Ohio EPA Credible Data Program - Level III Project Study Plan
Chemical Water Quality Assessment

2-10-09

Raccoon Creek, Pierce Run Acid Mine Drainage Remediation Project
Ohio University, Voinovich School of Leadership and Public Affairs

Pierce Run is a tributary to Raccoon Creek in Vinton County that is severely impacted from acid mine drainage (AMD). The Pierce Run Acid Mine Drainage Remediation Project was funded by an EPA Section 319(h) Clean Water Act (#07(h)EPA-09) grant with matching funds from ODNR Division of Mineral Resources Management. The grant/project sponsor is the Voinovich School for Leadership and Public Affairs at Ohio University. The proposed timeline for the project is from September of 2007 to December of 2009. The project will entail implementation of an acid mine drainage treatment project consisting of a steel slag leach bed and two wetland enhancement projects to reduce metal sludge into Pierce Run and Raccoon Creek. The objective of the project is to reduce or eliminate acid loading from the Pierce Run tributary into Raccoon Creek. This will potentially improve water quality and biological communities in Raccoon Creek and potentially in the lower section of Pierce Run.

(1) Monitoring Objectives

There are two monitoring objectives of the Pierce Run project water quality monitoring. The first is to establish base line chemical and physical conditions pre- AMD treatment in Pierce Run and Raccoon Creek. The second objective is to assess improvements/changes to that condition as a result of implementing the AMD remediation project.

To accomplish monitoring and analysis objectives, water quality data collected will consist of field measurements with a Hydrolab Quanta datasonde (pH, Dissolved Oxygen, Temperature, Specific Conductivity), grab samples (to be analyzed by the ODNR Mineral Resources Management lab), and instantaneous discharge at some locations. Water quality and discharge data at the project site will be used to determine load reductions to Pierce Run and thus Raccoon Creek. Acid load reductions will be achieved through alkaline addition via this project, therefore alkalinity (i.e. buffering capacity), pH and metals (Fe, Al, Mn) are important chemical constituents to understand the effects of the project on water quality. Chemical and physical water quality data in Pierce Run and Raccoon Creek will be compared pre and post AMD treatment. The project goals are to restore Raccoon Creek downstream of Pierce Run to meet state water quality standards/criteria and established Raccoon Creek Upper Basin TMDL targets: pH 6.5 – 9.0 (USEPA), net-alkalinity of 20 mg/l (Ohio EPA), iron 1000 ug/l ccc (USEPA), aluminum 87 ug/l ccc & 750 cmc (USEPA).

(2) Point and Non-point Issues to be Evaluated

The focus of the investigation is acid mine drainage (AMD) pollution, which is considered a non-point source pollutant. The major source of AMD to the Pierce Run basin is the Oreton abandoned underground mine discharge, PR0135. The coordinates of the Oreton AMD discharge are 39 9' 36.629" North and 82 25' 3.411" South. This AMD discharge accounts for approximately 90% of the mine drainage load to Pierce Run and is the target of treatment for the Pierce Run project. Chemical and physical water quality parameters measured include pollutants associated with acid mine drainage such as alkalinity, acidity, iron, aluminum, manganese, sulfur, TDS, TSS, and others (see Table 1 and Table 2).

(3) Parameter Coverage

A. Field Measurements

Field data will be collected at all sampling locations, which consists of dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, conductivity, temperature, and discharge (i.e. stream flow). Measurements of DO, ORP, pH, specific conductivity, and temperature are measured with a Hydrolab Quanta data sonde This data is collected during grab sample collection and may also be done independently of grab sample collection as a means of a preliminary or quick assessment of stream conditions.

B. Water Chemistry - Grab Samples

Water quality samples will be collected at each sampling station and will be analyzed for Group I parameters, which is classification established by the Ohio Department of Natural Resources Division of Mineral Resource Management. Group I water quality analysis includes analysis for pH, specific conductivity, acidity, alkalinity, hardness, aluminum, iron, manganese, calcium, magnesium, sulfate, total dissolved solids, and total suspended solids.

C. Discharge

Discharge will be measured at some sampling locations to determine pollutant loadings or flow regime of sampling. Discharge measurements will always be taken at the mouth of Pierce Run (PR0010) when sampled. Other sites that will have discharge measured are the Oreton Seep (PR0135) and Oreton Wetland discharge to Pierce Run (PR0131 & PR0132). During data analysis, a mean daily discharge may be estimated for Pierce Run and Raccoon Creek sites using a flow ratio method from a downstream USGS Gage on Raccoon Creek at Adamsville, Ohio.

(4) Field Collection and Data Assessment Techniques

A. Field Measurements

Measurements of DO, ORP, pH, specific conductivity, and temperature are measured with a Hydrolab Quanta data sonde. This data is collected during water sample collection and may also be done independently of water sample collection as a means of a preliminary or quick assessment of stream conditions. The probe or sonde is placed into the stream where flow exists (at least 1 foot per second for DO), and a reading is taken and recorded once meter stabilizes.

Table 1: Precision, Accuracy, & Measurement Range for Field Chemistry Data

Parameter	Meter	Precision	Accuracy (@ 20 C)	Measurement Range
Specific Conductance	Hydrolab Quanta	4 digits	±1% of reading ±1 count	0 – 100 mS/cm
Dissolved Oxygen	Hydrolab Quanta	0.01 mg/l	±0.2 mg/l (<20 mg/l) ±0.6 mg/l (>20 mg/l)	0 – 50 mg/l
Oxidation Reduction Potential	Hydrolab Quanta	1 mV	±25 mV	-999 – 999 mV
pH	Hydrolab Quanta	0.01 units	±0.2 units	2 – 12 units
Temperature	Hydrolab Quanta	0.01 C	±0.2 C	-5 – 50 C

B. Water Chemistry – Grab Samples

Grab sampling will follow protocols established by Ohio EPA (2003). A grab sample is collected by dipping a stainless steel bucket in the middle of a flowing run section at mid-depth. An integrated grab sample will be used if the sampling location is too shallow, which utilizes a clean polyethylene sample bottle to buildup water levels to a sufficient level. The stainless steel bucket is thoroughly cleaned and triple rinsed with water from the sampling site before a representative sample is taken. Grab samples can be filtered with Whatman® 25 μm filter papers depending on the clarity of the water. A water column with less than a 100 cm of clarity as measured by a 122 cm transparency tube will normally be filtered. Once a representative sample is taken, it is divided between a 250-ml polyethylene bottle and a 500-ml cubitainer. The 250-ml polyethylene bottle is acidified immediately with five milliliters of 20% nitric acid solution. All of the air is evacuated from the 500 ml cubitainer. Both sample containers are immediately placed in an ice bath to lower the temperature below 4^0C. Samples are mailed in a secured cooler through UPS and arrive at the ODNR MRM analytical lab in Cambridge Ohio within 48 hours. A chain of custody form accompanies all sample shipments. Table 2 shows the parameters analyzed from the grab samples, the standard method used, the reporting limit, range, precision, accuracy, and the minimum detectable limit (MDL).

C. Discharge

Flow measurement procedures are based on methods established by Rantz (1982) and US Geologic Survey (2005). The device used to measure flow varies depending on the velocity of water, depth of water, and channel characteristics. When stream depth is less than 2.5 feet and flow greater than 90 gallons per minute, stream discharge is measured with a current meter (pygmy, AA meter or Sontek acoustic doppler velocimeter). Stream discharge measurements with a flow of 2.5 – 1,000 gallons per minute can also be taken with a Baski Cutthroat Flume. Discharges below ten gallons per minute, typically from seepage points, are measured using a graduated bucket, PVC pipe, and stopwatch by averaging a minimum of five timed measurements.

(5) Planned Sampling Locations

Table 3 contains all the proposed sampling locations for the project. PR0135, the Oreton AMD seep, will be monitored to determine and quantify pollutant (acidity and metals). The inflow (PR0136) and the outflow (PR0134) of the steel slag leach bed will be sampled to quantify the alkaline load generated and neutralization from the passive treatment system. PR0133, located between the two wetland sites, will be monitored to document the effectiveness of each wetland. The discharge to Pierce Run from the Oreton project site (PR0132) will be sampled to determine pollutant loads to Pierce Run pre treatment and load reductions post treatment. Mainstem Pierce Run sites (6 total) and Raccoon Creek sites (4 total) will be monitored pre and post construction to analyze any changes in chemistry or pollutant reductions as a result of AMD treatment at Oreton Hollow in Pierce Run.

(6) Schedule of Planned Sampling

Monitoring for the project will entail several components: both pre-construction and post-construction at the Oreton Seep project site, the mainstem of Pierce Run, and Raccoon Creek sites upstream and downstream of Pierce Run. Monitoring will be conducted on a quarterly basis pre treatment. Post treatment monitoring at the Oreton project site and in Pierce Run will be monthly for three months and then quarterly thereafter for a minimum of one year. Table 4 below summarizes the proposed monitoring timeline for 2008 - 2010. Monitoring will not be conducted during project construction activities, which is expected to occur January to July 2009. Monitoring will be adapted to any change in project construction timelines. Raccoon Creek sites will be monitored quarterly post treatment project.

The EPA 319 grant may expire before a year of post treatment monitoring is complete but monitoring is planned to continue with support from ODNR Division of Mineral Resources Management. This sampling regime is proposed to account for variability in water chemistry under different precipitation/flow regimes.

Table 2: ODNR-DMRM Water chemistry Lab - List of Parameters Measured and Analytical Method Used

PARAMETER	STANDARD METHOD[a]	REPORTING LIMIT	RANGE	PRECISION	ACCURACY	MDL
Wet/Dry Chemistry						
Acidity	SM2310B	5.00 mg/L	5.00-5,000 mg $CaCO_3$/L	90-110%	± 10%	N/A
Alkalinity	SM2320B	5.00 mg/L	5.00-5,000 mg $CaCO_3$/L	90-110%	± 10%	N/A
Chloride	SM4500CID & SM4110B	5.00 mg/L/0.500 mg/L*	0.500-1,000 mg/L	90-110%	± 10%	0.0080 mg/L*
Conductivity	SM2510B	10.0 uS/cm	10.0-99,300 uS/cm	90-110%	± 10%	N/A
pH	SM4500H+B	0.00-14.0 SU	0.00-14.0 SU	90-110%	± 10%	N/A
Total Dissolved Solids	SM2540C	25.0 mg/L	25.0-500,000 mg/L	90-110%	± 10%	N/A
Total Suspended Solids	SM2540D	2.00 mg/L	2.00-50,000 mg/L	90-110%	± 10%	N/A
Sulfate	SM4500SO_4D & SM4110B	50.0 mg/L/0.500 mg/L*	0.500-1,000 mg/L	90-110%	± 10%	0.0039 mg/L*
Cations						
Aluminum	SM3120B	0.050 mg/L	0.050-50.0 mg/L	90-110%	± 10%	0.0022 mg/L
Calcium	SM3120B	0.050 mg/L	0.050-50.0 mg/L	90-110%	± 10%	0.0085 mg/L
Hardness	SM2340B	0.050 mg/L	0.050-10,000 mg $CaCO_3$/L	N/A	N/A	N/A
Iron	SM3120B	0.050 mg/L	0.050-50.0 mg/L	90-110%	± 10%	0.0066 mg/L
Magnesium	SM3120B	0.050 mg/L	0.050-50.0 mg/L	90-110%	± 10%	0.0021 mg/L
Manganese	SM3120B	0.030 mg/L	0.030-50.0 mg/L	90-110%	± 10%	0.0021 mg/L
Potassium	SM3120B	0.050 mg/L	0.050-50.0 mg/L	90-110%	± 10%	0.0123 mg/L
Sodium	SM3120B	0.050 mg/L	0.050-50.0 mg/L	90-110%	± 10%	0.0196 mg/L

a – ASTM 2005. Annual Book of ASTM Standards, Water and Environmental Technology. Section 11.01: Sampling and Flow Measurement; Inorganic Constituents. Section 11.02. Organic Constituents. American Society for Testing Materials International. West Conshohocken, PA. http://www.astm.org
[OAC Ohio Revised Code: 3745-4-06(C) section (B)(2)]

Table 3: Proposed Monitoring Locations for Chemical Water Quality Monitoring

RC Site #	Waterbody	Site Description	River Mile	USGS 7.5 Minute Quadrangle	Latitude	Longitude
PR0135	Oreton Hollow	Oreton acid mine drainage discharge		McArthur	39 9' 36.629" N	82 25' 3.411" W
PR0136	Oreton Hollow	Waterloo Coal Co. sediment pond - source water for slag bed		McArthur	39 9' 35.665" N	82 25' 3.412" W
PR0134	Oreton Hollow	Steel Slag Leach bed - passive AMD treatment system		McArthur	NA	NA
PR0133	Oreton Hollow	Downstream of upper Oreton wetland		McArthur	39 9' 43.190" N	82 24' 51.667" W
PR0132	Oreton Hollow	Oreton wetland discharge to Pierce Run		McArthur	39 9' 46.298" N	82 24' 43.569" W
PR0140	Pierce Run	Pierce Run, upstream of Oreton Hollow	RM 5.35	McArthur	39 9' 55.425" N	82 25' 8.579" W
PR0130	Pierce Run	Pierce Run, downstream of Oreton Hollow	RM 4.80	McArthur	39 9' 47.433" N	82 24' 37.640" W
PR0113	Pierce Run	Pierce Run @ large truck pull off on south side of SR 160	RM 3.70	McArthur	39 9' 24.068" N	82 24' 0.780" W
PR0060	Pierce Run	Pierce Run @ Mead Rd. crossing, south of SR 160	RM 2.55	McArthur	39 9' 5.134" N	82 23' 18.200" W
PR0020	Pierce Run	Pierce Run @ Radcliff bridge, downstream of wetland	RM 1.67	McArthur	39 8' 27.962" N	82 22' 48.645" W
PR0010	Pierce Run	Pierce Run near mouth, downstream of gas line crossing	RM 0.45	McArthur	39 7' 36.789" N	82 22' 38.576" W
MSPR0085	Raccoon Creek	RC @ SR 160 near Radcliff	RM 63.0	Vales Mills	39 7' 49.614" N	82 22' 19.492" W
MSSR0015	Raccoon Creek	RC adjacent to CR 10	RM 58.6	Mulga	39 7' 13.043" N	82 22' 52.377" W
MSSR0040	Raccoon Creek	RC @ Clarion Rd bridge	RM 58.1	Mulga	39 6' 22.437" N	82 23' 3.069" W
MSSR0300	Raccoon Creek	RC @ SR 124	RM 55.5	Mulga	39 5' 2.129" N	82 23' 28.533" W

Table 4: Proposed Timeline for Chemical Monitoring

2008

Basin	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Raccoon Creek Sites												
Pierce Run – Oreton Seep Project site												
Pierce Run Sites												

2009

Basin	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Raccoon Creek Sites												
Pierce Run – Oreton Seep Project site												
Pierce Run Sites												

2010

Basin	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Raccoon Creek Sites												
Pierce Run – Oreton Seep Project site												
Pierce Run Sites												

(7) Quality Assurance and Quality Control Plan

A Quality Assurance Project Plan (QAPP) for the Pierce Run AMD Remediation project has been developed as part of the EPA Section 319 grant. The QAPP covers both chemical and biological sampling QA/QC and was submitted to Ohio EPA Nonpoint Source Program in December of 2007. The document was approved with minor revisions in January of 2008. A final approved QAPP with all signatures was submitted to Ohio EPA on February 6th, 2008 (attached).

(8) Anticipated Work Products

Work products that will be submitted to the director will be all data in the acceptable and preferred manner by Ohio EPA. Chemical and habitat data will likely be entered into online database and biological data will be mailed (hard copy) to Ohio EPA. In addition, a water quality analysis and summary generated for the EPA Section 319 grant will be submitted to the director for review. The water quality analysis will include pre and post data analysis and comparison of stream sites to Ohio EPA standards and criteria.

(9) Data Collectors and Data Verification Procedures

The project manager, Level III certified, is responsible for ensuring data accuracy during collection, database entry, and reporting. The Project Manager, Field Assistant (Level II Qualified Data Collector), and Lab Supervisor's contact information is listed in Table 5.

Table 5: Data Collectors for Pierce Run AMD Project

Project Manager	Field Assistant	Lab Supervisor
Ben McCament Raccoon Creek Watershed Coordinator Ohio University – Voinovich School of Leadership and Public Affairs The Ridges, Building 22 Athens, Ohio 45701 740-597-1473 mccament@ohio.edu	Amy Mackey Mineral Resources Intern ODNR Division of Mineral Resources Management 280 East State Street Athens, Ohio 45701 740-592-3748 amylmackey@gmail.com	Jason McClarren Lab Supervisor ODNR Division of Mineral Resources Management 325 North 7th Street Cambridge, OH 43725 470-439-5591 Jason.McClarren@dnr.state.oh.us

The project manager will be the primary chemical data collector. The field assistant, or any other person assisting with data collection, will be trained according to sampling procedures outlined in the QAPP document by the project manager and data will be verified for accuracy by the project manager. The Field Assistant is currently a Level II qualified data collector. The project manager works with the field assistant on a weekly/monthly basis collecting water quality and flow data and is trained in all aspects of collection procedures for this project and others within the watershed. Data entry will be by the project manager or checked for accuracy by the project manager before final approval and use of data for analysis.

(10) Documentation of Level III Certification

The Project Manager, Ben McCament, is a Level III certified data collector (#047) for "chemical water quality assessment" by the Ohio EPA Volunteer Monitoring Program.

(11) Contract Laboratory

Grab sample analysis will be performed by the Ohio Department of Natural Resources Division of Mineral Resources Management water quality laboratory in Cambridge, Ohio. A laboratory QAPP is attached. The lab supervisor is Jason McLarren, contact information is listed above in Table 5.

(12) Scientific Collector's Permit

Not Applicable

(13) Digital Photo Catalog

A digital photograph catalog will be maintained for ten (10) years by the Voinovich School. The catalog will contain photographs of sampling locations, areas adjacent to sampling site, land use in the area, and Pierce Run AMD remediation project photos.

(14) Voucher Species

Not Applicable

(15) Statement of No Convictions for Trespassing in the Past Five Years

I, Beany K. McCament have not been convicted of or pleaded guilty to a violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Signature: Beany K. McCament Date: 2-10-09

References

ASTM 2005. Annual Book of ASTM Standards, Water and Environmental Technology. Section 11.01: Sampling and Flow Measurement; Inorganic Constituents. Section 11.02. Organic Constituents. American Society for Testing Materials International. West Conshohocken, PA.

Ohio EPA. 2003. Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices. Ohio Environmental Protection Agency, Division of Surface Water / Division of Environmental Services. Columbus, Ohio 47 p.

Rantz, S. E. et al. 1982. Measurement and computation of streamflow – v. 1, Measurement of stage, and v. 2, Computation of discharge. U.S. Geological Survey Water-Supply Paper 2175. United States Department of Interior, U.S. Geological Survey. Washington D.C. 631 p.

US Geological Survey. 2005. Techniques of Water Resources Investigations Reports. Book 3: Applications of hydraulics, Section A: Surface-water techniques. (21 chapters). United States Department of Interior, U.S. Geological Survey. Washington D.C.