$67.26	$102,235
LITTLE CONEMAUGH RIVER	18-E	MINING-AB	pH-METALS	1.4	TSF/WT	800	$67.26	$75,331
LITTLE CONEMAUGH RIVER	18-E	MINING-AB	pH-METALS	0.6	TSF/WT	800	$67.26	$32,285
BEAVERDAM RUN	18-E	MINING-AB	pH-METALS	2	TSF/WT	800	$67.26	$107,616
UNT PAINT CREEK	18-E	MINING-AB	pH-METALS	0.5	WT	500	$56.95	$14,237.50
BABCOCK CREEK (BASIN)	18-E	MINING-AB	pH-METALS	3.5	WT	500	$56.95	$99,662.50
UNT DARK SHADE CREEK	18-E	MINING-AB	pH-METALS	0.6	WT	500	$56.95	$17,085.00
UNT STONEY CREEK	18-E	MINING-AB	pH-METALS	2.1	WT	500	$56.95	$59,797.50
FALLEN TIMBER RUN	18-E	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
UNT STONEY CREEK	18-E	MINING-AB	pH-METALS	1.1	WT	500	$56.95	$31,322.50
OVEN RUN	18-E	MINING-AB	pH-METALS	1.8	WT	500	$56.95	$51,255.00
LAMBERTS RUN	18-E	MINING-AB	pH-METALS	3.1	WT	500	$56.95	$88,272.50
BOONE RUN	18-E	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
BOONE RUN	18-E	MINING-AB	pH-METALS	0.6	WT	500	$56.95	$17,085.00
CLEAR RUN	18-E	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
OTTO RUN	18-E	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
SULPHUR CREEK	18-E	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
SPRING RUN	18-E	MINING-AB	pH-METALS	2.1	WT	500	$56.95	$59,797.50
STONY CREEK	18-E	MINING-AB	pH-METALS	6.5	WWF	306	$50.53	$100,504.17
BUFFALO CREEK (UNT)	18-F	MINING-AB	pH-METALS	0.2	WT	500	$56.95	$5,695.00
TURTLE CREEK	19-A	MINING-AB	pH-METALS	14.5	TSF	1100	$67.26	$1,072,797
TURTLE CREEK	19-A	MINING-AB	pH-METALS	2	TSF	1100	$67.26	$147,972
BRUSH CREEK	19-A	MINING-AB	pH-METALS	0.5	TSF	1100	$67.26	$36,993
STREETS RUN	19-A	MINING-AB	pH-METALS	0.7	WT	500	$56.95	$19,932.50
THOMPSON RUN	19-A	MINING-AB	pH-METALS	3	WT	500	$56.95	$85,425.00
TENMILE CREEK	19-B	MINING-AB	pH-SULFATES	5.7	WWF	306	$50.53	$88,134.43
SOUTH FORK TENMILE CREEK	19-B	MINING-AB	pH-METALS	2	WWF	306	$50.53	$30,924.36
RUSH RUN	19-B	MINING-AB	pH-METALS-SULFATES	1.3	WWF	306	$50.53	$20,100.83
PUMKIN RUN	19-B	MINING-AB	pH-METALS	1.8	WWF	306	$50.53	$27,831.92
PIGEON CREEK	19-C	MINING-AB	pH-METALS-SULFATES	6.2	TSF	1100	$67.26	$458,713

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
NORTH BRANCH PIGEON CREEK	19-C	MINING-AB	pH-METALS	3.6	TSF	1100	$67.26	$266,350
PIKE RUN	19-C	MINING-AB	DISS SOLID	1	TSF	1100	$67.26	$73,986
REDSTONE CREEK	19-C	MINING-AB	pH-METALS	10.2	TSF	1100	$67.26	$754,657
DUNLAP CREEK	19-C	MINING-AB	pH-METALS	5	TSF	1100	$67.26	$369,930
UNT SALTLICK RUN	19-C	MINING-AB	pH-METALS	0.2	WT	500	$56.95	$5,695.00
RUSH RUN	19-C	MINING-AB	pH-METALS-SULFATES	2.4	WT	500	$56.95	$68,340.00
WALLACE RUN	19-C	MINING-AB	pH-METALS-SULFATES	1.3	WT	500	$56.95	$37,017.50
UNT MONONGHELA RIVER	19-C	MINING-AB	pH-METALS	0.5	WWF	306	$50.53	$7,731.09
PETERS CREEK	19-C	MINING-AB	pH-METALS	22.3	WWF	306	$50.53	$344,806.61
FALLEN TIMBER RUN	19-C	MINING-AB	pH-METALS	2.7	WWF	306	$50.53	$41,747.89
FALLEN TIMBER RUN	19-C	MINING-AB	pH-METALS	1	WWF	306	$50.53	$15,462.18
LONG RUN	19-D	MINING-AB	pH-METALS	4.6	TSF	1100	$67.26	$340,336
SEWICKLEY RUN	19-D	MINING-AB	pH-METALS	14.3	TSF	1100	$67.26	$1,058,000
SEWICKLEY RUN	19-D	MINING-AB	pH-METALS	23.7	TSF	1100	$67.26	$1,753,468
LITTLE SEWICKLEY CREEK	19-D	MINING-AB	pH-METALS	1	TSF	1100	$67.26	$73,986
BUFFALO RUN	19-D	MINING-AB	pH-METALS	1.3	TSF	1100	$67.26	$96,182
JACKS CREEK	19-D	MINING-AB	pH-METALS-TDS	2.6	TSF	1100	$67.26	$192,364
GLADE RUN	19-D	MINING-AB	pH-METALS	3.4	TSF	1100	$67.26	$251,552
WELTY RUN	19-D	MINING-AB	pH	7.8	WT	500	$56.95	$222,105.00
FERGUSON RUN	19-D	MINING-AB	pH-METALS-SULFATES	1.6	WT	500	$56.95	$45,560.00
INDIAN CREEK	19-E	MINING-AB	pH-METALS	2.9	TSF	1100	$67.26	$214,559
RASLER RUN	19-E	MINING-AB	pH-METALS-SULFATES	4.7	TSF	1100	$67.26	$347,734
BUCK RUN	19-E	MINING-AB	pH-METALS	1.7	TSF/WT	800	$67.26	$91,474
MEDOW RUN	19-E	MINING-AB	pH-METALS	5.6	TSF/WT	800	$67.26	$301,325
POPLAR RUN	19-E	MINING-AB	pH-METALS	2.8	WT	500	$56.95	$79,730.00
NEWMYER RUN	19-E	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
LAUREL RUN	19-E	MINING-AB	pH-METALS-SULFATES	2.7	WT	500	$56.95	$76,882.50
CASSELMAN RIVER	19-F	MINING-AB	pH-METALS	26	TSF	1100	$67.26	$1,923,636
WHITES CREEK	19-F	MINING-AB	pH-METALS-SULFATES	4	TSF	1100	$67.26	$295,944
BIGBY CREEK	19-F	MINING-AB	pH-METALS-	1.4	TSF	1100	$67.26	$103,580

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
			SULFATES					
BUFFALO CREEK	19-F	MINING-AB	pH-METALS	7.5	TSF	1100	$67.26	$554,895
ELKLICK CREEK	19-F	MINING-AB	pH-METALS-SULFATES	2.7	TSF/WT	800	$67.26	$145,282
CUCUMBER RUN	19-F	MINING-AB	pH-METALS	1.5	WT	500	$56.95	$42,712.50
WILSON CREEK	19-F	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
LAUREL RUN	19-F	MINING-AB	pH-METALS	0.8	WT	500	$56.95	$22,780.00
EAST BRANCH COXES CREEK	19-F	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
SHAFER RUN	19-F	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
LICK RUN	19-F	MINING-AB	pH-METALS	1.8	WT	500	$56.95	$51,255.00
PINEY RUN	19-F	MINING-AB	pH-METALS	2.1	WT	500	$56.95	$59,797.50
MILLER RUN	19-F	MINING-AB	pH-METALS	1.3	WT	500	$56.95	$37,017.50
GEORGES CREEK	19-G	MINING-AB	pH-METALS	4	TSF	1100	$67.26	$295,944
MOUNTAIN CREEK	19-G	MINING-AB	pH-METALS	4.1	TSF	1100	$67.26	$303,343
BIG SANDY CREEK	19-G	MINING-AB	pH-METALS	3.3	TSF	1100	$67.26	$244,154
CATS RUN	19-G	MINING-AB	pH	1.5	WT	500	$56.95	$42,712.50
YORK RUN	19-G	MINING-AB	pH-METALS-SULFATES	6.2	WT	500	$56.95	$176,545.00
DOOLEY RUN	19-G	MINING-AB	pH-METALS	2.2	WT	500	$56.95	$62,645.00
WHITELEY CREEK	19-G	MINING-AB	pH-METALS	9	WWF	306	$50.53	$139,159.62
DUNKARD CREEK	19-G	MINING-AB	OTHER	6.5	WWF	126	$50.53	$41,384.07
DUNKARD CREEK	19-G	MINING-AB	pH-METALS	8.5	WWF	126	$50.53	$54,117.63
BRUSH RUN	20-B	MINING-AB	pH-METALS-SULFATES	8.3	WWF	306	$50.53	$128,336.09
CLARKS RUN	20-B	MINING-AB	pH-METALS	0.8	WWF	306	$50.53	$12,369.74
SEATON CREEK	20-C	MINING-AB	pH-METALS-SULFATES	4	TSF	1100	$67.26	$295,944
LITTLE CONNOQUENESSING CREEK (BASIN)	20-C	MINING-AT/AB	UNDETERM	2.7	TSF	1100	$67.26	$199,762
DUCK RUN	20-C	MINING-AB	METALS	4.3	WWF	306	$50.53	$66,487.37
EAST BRANCH WOLF CREEK	20-C	MINING-AB	METALS	6	WWF	306	$50.53	$92,773.08
LONG RUN	20-C	MINING-AB	METALS	3.3	WWF	306	$50.53	$51,025.19
BLACKS CREEK	20-C	MINING-AB	pH-METALS	4.8	WWF	306	$50.53	$74,218.46
CONNOQUENSSING CREEK (UNT)	20-C	MINING-AB	METALS	0.6	WWF	306	$50.53	$9,277.31
RACCOON CREEK	20-D	MINING-AB	pH-METALS	22	TSF	1100	$67.26	$1,627,692

Stream Name	SWP	Cause	Pollutant	Miles	Projected Use	Use Rate (Trips/Year)	Valuation ($/Trip)	Lost Value ($)
POTATO GARDEN RUN	20-D	MINING-AB	pH-METALS	3.6	TSF	1100	$67.26	$266,350
BURGETTS FORK (RACOON CREEK)	20-D	MINING-AB	pH-METALS	5	TSF	1100	$67.26	$369,930
UNT LITTLE RACCOON RUN	20-D	MINING-AB	pH-METALS	0.9	WT	500	$56.95	$25,627.50
HARMON CREEK	20-D	MINING-AB	pH-METALS	5	WWF	306	$50.53	$77,310.90
OHIO RIVER	20-E	MINING-AB	pH-METALS	1.6	WWF	306	$50.53	$24,739.49
OHIO RIVER	20-E	MINING-AB	pH-METALS	1.6	WWF	306	$50.53	$24,739.49
OHIO RIVER	20-E	MINING-AB	pH-METALS	3.1	WWF	306	$50.53	$47,932.76
OHIO RIVER	20-E	MINING-AB	pH-METALS	1.8	WWF	306	$50.53	$27,831.92
OHIO RIVER	20-E	MINING-AB	pH-METALS	2.1	WWF	306	$50.53	$32,470.58
CHARTIERS CREEK	20-F	MINING-AB	pH-METALS	6.5	TSF	1100	$67.26	$480,909
MILLERS RUN	20-F	MINING-AB	pH-METALS	2.5	TSF	1100	$67.26	$184,965
NORTH BRANCH ROBINSON RUN	20-F	MINING-AB	pH-METALS-SULFATES	4.8	TSF	1100	$67.26	$355,133
NORHT BRANCH ROBINSON RUN	20-F	MINING-AB	pH-METALS	2.8	TSF	1100	$67.26	$207,161
CAMBELLS RUN	20-F	MINING-AB	pH-METALS	2	WT	500	$56.95	$56,950.00
UNT CAMPBELLS RUN	20-F	MINING-AB	pH-METALS	0.8	WT	500	$56.95	$22,780.00
SAWMILL RUN	20-F	MINING-AB	pH-METALS	3	WT	500	$56.95	$85,425.00
N. BR. ROBINSONS RUN (UNT)	20-F	MINING-AB	pH-METALS	0.7	WT	500	$56.95	$19,932.50
N. BR. ROBINSONS RUN (UNT)	20-F	MINING-AB	pH-METALS	3.5	WT	500	$56.95	$99,662.50
HALF CROWN RUN	20-F	MINING-AB	pH-METALS	1	WT	500	$56.95	$28,475.00
MONTOUR RUN	20-G	MINING-AB	pH-METALS	0.5	WWF	306	$50.53	$7,731.09
MOON RUN	20-G	MINING-AB	pH-METALS	2.5	WWF	306	$50.53	$38,655.45
MOON RUN	20-G	MINING-AB	pH-METALS	1.1	WWF	306	$50.53	$17,008.40
			TOTAL MILES AMD	**2167**			**TOTAL**	**$93,087,265**

APPENDIX D

Uniform Series Present Worth Factors

Table – Uniform Series Present Worth Factors for Various Interest Rates and Periods

Uniform Series Present Worth Factors

Years	Interest Rate (%)							
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5	4.85343	4.78264	4.71346	4.64583	4.57971	4.51505	4.45182	4.38998
10	9.47130	9.22218	8.98259	8.75206	8.53020	8.31661	8.11090	7.91272
15	13.86505	13.34323	12.84926	12.38138	11.93794	11.51741	11.11839	10.73955
20	18.04555	17.16864	16.35143	15.58916	14.87747	14.21240	13.59033	13.00794
25	22.02316	20.71961	19.52346	18.42438	17.41315	16.48151	15.62208	14.82821
30	25.80771	24.01584	22.39646	20.93029	19.60044	18.39205	17.29203	16.28889
35	29.40858	27.07559	24.99862	23.14516	21.48722	20.00066	18.66461	17.46101
40	32.83469	29.91585	27.35548	25.10278	23.11477	21.35507	19.79277	18.40158
45	36.09451	32.55234	29.49016	26.83302	24.51871	22.49545	20.72004	19.15635
50	39.19612	34.99969	31.42361	28.36231	25.72976	23.45562	21.48218	19.76201
Years	**Interest Rate (%)**							
	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5
5	4.32948	4.27028	4.21236	4.15568	4.10020	4.04588	3.99271	3.94064
10	7.72173	7.53763	7.36009	7.18883	7.02358	6.86408	6.71008	6.56135
15	10.37966	10.03758	9.71225	9.40267	9.10791	8.82712	8.55948	8.30424
20	12.46221	11.95038	11.46992	11.01851	10.59401	10.19449	9.81815	9.46334
25	14.09394	13.41393	12.78336	12.19788	11.65358	11.14695	10.67478	10.23419
30	15.37245	14.53375	13.76483	13.05868	12.40904	11.81039	11.25778	10.74684
35	16.37419	15.39055	14.49825	13.68696	12.94767	12.27251	11.65457	11.08778
40	17.15909	2.85715	3.18226	3.52564	3.88614	4.26244	4.65308	5.05649
45	17.77407	16.54773	15.45583	14.48023	13.60552	12.81863	12.10840	11.46531
50	18.25593	16.93152	15.76186	14.72452	13.80075	12.97481	12.23348	11.56560
Years	**Interest Rate (%)**							
	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5
5	3.88965	3.83971	3.79079	3.74286	3.69590	3.64988	3.60478	3.56057
10	6.41766	6.27880	6.14457	6.01477	5.88923	5.76777	5.65022	5.53643
15	8.06069	7.82818	7.60608	7.39382	7.19087	6.99671	6.81086	6.63289
20	9.12855	8.81238	8.51356	8.23091	7.96333	7.70982	7.46944	7.24135
25	9.82258	9.43758	9.07704	8.73902	8.42174	8.12361	7.84314	7.57901
30	10.27365	9.83472	9.42691	9.04744	8.69379	8.36371	8.05518	7.76638
35	10.56682	10.08699	9.64416	9.23465	8.85524	8.50304	8.17550	7.87036
40	10.75736	10.24725	9.77905	9.34829	8.95105	8.58389	8.24378	7.92806
45	10.88120	10.34904	9.86281	9.41727	9.00791	8.63080	8.28252	7.96008
50	10.96168	10.41371	9.91481	9.45914	9.04165	8.65802	8.30450	7.97785

APPENDIX E

Plan Evaluation and Score Sheets

A.1 - Local Support	Points	Score
Has a local entity formulated goals, developed a plan and begun plan implementation? **(none = 0 pts., formulated goals = 5 pts., developed plan = 10 pts., begun plan implementation =10-25 pts.)**	0 - 25	
Does the local entity have experience in project implementation? **(1 project = 5 pts., 2 projects = 10 pts., 3 or more = 15 pts.)**	0 – 15	
Does the local entity have a history of reliably providing for long-term O&M? **(1 project, 0-5 pts.; 2-4 projects 5-15 pts.; > 4 projects, 15-25 pts.; active treatment, additional 10 pts.)**	0 - 25	
Is there a non-local entity involved in restoration? (TU, SRBC, etc.)	0 - 5	
Total Section Score	**70**	

A.2 – Background Data	Points	Score
Does this plan include a watershed map showing major topographic features and pollution sources?	0 - 10	
Are historical, archeological, geological, and biological watershed features described?	0 - 5	
Are the problems in the watershed (such as AMD, sewage, habitat, etc.) and the opportunities clearly defined?	0 - 5	
Are AMD sources adequately located and characterized, including mass balance calculations and comparison to stream load?	0 - 10	
Are discharge/abatement projects prioritized based on their contribution to the stream load and location in the watershed?	0 - 10	
Has a biological assessment been completed that uses standard DEP protocols?	0 - 10	
Are there abatement projects identified that will reduce or eliminate the need for AMD treatment at any of the high priority sites?	0 – 15	
Have low flow or base flow and peak flow and associated chemistry been defined?	0 – 5	
Are flow and chemistry measurement frequency adequate to properly characterize the discharge(s)	0 – 5	
Has the design flow and chemistry characterization been scientifically and/or statistically determined?	0 – 5	
Have the water samples been analyzed by a certified/acceptable laboratory?	0 – 5	
Have an adequate number of parameters been identified to adequately characterize the AMD and reasonably ensure QA/QC?	0 – 5	
Total Section Score	**90**	

A.3 – Restoration Goals	Points	Score
Restoration goals are: 1) well-defined; 2)measurable (by lab analysis or bio survey); and 3) achievable; the 4) targeted area is clearly described; and the 5) goals fit well with DEP's overarching goals **(Decrease score by 5 pts for each of the above components that are missing)**	0 - 25	
No restoration goals have been developed	-25	
Total Section Score	**25**	

Develop a Technology Analysis score for each individual treatment or abatement project covered by the restoration plan. The overall score for the projects in the plan will be based on a weighted average of the individual scores multiplied by the percentage of pollution loading for each individual treatment or abatement project.

Individual Project #_____

A.4.a - Technology Analysis for Individual Treatment Projects		
Technological Evaluation	**Points**	**Score**
Evaluate whether the recommended technology has successfully been used at numerous locations under treatment scenarios similar to the proposed project.	0 – 20	
Evaluate whether (or the degree that) the proposed treatment system/facility was sized or manufactured using a science-based approach or other accepted sizing methodologies.	0 – 20	
Technological Evaluation Subtotal	**40**	
Operational Evaluation	**Points**	**Score**
Evaluate the prospects that the recommended treatment system/facility will achieve the treatment/abatement goals for the duration of the design life.	0 – 20	
Evaluate whether the proposed treatment system/facility can be operated and maintained to consistently achieve the treatment/abatement goals.	0 – 20	
Evaluate whether the proposed treatment system/facility can be manipulated to achieve treatment/abatement goals under varying flow, chemistry, and operational conditions.	0 – 20	
Operational Evaluation Subtotal	**60**	
Maintenance Evaluation	**Points**	**Score**
Evaluate the ease with which the proposed treatment system/facility can be evaluated for operational problems. (ease of troubleshooting)	0 – 20	
Evaluate whether the proposed treatment system/facility can be easily maintained or rehabilitated if the treatment/abatement goals are not being achieved.	0 – 20	
Maintenance Evaluation Subtotal	**40**	

Individual Project #_____

A.4.a - Technology Analysis for Individual Treatment Projects		
Application of Risk Matrix Table **(Only required for treatment technology category 4. All other types of Passive Treatment for Net Acidic Discharges)**	**Points**	**Score**
The proposed treatment system/facility has a **high** risk according to the Risk Matrix Table.	Yes - -80 No - 0	
The proposed treatment system/facility has a **moderate** risk according to the Risk Matrix Table.	Yes - -40 No - 0	
The proposed treatment system/facility has a **low** risk according to the Risk Matrix Table.	Yes - 0	
Risk Matrix Subtotal, if applicable (supplemental points)	----------	

A.4.a – (Alternate) -Technology Evaluation for Individual Abatement Projects (for projects that do not include treatment)	**Points**	**Score**
The proposed project is an ***abatement project*** that will ***eliminate*** a discharge or its effects on water quality or quantity.	106 – 140	
The proposed project is an ***abatement project*** that will ***significantly reduce (> 50%)*** a discharge or its effects on water quality or quantity.	71 – 105	
The proposed project is an ***abatement project*** that will ***reduce (> 10 up to 50%)*** a discharge or its effects on water quality or quantity.	36 – 70	
The proposed project is an ***abatement project*** that will ***likely reduce*** a discharge or its effects on water quality or quantity.	0 – 35	
Abatement Subtotal	**140**	

Individual Project #_____

A.4.a - Technology Analysis for Individual Treatment Projects*	**Points**	**Score**
Technological Evaluation Subtotal	40	
Operational Evaluation Subtotal	60	
Maintenance Evaluation Subtotal	40	
Risk Matrix Subtotal **(score only if applicable)**	----	
Individual Project #____ Score	140	(a)
A.4.a (Alternate) -Technology Analysis for Individual Abatement Projects*		
Individual Project #____ Score	140	(a)

Individual Project #____ percentage of pollution loading		**(b)**

Use additional sheet(s) for each individual treatment or abatement project covered by the restoration plan.

*Individual projects will receive a score for either A.4.a if they are treatment projects or for A.4.a (Alternate) if they are abatement projects.

A.4.a - Treatment or Abatement Technological Analysis Project Compilation				
Individual Project Number	**Individual Project Score (a)**	**Maximum Project Score (b)**	**Percentage of Pollution Loading (c)**	**Total Weighted Individual Project Score [a/b x c]**
Project #1		140		
Project #2, if applicable		140		
Project #3, if applicable		140		
Project #4, if applicable		140		
Project #5, if applicable		140		
Project #6, if applicable		140		
Project #7, if applicable		140		
Etc.				
Total Section Score (sum of total weighted individual project scores)				

Develop an Alternative Analysis for each individual treatment or abatement project covered by the restoration plan. The overall score for the projects in the plan will be based on a weighted average of the individual scores multiplied by the percentage of pollution loading for each individual treatment or abatement project.

Individual Project #_____

A.4.b – Alternatives Analysis		**Points**	**Score**
Poorly analyzed and/or presented	A poorly completed alternatives analysis fails to provide the project evaluator with enough information to adequately assess that the best approach is being proposed for a specific project.	0 – 10	
Adequate	An adequately completed alternatives analysis meets the minimum requirement of evaluating at least one passive treatment option and one active treatment option. However, the evaluation leaves the project evaluator with questions or inadequate information to completely assess that the best approach is being proposed for a specific project.	11- 20	
Analyzed in detail and clearly presented	A detailed and clearly presented alternatives analysis provides the project evaluator with adequate information to completely assess that the best approach is being proposed for a specific project. All applicable treatment approaches are evaluated, presented and discussed.	21 – 25	
Not required	No alternatives analysis is needed or warranted (Project cost <$250,000 or other documented reason(s).	25	
	Individual Project #____ Score	**25**	**(c)**

A.4.b - Alternative Analysis Project Compilation				
Individual Project Number	**Individual Project Score (a)**	**Maximum Project Score (b)**	**Percentage of Pollution Loading (c)**	**Total Weighted Individual Project Score [a/b x c]**
Project #1		25		
Project #2, if applicable		25		
Project #3, if applicable		25		
Project #4, if applicable		25		
Project #5, if applicable		25		
Project #6, if applicable		25		
Project #7, if applicable		25		
Etc.				
Total Section Score (sum of total weighted individual project scores)				

Develop an Other Considerations sheet for each individual treatment or abatement project covered by the restoration plan. The overall score for the projects in the plan will be based on a weighted average of the individual scores multiplied by the percentage of pollution loading for each individual treatment or abatement project.

Individual Project #_____

A.4.c - Other Considerations for Individual Projects		**Points**	**Score**
1.	Is adequate land available to construct properly sized treatment systems?	Yes - +5 No - -100	
2.	Does written or verbal property owner consent exist for the properties where treatment systems will be needed?	Written - +5 None - -100 Verbal - 0	
3.	Have any soil test pits and/or geotechnical evaluations been identified and/or performed on-site?	Yes - +5 No - 0	
4.	Have any environmental permit requirements been identified or any permits obtained?	Obtained - +5 Not Evaluated - -10 Identified - 0	
5.	Is there documented local and/or public project support?	Yes - +5 No - -5	
6.	For sites containing coal refuse material, has the material been tested or evaluated for fuel value and marketability?	Yes - +5 No - 0 not applicable - +5	
7.	Will the project result in restored stream miles or reclaimed acreage on public lands?	Yes - +5 No - 0	
	Individual Project #____ Score	**35**	**(d)**

A.4.c – Other Considerations Project Compilation				
Individual Project Number	**Individual Project Score (a)**	**Maximum Project Score (b)**	**Percentage of Pollution Loading (c)**	**Total Weighted Individual Project Score [a/b x c]**
Project #1		35		
Project #2, if applicable		35		
Project #3, if applicable		35		
Project #4, if applicable		35		
Project #5, if applicable		35		
Project #6, if applicable		35		
Project #7, if applicable		35		
Etc.				
Total Section Score (sum of total weighted individual project scores)				

B. Benefits			
Impact	**Stream Miles**	**Points**	**Score**
Minimal	Hydrologic Unit restoration will restore (meet treatment goals in) < 1 mile of stream	0 - 5	
Minor	Hydrologic Unit restoration will restore (meet treatment goals in) 1 - <5 miles of stream	6 - 10	
Moderate	Hydrologic Unit restoration will restore (meet treatment goals in) 5 - <10 miles of stream	11 - 15	
Significant	Hydrologic Unit restoration will restore (meet treatment goals in) 10 - <20 miles of stream	16 - 20	
Very Significant	Hydrologic Unit restoration will restore (meet treatment goals in) ≥20 miles of stream	21- 25	
Additional	Based on PA Code Ch. 93 Protected Water Uses: Restoration will restore an EV/HQ stream, or Restoration will restore a cold water fishery, or Restoration will restore a warm water fishery or trout stocked fishery	+25 +15 +10	
Additional	Restoration can be reasonably expected to result in the delisting of a stream or portion from the Department's Impaired Waters List	0 - 5	
Additional	Restoration will provide/improve water supplies for public or industrial use within the restoration area	0 - 10	
Additional	Restoration will provide increased water tourism benefits on public lands	0 - 10	
Additional	Restoration will to generate resources that could be used in other industries. Resource recovery should be stated in the goals	0 - 10	
Additional	Restoration will generate energy that could be used in the system or sold off. Energy generation should be stated in the goals of the proposed project	0 - 10	
Additional	Restoration will eliminate a documented OSM Priority 1 or 2 problem **(P2 = 0-5, P1 = 5-10, Multiple = 10-15)**	0 - 15	
Additional	Restoration involves new or innovative technologies. Documentation should be cited on how the technology applies to the problem. No adverse impacts should result.	0 - 5	
	Total Section Score	**25**	

C.1 - Capital Cost (Cost of Restoration Plan – All Projects)		Points	Score
Very High Cost	> $10.0 million	0 - 5	
High Cost	> $5.0 million and < $10.0 million	6- 10	
Moderate Cost	> $3 million and < $5.0 million	11-15	
Low Cost	> $1 million and < $3 million	16-20	
Very Low Cost	< $1 million	21- 25	
	Total Section Score	25	

C.2 - Non-Title IV Match Money and Projects Completed by Others		Points	Score
High	Greater than 50% of priority projects have been completed with funding from non-Title IV sources	25 - 50	
Medium	Greater than 25% of priority projects have been completed OR Greater than 25% of total needed funding has been committed from non-Title IV sources	6 - 15	
Low	Title IV sources will provide >75% of total capital costs needed to complete priority projects	0 - 5	
Additional	Add points if any of match is from a private source	0 – 25	
	Total Section Score	**50**	

C.3 – Matching Funds for Operation and Maintenance		Points	Score
Local Support	Routine O&M to be provided by local entity	0 - 10	
Other Support	Maintenance needs to be provided by local industry or other private entity (partial – 0 – 5, full – 5 – 10)	0 - 10	
Treatment Funding	A trust fund or legal agreement is in place to fund > 25% of long-term treatment needs in the watershed from non-Title IV sources	0 - 10	
	A trust fund or legal agreement is in place to fund > 50% of long-term treatment needs in the watershed from non-Title IV sources	11 - 25	
Abatement	At least 25% of the pollution load to be reduced by abatement projects that will require no long-term O&M	0 - 10	
	At least 50% of the pollution load will be reduced by abatement projects that will require no long-term O&M	11 - 25	
Active Treatment	Active treatment is needed in the watershed and no non-Title IV funding source is identified (at a cost < $100,000/year)	-15	
Active Treatment	Active treatment is needed in the watershed and no non-Title IV funding source is identified (at a cost < $100,000 - $500,00/year)	-35	
Active Treatment	Active treatment is needed in the watershed and no non-Title IV funding source is identified (at a cost > $500,000/year)	-70	
	Total Section Score	**70**	

Score Sheet Summary

Restoration Plan Scoring Criteria	Total Section Score (e)	Maximum Criteria Score (f)	Weighted Percentage (g)	Score [(e)/(f) x(g)]
A.1 - Local Support		70	10	
A.2 – Background Data		90	10	
A.3 – Restoration Goals		25	5	
*A.4.a - Technological Analysis		140	15	
*A.4.b - Alternatives Analysis		25	5	
*A.4.c - Other Considerations		35	5	
B. - Benefits		25	15	
C.1 - Capital Costs		25	15	
C.2 – Match Money and Projects Completed by Others		50	10	
C.3 – Matching Funds for Operation and Maintenance		70	10	
Overall Restoration Plan Score				

*These are the combined weighted scores of all projects.

Record of Decision

	Project Selection Criteria	Record of Decision
A.1	Local Support	
A.2	Background Data	
A.3	Restoration Goals	
A.4.a	Technological Analysis	
A.4.b	Alternatives Analysis	
A.4.c	Other Considerations	
B.	Benefits	
C.1	Capital Costs	
C.2	Match Money and Projects Completed by Others	
C.3	Matching Funds for Operation and Maintenance	
	Additional Comments	

The evaluator should complete a brief Record of Decision to document reason(s) for scoring and items used as the basis for the evaluation.

D. Restoration Plan Worth	Overall Plan Score
Exceptional Worth	> 90 – 100+
High Worth	> 70 – 90
Moderate Worth	> 50 – 70
Low Worth	50 or less