Quality Assurance Project Plan

ER-8 Acid Mine Drainage (AMD) Construction Project

Prepared by:

**new Miles of
Blue Stream**

NMBS

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Prepared for:

Emigh Run/Lakeside Watershed Association Inc.
P.O. Box 204
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PROJECT MANAGEMENT

A. Distribution List

> Emigh Run/Lakeside Watershed Association, Inc.
> PO Box 204
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> NMBS
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> Alder Run Engineering, LLC.
> 107 Coal Street
> Osceola Mills, PA 16666
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> Rachel Kester, Watershed Specialist
> Clearfield County Conservation District
> 650 Leonard Street
> Clearfield, PA 16830
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> Mahaffey Laboratory
> 551 State Street
> Curwensville, PA 16833
>
> Donna Carnahan
> Pennsylvania Department of Environmental Protection
> Bureau of Watershed Conservation
> PO Box 8555
> Harrisburg, PA 17105-8555
>
> U.S. Environmental Protection Agency, Region III
> Non-Point Source Program
> 1650 Arch Street
> Philadelphia, PA 19103-2029

B. Project Organization

> Project Officer
> Anna Mae Pezzulla, President
> Emigh Run/Lakeside Watershed Association, Inc.
> PO Box 204
> Morrisdale, PA 16858

Quality Assurance Officer
Jennifer Demchak
NMBS
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Principal Investigator
Brian Merrow
Alder Run Engineering, LLC.
107 Coal Street
Osceola Mills, PA 16666

Lab Analysis
Mahaffey Laboratory
551 State Street
Curwensville, PA 16833

C. Responsibility

1. Project Officer – Responsible for oversight of administrative aspects of the program including fiscal management, coordination among other administrators, and coordination with cooperating agencies and institutions.
2. Quality Assurance Officer – Oversight and resolution of all Project QA concerns, coordination with principal investigator. Responsible for QC checks of the database.
3. Principal Investigator – Responsible for field operations of sample collection and handling including QA samples, submission of samples including QA samples to the appropriate laboratory, field data collection and field QA, review and interpretation of laboratory data, and data management, reduction, analysis, and reporting. Assist QA officer in resolution of all project QA/QC concerns.
4. Mahaffey Laboratory Ltd. – Responsible for overall laboratory QA
5. Mahaffey Laboratory Program Chief – Responsible for analysis of samples and QA/QC in the laboratory section.

D. Abbreviations

Emigh Run/Lakeside Watershed Association, Inc. (ERLWA)
New Miles of Blue Stream (NMBS)
Alder Run Engineering (ARE)
Pennsylvania Department of Environmental Protection (PA DEP)
Milligrams per liter (mg/L)
Gallons per minute (gpm)
Million gallons per day (MGD)
Total Maximum Daily Load (TMDL)
Inductively coupled plasma mass spectrometry (ICP)

Environmental Protection Agency (EPA)
U.S. Gelogical Survey (USGS)

II. BACKGROUND OF PROBLEM

The Emigh Run Watershed is located in Central Pennsylvania in Morris Township, Clearfield County. The watershed is located on the USGS 7.5 minute series topographic maps of Wallaceton and Philipsburg near Wallaceton, PA. A project location map has been provided in Appendix A.

The main stem of Emigh Run is approximately 5.2 miles in length. A few tributary streams feed Emigh Run, and they are of good water quality. The stream enters Moshannon Creek between Hawk Run and Troy off of State Route 53 between Philipsburg and Morrisdale.

Emigh Run is a subwatershed of Moshannon Creek and is severely impacted by AMD, a non-point source pollutant, resulting from years of deep mining and surface mining for bituminous coal in the watershed. Deep mining began in the area in the 1800s, and slowly increased through the Civil War era. During the 1940s strip mining became the dominant mining practice in the area. As with most of the watershed, Emigh Run was severely impacted by past mining practices, which have scarred the landscape and severely impacted the hydrology.

Water sampling has been performed along Emigh Run as part of the assessment performed by the ERLWA and the WBASD. The sampling has verified that Emigh Run is severely impaired by AMD. There are unconfirmed, anecdotal reports of individuals stocking trout, which reportedly survive, in the swampy area below Lakeside Dam, but these reports have not be substantiated. Emigh Run is a significant contributor of acidity and metals loadings to Moshannon Creek, and as such is a priority for the restoration of Moshannon Creek.

Emigh Run provides the only source of surface water hydrology for the 22 acre Lakeside Dam, which is located between Troy Hill and Morrisdale. (Lakeside Dam is often referred to as Morrisdale Dam by local residents.) The Dam was built in the 1800s by a mining company and was the primary source of drinking water for the town of Morrisdale. The Dam is now privately owned. The owner hopes to donate the Dam along with five acres of wooded area to create a nature park. Before repairs on the Dam can occur, there is a great need to treat the AMD that is severely affecting the water quality and in turn, the aquatic life of the Dam. A complete watershed assessment and restoration plan has been developed in order to recover this area as both a potential water source and a recreational/educational area, funding through the PA Growing Greener Program.

As stated previously, the Emigh Run Watershed is the only source of surface water feeding the Lakeside Dam, and therefore, its clean-up is an essential factor in establishing the Lakeside Dam as a recreational area. Lakeside Dam is located directly off of State Route 53, and its re-establishment as a recreational area would be a valuable promotional

project for various grant agencies. Its close proximity to both the West Branch and Philipsburg-Osceola School Districts would allow it to be used as an educational area. Both the dam itself and the subsequent recreational areas that will be established will provide valuable educational services to the surrounding schools and communities. Projects that are highly visible and successful are great motivators for the community to get involved in future projects.

Extensive mining occurred in the headwaters of Emigh Run prior to the Surface Mine Conservation and Recovery Act (SMCRA), leaving abandoned highwalls and spoil areas that degrade stream quality. Efforts are underway to remine some areas in the headwaters. With the addition of lime to the backfill, we are confident we will see improvement in the quality of some of the discharges. The remining efforts, in combination with proposed restoration of water quality, including ER-8, are the first necessary steps in the restoration of Emigh Run.

The discharge of ER-8 seeps through a reclaimed surface mine, degrading water quality to the discharge and to Emigh Run. We feel that through treating the discharge by constructing two limestone cells and a final settling basin, water quality will improve and a higher pH and lower metal concentrations will be noticed in the stream. This will have a beneficial effect throughout the watershed. The proposed construction project includes six months of monitoring after the system is construction to characterize the success of the treatment system on the discharge and the impact on the main stem of Emigh Run. This Quality Assurance Project Plan was developed to support the data collection for the ER-8 project.

III. PROJECT DESCRIPTION

The objective of the project is to collect samples after the passive treatment system has been installed to monitor the efficiency or success of the treatment system along with the impact of the system on the main stem of Emigh Run. We will monitor the raw water if possible, discharge out of the treatment system and above and below the treatment system on Emigh Run. This will allow us to determine if the treatment system is working effectively and what the impact the system is having on Emigh Run.

Work Plan

Design and Permitting
December 2006-March 2007

OBJECTIVES:	RESPONSIBLE PARTY
Property Owners Permission	ARE, NMBS
Preliminary Design	ARE, NMBS
Permitting: Joint and NPDES	ARE, NMBS
Engineer Design	ARE, NMBS
Project Complete	ARE, NMBS

Pre-Construction Phase
May 2008 – August 2008

OBJECTIVES	RESPONSIBLE PARTY
Pre-bid documents and meetings	ARE, NMBS
Bid awarded, contracts signed	ARE, NMBS

Construction and Construction Oversight
August 2008-June 2010

OBJECTIVES	RESPONSIBLE PARTY
Construction of treatment system	ARE, NMBS
Post-construction monitoring	ARE, NMBS

IV. QUALITY OBJECTIVES AND CRITERIA

Data collected during this study will be used to: (1) characterize the water quality emanating from the passive treatment system; and (2) characterize the water quality above and below the treatment system on the main stem of Emigh Run to determine the impact of the treatment system. Therefore, the QA/QC objectives for the study are to assure that: (1) samples collected are representative of the water being sampled; (2) samples collected at treatment system and stream are representative of the true water quality; (3) data analyses are precise and accurate; and (4) samples are not contaminated from sampling equipment. Objectives for precision and accuracy and detection limits for this project are presented in Table 1. Analytical methods, reporting limits, and preparation and handling requirements are provided in Table 2 for the chemical constituents and properties to be characterized.

Table 1. Summary of precision, accuracy, and recovery goals for laboratory analyses of water samples for ER-8 AMD Treatment System (mg/L, milligram per liter)

Analytical Parameter	Field Duplicate Precision (RPD)	MS/MSD Precision (RPD)	MS/MSD Percent Recovery	Detection Limit
Field parameters				
Field pH (standard units)	± 10			0.1
Discharge	± 10	--------	--------	1.0 gpm
Temperature, water (°C)	± 10			0.5 °C
Specific Conductance (μS/cm at 25°C)	± 10			10 μS/cm
Lab parameters				
Lab pH (standard units) SM 4500-H$^+$ (18th ed.)	± 0.1 units			0.1
Hot acidity	Low level ± 10			2.0 mg/L

SM 2310 B (18th ed.)	High level ± 25			
Alkalinity SM 2320 B (18th ed.)	Low level ± 10 High level ± 25	_ _ _ _	_ _ _ _	1.0 mg/L
Total iron EPA 200.7	Low level ± 10 High level ± 20	Low level ± 10 High level ± 20	± 30	0.01 mg/L
Total Manganese EPA 200.7	Low level ± 10 High level ± 20	Low level ± 10 High level ± 20	± 30	0.01 mg/L
Sulfate SM 4110 B (18th ed.)	Low level ± 10 High level ± 25	Low level ± 10 High level ± 25	± 20	2.0 mg/L
Aluminum EPA 200.7	Low level ± 10 High level ± 20	Low level ± 10 High level ± 20	± 30	0.01 mg/L
Specific Conductance (µS/cm at 25°C) SM 2510 B (18th ed.)	Low level ± 10 High level ± 25	_ _ _ _	_ _ _ _	10 µS/cm

a. Precision expressed as percent generally applies to concentrations that are a minimum of five times the detection limit. Precision of ±100 percent is the expected goal for concentrations that are at the detection limit.

b. Method Detection Limit is the smallest concentration of a substance that can be detected and reported with 99% confidence that the concentration of the substance is >0.

* Low level refers to concentrations less than 20 times the MDL. High level refers to concentrations greater than 20 times the MDL.

Accuracy shall be defined as the degree in which the obtained results compare with the actual result.

Accuracy shall be calculated using the formula:

For standard reference material: $\%R = 100 \times \dfrac{OV}{KCV}$

%R = percent recovery
OV = the analytical result obtained for the standard reference material
KCV = known certified value of the standard reference material

Standard matrix spikes: $\%R = \dfrac{SSR - SR}{SA} \times 100$

%R = percent recovery
SSR = Spiked sample result
SR = Sample result
SA = Spike added

EPA defines precision as "The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves."

Field duplicate precision shall be calculated using the formula:

$RPD = \dfrac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100$

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RPD = relative percent difference between duplicate determinations
C_1 and C_2 are the results for the duplicate determinations where
C_1 = larger of two observed values
C_2 = smaller of two observed values

The relative percent difference between the MS and the MSD is calculated as follows:

$$RPD = \frac{|MSR - MSDR|}{\frac{1}{2}(MSR + MSDR)} \times 100$$

RPD = Relative percent difference
MSR = Matrix spike recovery
MSDR = Matrix spike duplicate recovery

A. Data Representativeness

Monitoring of the implementation project will be conducted in a manner that will indicate in-stream conditions above the treatment project and downstream of the effluent discharge point. Measurable environmental results (MERs) will be measured at the downstream monitoring point.

Streams: Stream flow measurements along with associated sampling will be performed at least once at both low baseflow and at high baseflow to determine in-stream loadings. In accordance with standard methods, field measurements will be performed for temperature, pH, and specific conductance. Water samples will be collected by the partners involved in the assessment project and will be analyzed by Mahaffey Laboratory. Lab samples will be tested for hot acidity, alkalinity, total iron, total aluminum, total manganese, TDS, and total sulfates. Samples will be chosen by the sampler to be analyzed for matrix spikes (MS)/matrix spike duplicates (MSD's) for the metals. These will be identified on the chain of custody form.

Abandoned Mine Discharges (raw water and system effluent): In accordance with standard methods, field measurements will be performed for temperature, pH, specific conductance, and dissolved oxygen (where appropriate) on AMD discharges using electronic meters. Water samples will be collected at five locations, and will be analyzed by Mahaffey Laboratory. Lab samples will be tested for hot acidity, alkalinity, total iron, total aluminum, total manganese, TDS, and total sulfates. Water sampling will be collected monthly for a period of six months to monitor for seasonal changes and their effect on the treatment effectiveness. A flow measuring devices, likely consisting of a V-notch weir, will be installed at the effluent location. All chemical samples will be collected as grab samples to limit the possibility cross contamination. The samples will be tested in the lab only. Samples will be chosen by

the sampler to be analyzed for matrix spikes (MS)/matrix spike duplicates (MSD's) for the metals. These will be identified on the chain of custody form.

B. Data Comparability

The purpose of this QA plan is to eliminate factors in sampling and analysis that reduce the comparability of data collected at different points in space and time. All sampling, analysis, and processing procedures shall be standardized to ensure comparability.

C. Data Completeness

Collection of 95 percent of the total programmed samples will be deemed as fulfilling the project objectives for data completeness.

Completeness can be calculated using the formula: $\%C = 100 \times \dfrac{V}{N}$

$\%C$ =   percent completeness
V =   number of measurements judged valid
N =   total number of measurements necessary to achieve a specific statistical level of confidence in decision making

VI. DATA GENERATION AND ACQUISITION

A. Sampling Process Design

Abandoned mine discharges and stream sample stations will be monitored on a monthly basis, on or about the first of the month. The flow will be measured at cross sections to be permanently established in the field for sample stations with sufficiently large flows to allow the use of a flow meter. The flow velocities will be measured using a Global Flow Meter. Flow volumes will be calculated using the cross section procedures developed by USGS and described in the USGS Mid-Section Velocity-Area Method, documented on the USGS website (www.usgs.gov). For other smaller flow locations, V-notch weirs will be installed. Field chemistry (pH, conductivity, temperature) will be measured using a Myron L Ultrameter. Water samples will be collected and sent to Mahaffey Lab. The data collected will be used to calculate loadings.

B. Sampling Procedures

1. Sample Collection

Water samples shall be taken at the raw water and treatment effluent, along with stream samples above and below the treatment system. Each point shall have a specific label that will be consistently used throughout the assessment.

2. Water samples

All chemical samples will be collected as grab samples to limit the possibility of cross contamination. Water samples will be collected using new polyethylene bottles provided by Mahaffey Lab. Bottles shall be labeled using water-resistant labels identifying sample point location (number), collector, and collection time and date. Sample number, date, and time shall also be written on the bottle cap using waterproof marker.

Bottles will be rinsed with the sample water before the actual final sample is collected. Rinsing shall occur downstream of the sampling location to avoid suspension of sediment which could affect the chemistry of the sample.

The sample will be collected at mid-stream and at mid-depth when safe to do so. The sampler will face upstream and dip the bottle in to mid-depth until the bottle fills to the top. The smaller bottle will have 3-5 drops of nitric acid added to acidify the metals. The bottles will be placed on ice until delivery to laboratory. All water quality samples will be tested at the laboratory for pH, conductivity, alkalinity, acidity, iron, aluminum, sulfates, manganese, total suspended solids, and total dissolved solids.

3. Field Chemistry and Temperature

At each sampling location, field measurements will consist of pH, conductivity, temperature and flow. Field measurements may also include dissolved oxygen should deep mine sources of AMD be suspected. The pH, conductivity (μS), and temperature (Fahrenheit) will be measured with Myron L 6p Ultra meter. Dissolved oxygen will be measured using an YSI 550A Dissolved Oxygen Instrument. Duplicates will be taken throughout the sampling day. All measurements will be recorded in a field book.

4. Discharge Measurements

A flow measurement will be taken with each water sample. For in stream sample points a Global Flow Probe with a digital readout will be used to measure flow velocities. Flow depths and widths will be measured using a standard tape measure. All measurements will be recorded in a field book.

C. Quality Control

Duplicate samples will be submitted to the laboratory (at least one per 15 samples). Blanks will be sent once per quarter. The formulas listed on page 8 will be used to ensure good water quality data. It will be the principal investigators responsibility to identify any problems with the precision and accuracy and contact the responsible parties.

D. Sample Custody Procedures and Analytical Methods

Water sample bottles shall be labeled at the time of collection. Each site will have its own unique identifier. This identifier will be put on the bottles along with the sampler, date sampled, and the time that the sample was drawn. This information will be entered into the field book along with pH, conductivity, temperature and flow. The information

will also be entered on the Mahaffey Laboratory LTD Mine Drainage Information/Chain of Custody Form.

Water quality samples will be delivered to Mahaffey Lab, a PA DEP accredited laboratory in Curwensville, PA. It is approximately a forty-five minute drive from the ER-8 site to Mahaffey Lab. Samples shall be delivered to the lab on the same working day as they are collected. The water will be tested at the laboratory for pH, acidity, alkalinity, conductivity, total iron, manganese, aluminum, sulfates, suspended solids and total dissolved solids (See Table 2). When samples are delivered to the lab, the chain of custody form shall be signed by both parties and a copy shall be kept for the project records.

Results of laboratory analyses shall be entered into an Excel spreadsheet once they are received from the lab. Results are typically received within two to three weeks once the samples have been delivered to the lab. Data entries are verified, and reductions are performed using computer files to eliminate transcription errors.

The majority of the time lab pH is close to what is obtained in the field. The field pH is the more accurate measurement since it is taken during the holding time for the sample. The field pH will be compared with lab pH and consistent unexplained discrepancies will lead to replacement of the field meter. In this comparison, the possible change in pH from exsolution of CO_2 or oxidation of Fe will be taken into consideration.

Field chemistry and laboratory analysis sheets are retained for a period of two years and, subsequently, archived. Excel spreadsheets containing all information are retained. Back-up copies are retained by the project manager in addition to a copy which will be kept in the filing system with hard copies of the data sheets.

The physical characteristics, chemical constituents, and analytical methods to be used on the water samples are summarized in Table 2.

computer entries to field and laboratory data sheets, examining for data gaps and missing information, re-checking flow calculations, and examining raw data for outliers or inappropriate measurements. Flags will be used to identify outliers. They will be included in the database. Flags that will be used are listed below.

L – Value has a low bias compared to other results
H – Value has a high bias compared to other results
B – Blank shows the presence of substance. Maybe be a sign of contamination in the blank.
X – Duplicate's value is high compared to other results.
Z – Duplicate's value is low compared to other results

During the data validation process, data quality or completeness issues may arise. Issues may include lost samples or results which cause data set completeness issues, or the presence of outlier data results which may skew the statistical analysis that will be used to develop the design water quality data set. The decision as to how outlier data will be handled will depend upon data completeness. Data completeness was determined to be collection of 95% of the total programmed samples. The programmed samples total 60 (or 12 months x 5 samples), so completeness would be the collection of 57 samples, at minimum. Should an occurrence resulting in the loss of more than 1 sample exist, re-sampling to re-collect the lost sample shall occur immediately. After one such loss, as described in the proceeding sentence, immediate re-sampling shall occur automatically for the remainder of the sampling period due to the small total number of samples. If the re-sampling results are outliers, the cause of the problem will be investigated. Calibration and/or maintenance techniques will be improved if there is a problem with the equipment. Samplers will be re-trained if it appears to be a case of collector's error.

Several of the sample locations are thought to have seasonal flow and as such may be dry during the summer. In this situation, the data sheet shall be marked as "dry-no sample." The inability to collect a sample due to no flow shall not be considered a failure or loss of a sample, and shall not affect the calculation of completeness of the data set.

The data collected through this project will be instrumental in determining the success of the ER-8 treatment system in remediating the mine drainage discharge and improve water quality in Emigh Run.