SLIPPERY ROCK WATERSHED COALITION

DeSale Restoration Area Phase II

Public Private Partnership Effort

Venango Township, Northern Butler County, PA

SLIPPERY ROCK WATERSHED COALITION

DE SALE PHASE II RESTORATION PROJECT

Venango Township, northern Butler County, PA

"A Public-Private Partnership Effort"

PROJECT PARTICIPANTS:

PA DEP Knox District Mining Office	Amerikohl Mining, Inc.
Grove City College	Aquascape
BioMost, Inc.	SRWC Volunteers
Private Landowners	WOPEC
Quality Aggregrates Inc.	Stream Restoration Inc.

SITE HISTORY: Half-century old, abandoned surface coal mining activities severely impacted a tributary to Seaton Creek within the headwaters of the Slippery Rock Creek Watershed. The flow from this essentially "dead" stream was one of the major pollution contributors to Seaton Creek.

DRAINAGE ABATEMENT: Passive treatment system installed in six weeks (7/13/00 to 8/29/00) included six components: stream intake (3' ht.); forebay (8000 SF); two Vertical Flow Ponds (in parallel with two-tier underdrain system with 2 miles piping and 4400 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate overlain by ½-foot spent mushroom compost); Settling Pond (0.2 ac., 5' depth); Constructed Wetland (1.5 ac.); Horizontal Flow Limestone Bed (2900 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate).

The treatment media generates alkalinity. Two tiers of perforated plastic pipe installed in the aggregate collect the water flowing through the Vertical Flow Ponds. The treated water discharges through the outlet control structures into a settling pond. This settling pond allows periodic flushing of the Vertical Flow Ponds in order to remove accumulated metal precipitates (mainly iron and aluminum). The wetland facilitates additional iron oxidization and settling of iron and aluminum precipitates. Finally, the water passes through a Horizontal Flow Limestone Bed, adding alkalinity and removing a portion of manganese, which discharges through a 8" perforated underdrain.

WATER QUALITY (representative)**:**

	Flow (gpm)	pH	Alk (mg/L)	Acid (mg/L)	Fe (mg/L)	Mn (mg/L)	Al (mg/L)
Pre-construction Raw	85/150	3.5/3.0	0/0	179/420	9/20	36/81	7/14
Post-construction Final	85/200	7.3	72	0	2	3	<1

total metals reported; 200 gpm design flow

FUNDING SOURCE:

Commonwealth of Pennsylvania "Growing Greener" initiative

Contributions from project partners

Stream Restoration Incorporated

A PA Non-Profit Organization 501(c)(3)
3016 Unionville Rd., Cranberry Twp., PA 16066
PH: 724-776-0161 FX: 724-776-0166 sri@salsgiver.com

Date: June 30, 2002

To: PA Department of Environmental Protection
Bureau of District Mining Operations
P.O. Box 669, Knox, PA 16232-0669

Attn: Tim VanDyke, Project Officer

Re: De Sale Restoration Area Phase II Final Report
Project# NW90624; ME# 3591053
Slippery Rock Creek Watershed, Venango Twp., Butler Co., PA
200214/FR-trans

Enclosed is the final report for the above noted project.

The De Sale Phase II passive treatment system has been online and successfully treating one of two unnamed tributaries in the uppermost headwaters of Seaton Creek for over 1½ years, since 09/28/00. The other tributary has been successfully treated passively at De Sale Phase I for over 2 years, since 05/10/00.

Please be aware that because of the strong public-private partnership effort, system upgrades, Operation and Maintenance, and the extremely valuable educational/outreach efforts which are imperative to the expansion of support for watershed restoration efforts and development of passive treatment technology, has continued since that time. Because of these on-going efforts the grant funding has been substantially exceeded. Our preliminary estimate is that **matching/in-kind is greater than $300,000** with future site work planned.

This system has resulted in spectacular improvements to the Seaton Creek ecosystem with fish and AMD-sensitive macroinvertebrates documented to have returned to the stream.

In addition to the environmental benefits, advances in passive treatment technology demonstrated at this site have been recognized nationally in professional publications by the U. S. Department of Energy and by Slippery Rock Watershed Coalition participants, which has led to improvements in system design for future projects.

We can not adequately express our appreciation to the PA Department of Environmental Protection Grants Center and the Knox District Mining Office for providing both the opportunity and the support to make this project possible.

Please review and comment on the enclosed report, as the submission of a good quality work product is important to all of us.

If there are any questions, do not hesitate to contact any of the participants.

From: Stream Restoration Incorporated

Margaret Dunn, PG; Tim Danehy, EPI; Shaun Busler, Bio.; Cliff Denholm, Env. Sci.; Deanna Treter, Office Mgr.

Copy: John Stilley, Pres. & Fred Johnson, Rec. Mgr., Amerikohl; Bob Beran, Wetland Ecologist, Aquascape; Tiff Hilton, Mining Eng., WOPEC; Fred Brenner, PhD Biologist, Grove City College; Ron Stanley, Dir., DEP Grants Ctr.; David Hess, Sec., PA DEP; Mark Schweiker, Gov., Commonwealth of PA; Mary Jo White, PA Senator; Glen Anderson, Chairman, Butler Co. Comm. Robert Dolence, VP, SAIC

SLIPPERY ROCK WATERSHED COALITION

DE SALE RESTORATION AREA: PHASE II FINAL REPORT

Seaton Creek Watershed, Slippery Rock Creek Headwaters
Venango Township, Butler County, PA

"Making It Happen" through a Public-Private Partnership Effort

A Pennsylvania Growing Greener Watershed Restoration Project

Brief Description of Project Work through Grant and Partnership Contributions

- Completed applications and received permits and approvals. Installed approved Erosion and Sediment Controls.

- Designed passive system complex (25-year design life) for an unnamed, perennial, essentially "dead", Seaton Creek tributary, conveying polluted mine drainage from extensive abandoned, surface coal mining activities in the uppermost reaches. Design basis (raw water monitoring, 75th percentile, reported in PA DEP, Knox DMO, 1988, CMRS): 204 gpm flow, 3.2 pH, no alkalinity, 233 mg/l acidity, 10 mg/l iron, 50 mg/l manganese, and 8 mg/l aluminum. (Design basis submitted to Knox DMO 7/7/00)

- Installed components in series: instream dam (height: ~3') and intake; Forebay (8,000 SF), two Vertical Flow Ponds (in parallel; two-tier underdrain system with ~2 miles of piping, 4-in., Sch. 40 PVC with perforated laterals and solid mains; combined total of 4400 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate overlain by ½ -foot spent mushroom compost); Settling Pond (area: 0.2 ac.; depth: 5 ft.); Constructed Wetland (area: 1.5 ac.); Horizontal Flow Limestone Bed (2900 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate).

- Planted Aerobic Wetlands using Slippery Rock Watershed Coalition volunteers and other participants in the public-private partnership effort.

- Continued monitoring of Seaton Creek Watershed by Grove City College and Urban Wetlands Institute with outgrowth projects including electrofishing of Seaton Creek, installation of jack dams, and bacteriological studies of passive system.

- Conducted and published Vertical Flow Pond flushing research with US Dept. of Energy.

- Conducted before, during, and after site tours for news media, community groups, watershed education programs, etc. Presented site work in the form of posters and lectures at numerous conferences and meetings. Kept photographic log.

- Submitted electronic updates, quarterly status reports, and final report; administered contract.

DEP Grant Program: Environmental Stewardship and Watershed Protection Grant
Growing Greener Initiative - $449,342

In-Kind/Matching: The Terwilliger Family; Amerikohl Mining, Inc.; Aquascape; BioMost, Inc.; WOPEC; US Department of Energy; Slippery Rock Watershed Coalition; Stream Restoration Inc. [non-profit]

PUBLIC-PRIVATE PARTNERSHIP

Water Quality Monitoring, Construction Inspection
PA Dept. of Environmental Protection, Bureau of District Mining Operations,
Po Box 669, Knox, PA 16232
GILLEN, Timothy, PG; BOWMAN, Roger, Engineer; PLESAKOV, James, MCI; ELICKER, Theresa, MCI; VanDYKE, Timothy, Insp. Supervisor; ODENTHAL, Lorraine, Permit Chief; CARLIN, Sherry, Watershed Manager; MIRZA, Javed, Dist. Mining Mgr. (814) 797-1191

Landowner
TERWILLIGER, David and Karen, 128 McJunkin Rd, Boyers, PA 16020

Passive Treatment System Construction
Amerikohl Mining, Inc., 202 Sunset Drive, Butler, PA 16001
STILLEY, John, President; JOHNSON, Fred, Reclamation Manager (724) 282-2339

Wetland Plantings, Environmental Assessment, Education and Public Outreach
Aquascape, 147 S. Broad Street, Grove City, PA 16127
BERAN, Robert, President; REIDENBAUGH, Jeff, Env. Eng.; SPENCER, Laura, Biologist; (734) 458-6610

Conceptual and Engineering Design of Passive Treatment Systems, Water Quality Monitoring, Operation & Maintenance
BioMost, Inc., 3016 Unionville Rd., Cranberry Twp., PA 16066
DANEHY, Timothy, EPI; DUNN, Margaret, PG; BUSTLER, Shaun, Biologist; DENHOLM, Clifford, Environmental Scientist; TRETER, Deanna, Office Manager (724) 776-0161

WOPEC, Rt 2, Box 294B, Lewisburg, WV 24901
HILTON, Tiff, Mining Engineer (304) 645-7633

Limestone Aggregate
Quality Aggregates Inc., 200 Neville Rd., Neville Island, PA 15225
ALOE, Joseph, President; ANKROM, Jeff, Mine Manager (412) 777-6717

Aquatic Life and Water Quality Monitoring
Grove City College, 100 Campus Dr., Grove City, PA 16127
BRENNER, Frederick, PhD, Biologist, Biology Dept. (724) 458-2113

Urban Wetland Institute [non-profit], 789 North Liberty Rd., Grove City, PA 16127
BRENNER, Frederick, President (724) 748-4310

Grant Administration, Education and Public Outreach, Volunteer Effort
Stream Restoration Incorporated, 3016 Unionville Rd., Cranberry Twp., 16066
DANEHY, Timothy, EPI; DUNN, Margaret, PG; BUSTLER, Shaun, Biologist; DENHOLM, Clifford, Environmental Scientist; TRETER, Deanna, Office Manager; TRETER, Chris, Intern; SHORT, Steve, OSM Intern (724) 776-0161

TABLE OF CONTENTS

DE SALE RESTORATION AREA PHASE II FINAL REPORT

VENANGO TOWNSHIP, BUTLER COUNTY, PA

A SEATON CREEK MINE DRAINAGE ABATEMENT PROJECT
Slippery Rock Creek Headwaters

submitted to

Pennsylvania Department of Environmental Protection

EXECUTIVE SUMMARY

Participants in the Slippery Rock Watershed Coalition received a grant from the Pennsylvania Department of Environmental Protection through the Commonwealth's Growing Greener initiative. The purpose of the grant was to fund installation of a passive system to treat an acidic, metal-bearing, stream and related education and public outreach activities.

Within four months (4/18/00 to 8/29/00) of grant approval, not only were the necessary permits/approvals received but also the passive system was designed and placed online without change orders. This economic, efficient, and effective method of project implementation is attributed to the public-private partnership effort that included federal, state, and local agencies, private industry, nonprofits, a local college, and volunteers.

The passive treatment system includes six components: an instream barrier (height: 3 feet) with overflow spillway and system intake, Forebay, Vertical Flow Ponds (two in parallel; 4400 tons limestone aggregate combined total; ½-foot compost layer in each), Settling Pond, Wetland (1.5 ac.), and Horizontal Flow Limestone Bed (2900 tons limestone aggregate). With a 200-gpm design flow, after a year of operation the improvement in discharge quality is characterized as follows; (Raw/*treated*) 3/*6*+ pH; 0/*90* mg/l alkalinity; 270/*0* mg/l acidity; 28/*<1* mg/l iron; 58/*<7* mg/l manganese; 10/*<1* mg/l aluminum. Currently, the passive system is neutralizing about 200 lbs/day of acidity and preventing about 50 lbs/day of metals from entering the receiving stream.

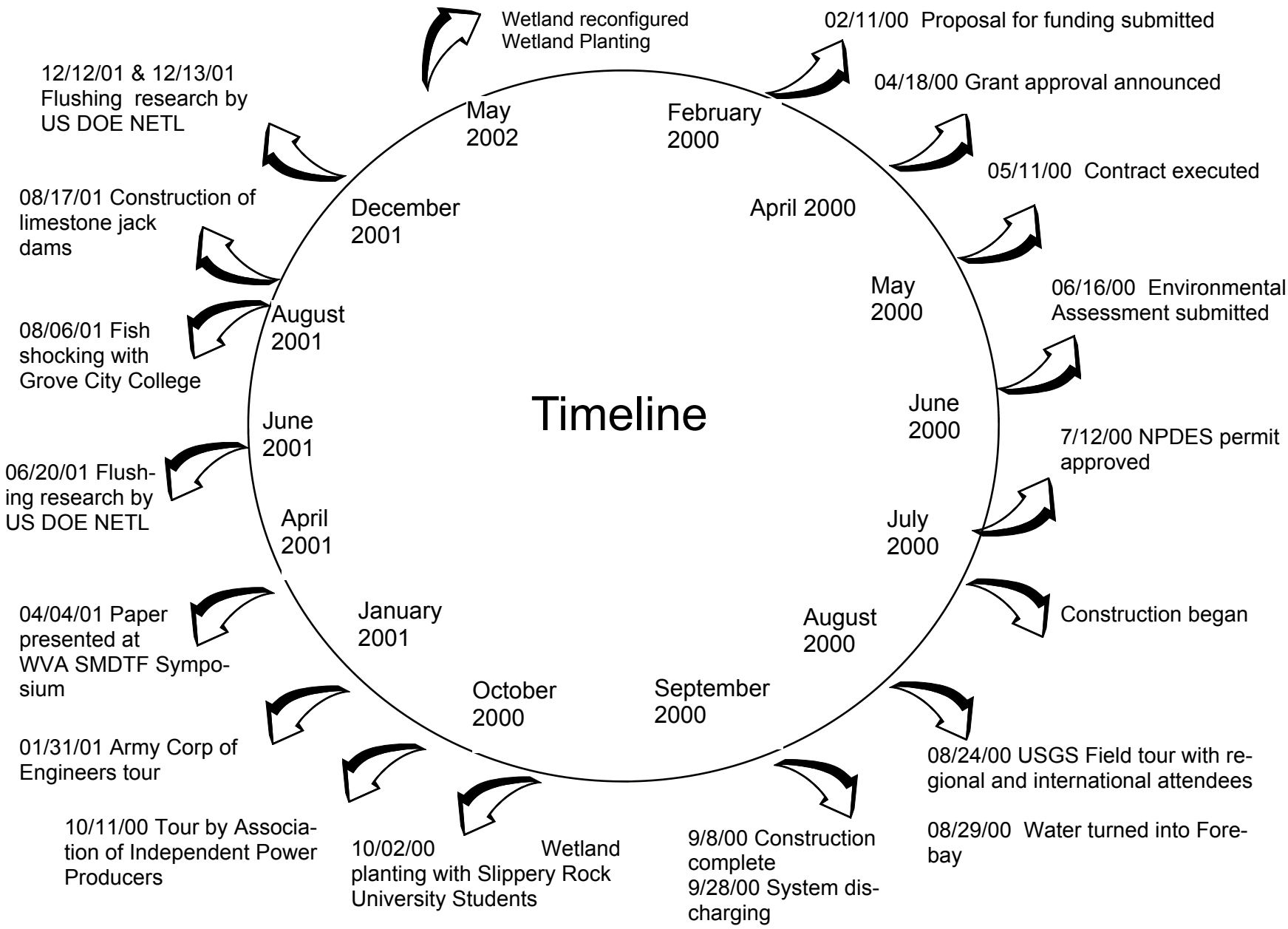
Through the partnership effort and because of the national significance of this system in the development of passive treatment technology, outgrowth projects, not originally included in the grant proposal, relating to Vertical Flow Pond flushing and effluent bacteria have been and are continuing to be conducted. The work to date, although very preliminary, on the Vertical Flow Pond flushing has led to improvements that are being implemented at the De Sale Phase III passive system and at other sites in the Commonwealth. Furthermore, the bacteriological studies have indicated that coliform, which was in question, is not present in significant numbers at the final effluent. The documented presence of manganese bacteria, however, may help explain the success in manganese removal by the Horizontal Flow Limestone Bed after a year of operation.

This project is a “Sister” project to the De Sale Phase I site completed through the Pennsylvania Department of Environmental Protection’s “Reclaim PA” initiative. The combined effect of these two innovative passive treatment systems have made a dramatic impact to the water quality of Seaton Creek, which can be most easily illustrated at sampling point #48 located at the bridge on McJunkin Road. At this location over 1½ miles downstream of the systems, Seaton Creek has significantly decreased metal loadings and the pH has increased from 4.7 to 6.5. These changes in water quality were nearly simultaneous with the completion of the De Sale Phase I & II sites. Further improvements to Seaton Creek are expected with the completion of the De Sale Phase III and Erico Bridge projects that are under construction.

In order to fully evaluate the continued effectiveness of the system and the degree of success in improving the unnamed tributary and Seaton Creek on a long-term basis, Grove City College students and faculty, Pennsylvania Department of Environmental Protection-Knox District Mining Office personnel, and other participants in the Slippery Rock Watershed Coalition will continue, based on available resources, to monitor the system after the term of the grant. In addition, continued research conducted at this site by the U.S. Department of Energy National Energy Technology Laboratory in Pittsburgh will be utilized to not only further our understanding of passive treatment systems, but also to improve this valuable and environmentally-based technology.

De Sale Phase II Restoration Area

Selected Highlights



COMPREHENSIVE TIMELINE

DEP Inspection
Tour
News Item

Date	Description
01/24/00	Water sampling
02/11/00	Growing Greener Grant proposal submitted
02/25/00	Additional information for grant provided as per request by DEP Knox DMO
04/17/00	Site investigation
04/18/00	Grant approval announced
04/19/00	Field meeting: landowner, Amerikohl Mining(AMI), Stream Restoration (SRI)
05/04/00	GP-7 submitted to Butler County Conservation District (BCCD)
05/10/00	GP-7 permit approved by BCCD
05/11/00	Contract executed by SRI
05/19/00	Access road under construction; Stream crossing in place; DEP insp. (T. Elicker, MCI)
06/04/00	Marked/Flagged area to be timbered
06/16/00	Environmental Assessment submitted to DEP
07/07/00	Design plan submitted to DEP Knox DMO
07/10/00	Erosion & Sedimentation Control Plan submitted to BCCD
07/12/00	NPDES Permit issued by BCCD; E & S Control Plan approved by DEP
07/13/00	Clearing & grubbing has begun; Wetland areas being flagged; DEP insp. (T. Elicker, MCI)
07/17/00	Site inspection
07/20/00	Silt fence partially installed; Location of passive treatment system staked out; Wetlands re-flagged; DEP insp. (T. Elicker, MCI)
07/24/00	Site inspection
07/26/00	Access road under construction; silt fence installed; Wetland construction begun; piping for Vertical Flow Ponds delivered; DEP insp. (T. Elicker, MCI)
08/01/00	Grading of constructed wetland almost complete; Excavation for Horizontal Flow Limestone Bed completed, Geotextile being placed; DEP insp. (T. Elicker, MCI)
08/07/00	19" of poor quality coal encountered and removed during excavation of wetland; Limestone placed in Horizontal Flow Limestone Bed; Final Effluent spillway constructed; DEP insp. (T. Elicker, MCI)
08/09/00	Vertical Flow Ponds being excavated, black shale encountered, removed, and replaced with clean fill; Clean fill placed in wetland; Horizontal Flow Limestone Bed completed; DEP insp. (T. Elicker, MCI)
08/11/00	Excavation for Vertical Flow Pond1 (VFP1) completed, geotextile and 6" of #2B limestone in place in VFP1; DEP insp. (T. Elicker, MCI)
08/14/00	Lower tier of pipe in VFP1 in place; limestone being placed in VFP1; Excavating for Vertical Flow Pond2 (VFP2) has been completed; DEP insp. (T. Elicker, MCI)

08/17/00	Both tiers of pipe and both layers of limestone placed in VFP1; compost being placed in VFP1; Upper tier of pipe being placed in VFP2; Excavation of Forebay begun; Wetland const. continues; DEP insp. (T. Elicker, MCI)
08/21/00	Excavation and grading Forebay nearly completed; Both layers pipe and limestone placed in VFP2; Composted being placed in VFP2; Clean fill spread in wetland; Surveying; Site inspection; DEP insp. (T. Elicker, MCI)
08/22/00	Site inspection
08/23/00	Sump dug in stream for intake, water being pumped around dam location; Compost spread in both Vertical Flow Ponds; Inlet pipes from Forebay in place; Settling Pond being excavated; DEP insp. (T. Elicker, MCI)
08/24/00	Included as part of tour organized by Chuck Cravotta of USGS with students and professors from University of New South Wales (Australia), Univ. of Pittsburgh, Ohio State Univ., Penn State Univ, as well as PA DEP, USGS, US EPA, Susquehanna River Basin Commission, US DOE, and others; Reported in 9/00 Catalyst
08/25/00	3' dam constructed in stream; Hay bale barriers placed in stream below dam for sediment control; Valves installed on outlet pipes for both Vertical Flow Ponds; Compost for wetland delivered; DEP insp. (T. Elicker, MCI)
08/28/00	Settling ponds being excavated; Forebay excavated; Vertical Flow Ponds completed; DEP insp. (T. Elicker, MCI)
08/29/00	Intake structure completed; Water turned into Forebay
08/31/00	Forebay filling with water; Settling Pond completed; Wetlands constructed with berms and compost in place; final grading being completed; DEP insp. (T. Elicker, MCI)
09/05/00	Site seeded
09/08/00	Treatment system complete except for valve boxes and wetland plantings; Forebay full and discharging into both VFPs; DEP insp. (T. Elicker, MCI)
09/12/00	Site inspection
09/19/00	VFP1 discharging into Settling Pond; Settling Pond & Wetland holding water but not discharging; DEP insp. (T. Elicker, MCI)
09/28/00	All components discharging; DEP insp. (T. Elicker, MCI) Growing Greener contract processing completed by DEP
10/02/00	Wetland planting by students from Slippery Rock University's Aquatic Plants Lab taught by Dr. John Constable; Reported in 10/00 Catalyst
10/11/00	Included in tour sponsored by the Association of Independent Power Producers (~25 attendees); Reported in 11/00 Catalyst
10/13/00	Site included in Power Point and poster presentations at DEP Growing Greener Conference
10/18/00	Valve boxes installed; DEP insp. (T. Elicker, MCI)
10/30/00	Water sampling
11/14/00	Water level in wetland being lowered; DEP insp. (T. Elicker, MCI)
11/19/00	Site included in DEP Releaf Tour (over 40 attendees); Reported in 12/00 Catalyst
11/20/00	Water sampling
12/19/00	DEP insp. (T. Elicker, MCI)
01/03/01	DEP insp. (T. Elicker, MCI)
01/06/01	Leveled pipes

01/08/01	Water sampling
01/17/01	DEP insp. (T. Elicker, MCI)
01/29/01	Pipe and flow adjustments
01/31/01	Tour of site given to Army Corp of Engineers
02/–/00	Multiple entries in "Year 2000 in Review" article in The Catalyst
02/01/01	Army Corp of Engineers letter complimenting restoration effort
02/08/01	Cubitainer Test
02/22/01	DEP insp. (T. Elicker, MCI)
02/28/01	Water sampling
03/16/01	Limestone spread on access road; Open water warning signs posted; DEP insp. (T. Elicker, MCI)
03/24/01	Water sampling; maintenance
04/04/01	Technical Paper presented at 22nd West Virginia Surface Mine Drainage Task Force Symposium focused on the innovative Vertical Flow Pond design
04/05/01	DEP insp. (T. Elicker, MCI)
04/06/01	Site included as part of virtual tour at the Slippery Rock Watershed Coalition's Annual Symposium; Reported in 4/01 Catalyst
04/20/01	Water sampling
05/04/01	DEP insp. (T. Elicker, MCI)
05/17/01	Intake pipe was cleaned
05/18/01	DEP insp. (T. Elicker, MCI)
06/—/01	Aerial photo of De Sale Phase I & II taken by PA DEP Sec. Dave Hess during a helicopter tour featured in The Catalyst
06/06/01	Water sampling
06/19/01	Barren areas reseeded; DEP insp. (T. Elicker, MCI)
06/20/01	Vertical Flow Pond East flushed not only as part of routine maintenance, but also for research conducted by George Watzlaf, US DOE, National Energy Technology Laboratory; Reported in 7/1 Catalyst; Water Sampling
07/11/01	DEP insp. (T. Elicker, MCI)
08/02/01	Water sampling
08/06/01	Fish shocking & water sampling conducted by Grove City College and Stream Restoration; Reported in 9/01 Catalyst
08/17/01	Jack dams of limestone aggregate placed by Nick Morgan, Grove City College & Shaun Busler, Stream Restoration Inc.; Reported in 10/01 Catalyst
08/30/01	DEP insp. (T. Elicker, MCI)
09/27/01	DEP insp. (T. Elicker, MCI)
11/29/01	Water sampling
12/12 - 13/01	Flush study continued by US DOE NETL; Reported in 1/02 Catalyst
02/02/02	DEP insp. (T. Elicker, MCI)
02/14/02	DEP insp. (T. Elicker, MCI)
02/15/02	Site inspection and pipe cleaning
02/17/02	Pipe cleaning
03/13/02	DEP insp. (T. Elicker, MCI)
03/14/02	Water sampling
03/18/02	Extension request submitted to DEP Knox DMO
03/21/02	Grant termination extended till 06/30/02
04/17/02	George Watzlaf presented paper at the 23rd West Virginia Surface Mine Drainage Task Force Symposium which utilized flushing data from De Sale II

05/–/02	De Sale Phase II wetland planting announced in The Catalyst
05/11/02	Included in tour before the Erico Bridge wetland planting; Inspected and cleaned Forebay piping; Installed bar guard on Forebay effluent pipe
05/23/02	Moved and replanted wetland plants before wetland reconfiguration wetland
05/24/02	Trench dug and new 8" pipe installed to convey raw water from sump to inlet of Forebay.
05/28/02	Wetland reconfigured
06/11/02	Water sampling and site inspection
06/15/02	Site inspection
06/28/02	Site inspection

PROJECT DESCRIPTION

INTRODUCTION

In northern Butler County in western Pennsylvania, coal mining has been conducted in a 27-square mile area of the Slippery Rock Creek headwaters for over 100 years. Once bustling mining communities are now either abandoned or in decline, leaving only polluted streams, coal refuse, spoil, and highwalls. The residents that stayed called Slippery Rock Creek, "Sulfur Creek", due to the affects of mine drainage. In 1970 during the Commonwealth's Operation Scarlift, the quality of the headwaters was documented to be "the most severe condition of coal mine drainage…Indeed, very little drainage from this region is produced exclusive of contact with, or issuance from mine workings." (About 4,000 acres are underlain by mine workings and 8,000 acres were included in surface mine permits.) Within the 410 square miles of the Slippery Rock Watershed, the streambed sediments in the headwaters have the highest heavy metal concentrations.

Since December 1994, participants in the Slippery Rock Watershed Coalition have been working to restore the headwaters and have successfully completed thirteen abandoned mine restoration projects. As reported in the PA DEP, Knox District Mining Office (10/01) Slippery Rock Creek Progress Report: 2001, these systems have been about 100% effective in neutralizing acidity and 60 to 100% effective in reducing metal loadings. Also reported is the significant improvement of 11 stream miles.

Based on the 1998 Compehensive Mine Reclamation Strategy Report (CMRS) by the Pennsylvania Department of Environmental Protection, Knox District Mining Office, the De Sale Restoration Area, is one of the headwater areas most heavily impacted by pollutive drainage from abandoned coal mines. About 100 acres of pre-act surface coal mining (including coal refuse disposal) on the Middle Kittanning coalbed surround the two unnamed tributaries, which form the northeastern uppermost reaches of Seaton Creek. Seaton Creek (stream # 34751; segment #4571), the most impacted, major stream in the Slippery Rock Creek headwaters, is listed on the 1998 PA DEP 303(d) list as high priority for restoration due to abandoned minelands.

The easterly, unnamed tributary in the uppermost reaches of Seaton Creek is being substantially improved by a previously installed passive treatment system at the De Sale Phase I restoration area. The system and the extensive education and public outreach efforts were funded through the Commonwealth's "Reclaim PA" initiative and matching/in-kind contributions. (Refer to De Sale Phase I Final Report, July 2000.)

Funding was received for the De Sale Phase II site through the PA DEP "Growing Greener" initiative and through substantial participant contributions. The De Sale Phase II passive system treats, except during high flow events, the entire stream flow in the westerly tributary, whose contributory drainage area is dominated by degraded seeps from pre-1977 abandoned surface mining activities on the Middle Kittanning coalbed (Kittanning Fm.; Allegheny Gp.).

Phase III (under construction), which addresses additional downstream drainage, has received funding through the "Growing Greener" initiative, Butler County Commissioners, Western Pennsylvania Watershed Protection Program, and other participant matching/in-kind contributions.

Completion of these three projects combined with the stream improvements associated with the reclaimed Able/Dreshman, Goff Station, and current Erico Bridge Restoration Area projects is predicted to substantially improve the water quality in about 5 miles of Seaton Creek.

Phase II Site Location

Phase II is located in Venango Township, Butler County along State Route 58 about 2 miles west of Eau Claire, PA. The systems are constructed on the property of David and Karen Terwilliger. There is currently no residence on the property. The site is located on the 7½' USGS Eau Claire topographic map (PR1979) at latitude 41° 08' 48" and longitude 79° 50' 00".

PRE-EXISTING CONDITIONS

Pre-act (1977 SMCRA), half-century old, abandoned surface coal mining activities severely impacted the westerly unnamed tributary to Seaton Creek. The acidic, metal-laden, pollutive mine drainage, which emanated from an area near the Middle Kittanning coal crop (Kittanning Fm.; Allegheny Gp.) flowed directly into and was the major contributing source of flow to this unnamed tributary.

Major improvements at the De Sale Phase I site through the construction of a passive treatment system and mineland reclamation significantly improved the water quality of the easterly unnamed tributary to Seaton Creek.

Due to the acid and metal loadings coupled with the lack of substrate, neither fish nor benthic organisms were found in the unnamed tributuaries and the headwaters of Seaton Creek prior to installation of the passive systems. .

Pre-Existing Stream and Drainage Characteristics: The following table depicts the site drainage relative to the stream quality prior to installation of the passive treatment system:

Pre-Existing Average/"Worst Case" Stream and Drainage Characteristics

Point	Flow	pH	Alkalinity	Acidity	Fe	Mn	Al
Discharge*	85/150	3.6/2.8	0/0	271/339	29/82	60/84	10/13
410**	130/338	4.3/3.6	0/0	152/420	7/20	35/81	7/14
48***	1160	4.8/4.4	0/0	54/124	1/5	15/34	4/10

flow in gpm; alkalinity, acidity, and total metals expressed in mg/L; pH not averaged from H-ion concentrations; (Note the maximum flows do not necessarily correspond to maximum concentrations. See attached data and water sample location map.)

**Discharge is equal to the raw water quality of the westerly unnamed tributary.*

***Point 410 is the westerly unnamed tributary to Seaton Creek sampled at State Route 58 about 500' downstream.*

****Point 48 is Seaton Creek at the McJunkin Road bridge about 1½ miles downstream.*

PASSIVE TREATMENT SYSTEM INSTALLATION

Site Preparation: Erosion and Sediment Pollution Controls were installed after plan approval by the Butler County Conservation District. Aquascape completed the Environmental Assessment and a wetland waiver was received. Road bonds and permits were handled by Amerikohl Mining, Inc. Passive system design plans were completed by BioMost Inc. and reviewed by the PA DEP, Knox District Mining Office. Army Corps of Engineers approval to divert the stream. Submission to the PA Historical and Museum Commission was not required as the proposed affected area was less than 10 acres. PA One Call relating to underground utilities was contacted and the response was no involvement. A haul road with a stream crossing was constructed following approval of GP-7. The site of the passive treatment system was cleared and grubbed.

System Construction: The passive treatment system installed at De Sale Phase II consists of the following six components in series **(See plans and photo section.)**:

1. Three-Foot Dam with Stream Intake
2. Forebay
3. Vertical Flow Ponds (two in parallel with two-tier underdrain system)
4. Settling/Flush Pond
5. Wetland
6. Horizontal Flow Limestone Bed

Selected Milestones

07/19/00	Clearing & Grubbing begins
07/26/00	Construction of Wetland begins
08/09/00	Horizontal Flow Limestone Bed completed
08/25/00	Dam completed
08/28/00	Vertical Flow Ponds completed
08/29/00	Intake structure and Forebay completed
08/31/00	Settling Pond and Wetland completed (excluding wetland planting)
09/05/00	Site seeded
09/28/00	Final effluent discharging
10/28/00	First wetland planting

Bulk Materials: Spent mushroom compost was placed in the wetlands and in the Vertical Flow Ponds in a layer above the limestone aggregate. The source of the compost is Creekside Mushroom Ltd., Worthington, PA.

Limestone aggregate was used in the spillways, Vertical Flow Ponds, and Horizontal Flow Limestone Bed. The source of the aggregate is the Quality Aggregates Inc., Boyers Quarry, Boyers, PA. The Vanport limestone (Clarion Fm.; Allegheny Gp.), is a high calcium, 90% $CaCO_3$, marine limestone.

Three-Foot Dam with Stream Intake: Due to mining through the headwaters of the unnamed tributary, the stream flow was almost exclusively degraded abandoned mine drainage. To treat the entire stream, except during high flow events, a slightly different approach was used at this site. First, the stream was temporarily diverted. Next, an approximate sixteen-foot long, three-foot high dam constructed with concrete Jersey barriers was installed within the stream channel. A pooled sump area was created and a 6-inch PVC intake pipe was installed to permit a maximum 200 gpm to flow into the passive system. This flow rate is controlled by the pipe diameter and length of pipe with the maximum head controlled by the dam. A valve was also installed. Any flow rate exceeding 200 gpm would cascade over the dam and continue to flow downstream, mixing with the treated final effluent of the passive system and other small surface and base flows. From the intake the water is conveyed to the Forebay via 6-inch, Schedule 40, PVC pipe about 130 feet in length. In May 2002, an additional 8-inch, Schedule 40, PVC pipe was added to ensure that 200 gpm would be conveyed to the system. A bar guard was also added at this time to prevent debris from entering and plugging the piping.

Forebay: The site provided only a limited amount of drop or elevation change in the preferred construction area. The Forebay conveys the flow about 400 feet, enabling construction of the Vertical Flow Ponds where the needed drop was available. The pond configuration of the Forebay provides for a small difference between inlet and outlet elevations while minimizing maintenance issues typically associated with conveying abandoned mine drainage utilizing flat pipes or open channels. In addition, the extended length of the Forebay not only conveyed the drainage from the stream intake to the Vertical Flow Pond, but also prevented settleable solids from entering the Vertical Flow Ponds. The Forebay was constructed with a bottom width of 5 feet, top width of 29 feet, 2:1 inside slopes, design water depth of about 4.5 feet, and a total depth of about 6 feet. The outlet is a single 10-inch pipe that terminates in a 10-inch to 8-inch reducer with an 8-inch tee. From each end of the tee the 8-inch pipe extensions discharge into their respective Vertical Flow Ponds. Flow rate into the Vertical Flow Ponds can be controlled by rotating a 90° elbow attached with a rubber coupler to the 8-inch pipe.

Vertical Flow Ponds: The primary purpose of the Vertical Flow Ponds is to neutralize acidity while generating alkalinity as well as precipitating dissolved aluminum. (Significant quantities of iron also form solids within the component.) The system utilizes two Vertical Flow Ponds of equal size built in parallel, designated Vertical Flow Pond East and Vertical Flow Pond West. The parallel configuration allows for the continual treatment of the discharge by one pond while maintenance activities are performed on the other pond. Geotextile was used to line the bottom and sides of the pond to the approximate elevation of the top of the limestone. Bedding stone (½-foot in thickness) was placed on the geotextile and the lower underdrain piping system was installed. Two feet of AASHTO #1 $CaCO_3$ limestone aggregate was then placed on top of the lower layer of pipes. A second (upper) underdrain similar to the first was installed and covered by a second two-foot layer of limestone aggregate. A layer, about ½-foot in thickness, of spent mushroom compost was then spread over the limestone.

An innovative underdrain system was developed in order to optimize flow distribution and flushing of accumulated iron and aluminum solids. Two layers of pipes or tiers were installed in each pond. Each tier was divided into 4 quadrants or cells giving a total of 16 cells between the two ponds. Each cell was outlet through individual discharge pipes. The underdrain was constructed of 4-inch, Schedule 40, PVC pipe. Perforated laterals were placed on 4.5-foot centers and connected to a solid header with a sanitary-type tee. Perforations were hand-drilled with two, 0.5-inch perforations approximately 30° from the top of the pipe. The perforation spacing was equal to the lateral spacing (4.5 feet). Four separate header pipes were used for each underdrain; thus, dividing the surface area into approximately equal quadrants. Each header pipe was extended from the treatment media through the breastwork to an individual 4-inch, slide-type, gate valve. Prior to the gate valve, a tee was installed about midway through the breastwork to create a riser, which leads to the primary outlet for that cell. Each outlet included a 4-inch to 3-inch rubber reducer into which a 3-inch riser (1.5-foot section with 3-inch, 90° elbow) was inserted. The reducer was equipped with two stainless steel hose clamps. The 4-inch hose clamp fastened the reducer to the 4-inch riser pipe. The 3-inch clamp was used to vertically adjust the 3-inch riser to control the flow rates within each cell.

Settling/Flush Pond: The Vertical Flow Ponds are followed by the Settling/Flush Pond, which serves two purposes. First, it acts as a Settling Pond for oxidation and settling of metal precipitates during normal operation of the system. The second purpose of the pond was to provide holding capacity for settling of solids during flushing events. A valved, draw-down device (10 inches in diameter) was added in order to have the capability to lower the water level within the pond prior to a flushing or a maintenance event.

Wetland: Naturally-functioning wetlands have both water treatment and wildlife habitat value. These wetlands allow additional oxidation and settling of metal solids. A second function is to provide wildlife habitat. Water treatment consists of “polishing” (settling of solids) and uptake, storage, and conversion of various pollutants. All of these functions are accomplished and enhanced through the use of microtopographic relief, directional earthen baffles, and vegetation with high species diversity and density.

The wetland was planted with hydrophytic species by Slippery Rock University students through professor John Constable’s Aquatic Plants class on October 2, 2000. Prior to the wetland planting the students were given a tour of the site and instructed on the types of plants, their function, and planting procedures. These activities were led by Bob Beran of Aquascape. Unfortunately, due to high water levels within the wetland and also possibly due to planting late in the year which might have prevented plants from fully establishing before cold weather, adequate vegetation was not established.

In May 2002, the wetland was reconfigured to eliminate the deep water areas. Prior to reconfiguring, established wetland plants were removed and replanted in other suitable locations within the wetland.

The plant species chosen for this system were selected from local wetlands on PA State Game Lands No. 95 and other areas with similar water chemistry thus promoting a higher probability of becoming successfully established. Naturally-occurring volunteer plant establishment will supplement and contribute to the wetland's diversity and function. Now that the wetland and other site work has been completed, additional vegetation efforts are planned utilizing a plant selection comparable to 10/02/00.

Wetland Species Planted 10/02/00

Common Name	Scientific Name	Indicator Status	Preferred Hydrology
Button bush	*Cephalanthus occidentalis*	Obligate	Inundated ≤ 3 ft.
Water Pepper	*Polygonum hydropiperoides*	Obligate	Inundated ≤ 12 in.
Broad-leaved cattail	*Typha latifolia*	Obligate	Inundated ≤ 12 in.
Soft rush	*Juncus effuses*	Facultative wet +	Inundated ≤ 12 in.
Tussock sedge	*Carex stricta*	Obligate	Inundated ≤ 0.5 ft.
Fox sedge	*Carex vulpinoidea*	Obligate	Inundated ≤ 0.5 ft.
Eastern bur-reed	*Sparganium americanum*	Obligate	Inundated ≤ 0.5 ft.
Purple osier willow	*Salix purpurea*	Facultative wet	Saturated to inundated
Purple leaf willow-herb	*Epilobium coloratum*	Obligate	Saturated
Purple stemmed aster	*Aster puniceus*	Obligate	Saturated
Blue vervain	*Verbena hastate*	Facultative wet +	Saturated
Meadow sweet	*Spirea alba*	Facultative wet +	Saturated
Swamp milkweed	*Asclepias incarnata*	Obligate	Sat./inun. ≤ 75% growing season
Flat sedge	*Cuperus strigosus*	Facultative wet	Sat./inun. ≤ 75% growing season
Silky Dogwood	*Cornus amomum*	Faculative wet	Irregularly to seasonally inun.

Horizontal Flow Limestone Bed: The primary function of the Horizontal Flow Limestone Bed is to provide an alkalinity "boost" before discharging to the stream. Much of the alkalinity generated by the Vertical Flow Ponds is consumed through the precipitation of metals, which produces mineral acidity. The additional alkalinity generated from the Horizontal Flow Limestone Bed generally provides sufficient buffering capacity to the effluent of the passive treatment system, which can help to treat downstream discharges or at least limit their impact to the stream. A secondary function, which has received national interest by the mining and reclamation community, is the ability of the Horizontal Flow Limestone Bed to remove manganese. Manganese is traditionally very difficult to treat chemically due to the high pH requirement needed for precipitation. With this component, however, high pH does not appear to be needed for manganese removal. This phenomenon is probably due to several factors including establishment of substrate, low concentrations of dissolved iron, bacteriological activity, and other factors.

The Horizontal Flow Limestone Bed contains about 5 feet of limestone aggregate. The water is conveyed from the wetland to this component through a rock-lined spillway. The water is encouraged to flow horizontally through the limestone aggregate to a perforated header along the outlet end near the base of the component. A riser pipe extends to within one foot of the top of the limestone, the design water level. The final effluent then flows in a rip-rap lined spillway and is returned to the the unnamed tributary about 1000 feet downstream of the intake.

PASSIVE TREATMENT SYSTEM PERFORMANCE

The passive treatment system at De Sale Phase II has been online and functional since September 28, 2000. In addition to monitoring by BioMost Inc. and the PA DEP, additional sampling has been conducted by Grove City College and the US Department of Energy National Energy Technology Laboratory (US DOE NETL). George Watzlaf of US DOE NETL has been conducting research regarding the effectiveness of the entire passive treatment system along with the flushing mechanism of the Vertical Flow Ponds. (See attached publications and reports.)

Even though sampling has been conducted over the last 18 months, the results must be considered preliminary when considering the design life of the system to be 25 years. The table below identifies these initial water quality characteristics through each component from the influent to the effluent. Consistently, since the system was placed online the stream flow was improved from acid to net alkaline with pH >6.

COMPARISON OF WATER QUALITY
Through the
DE SALE PHASE II PASSIVE TREATMENT SYSTEM

Component	Flow	pH	Alkalinity	Acidity	Fe	Mn	Al
Up (raw)	**61**	**3.24**	**0**	**267**	**28**	**58**	**10**
Forebay	**58**	**3.18**	**0**	**255**	**24**	**61**	**10**
VFPE	**34**	**6.85**	**59**	**0**	**5**	**43**	**<1**
VFPW	**22**	**6.89**	**79**	**0**	**5**	**44**	**<1**
Settling Pond	**~60**	**7.25**	**85**	**0**	**6**	**38**	**<1**
Wetland	**~60**	**6.87**	**57**	**0**	**2**	**38**	**<1**
HFLB (final)	**66**	**6.98**	**98**	**0**	**4**	**28**	**<1**

Average values; flow in gpm; alkalinity, acidity, and total metals expressed in mg/L; lab pH not averaged from H-ion concentrations (See attached analyses.)

Please note that the final effluent from the Horizontal Flow Limestone Bed has contained <7 mg/l total manganese during the last 5 sampling events since 02/14/02. The Dissolved Iron maintains an average of 1 mg/l. (See attached monitoring.)

Three-Foot Dam with Stream Intake: Initially, following installation of the three-foot dam, leakage was observed around the Jersey barriers, but since being sealed, the dam has functioned very well. A sump was created to pool the stream to insure constant flow into the system through the intake pipe. As long as the streamflow did not exeed the design flow of 200 gpm, the entire stream was expected to be conveyed through the system. If the stream exceeded the design flow, the excess was intended to cascade over the dam and continue downstream. Initially, no screen or guard was placed at the inlet of the intake. The pipe, at times, became clogged with debris and the flow entering the system was decreased. A bar guard was placed on the inflow pipe by BioMost, Inc. to substantially decrease the clogging potential. Furthermore, an 8-inch PVC intake pipe was installed beside the original 6-inch pipe to provide a redundancy.

Forebay: A slight decrease in metal concentrations has been observed which is probably due to oxidation and/or settling caused by a decrease in water velocity.

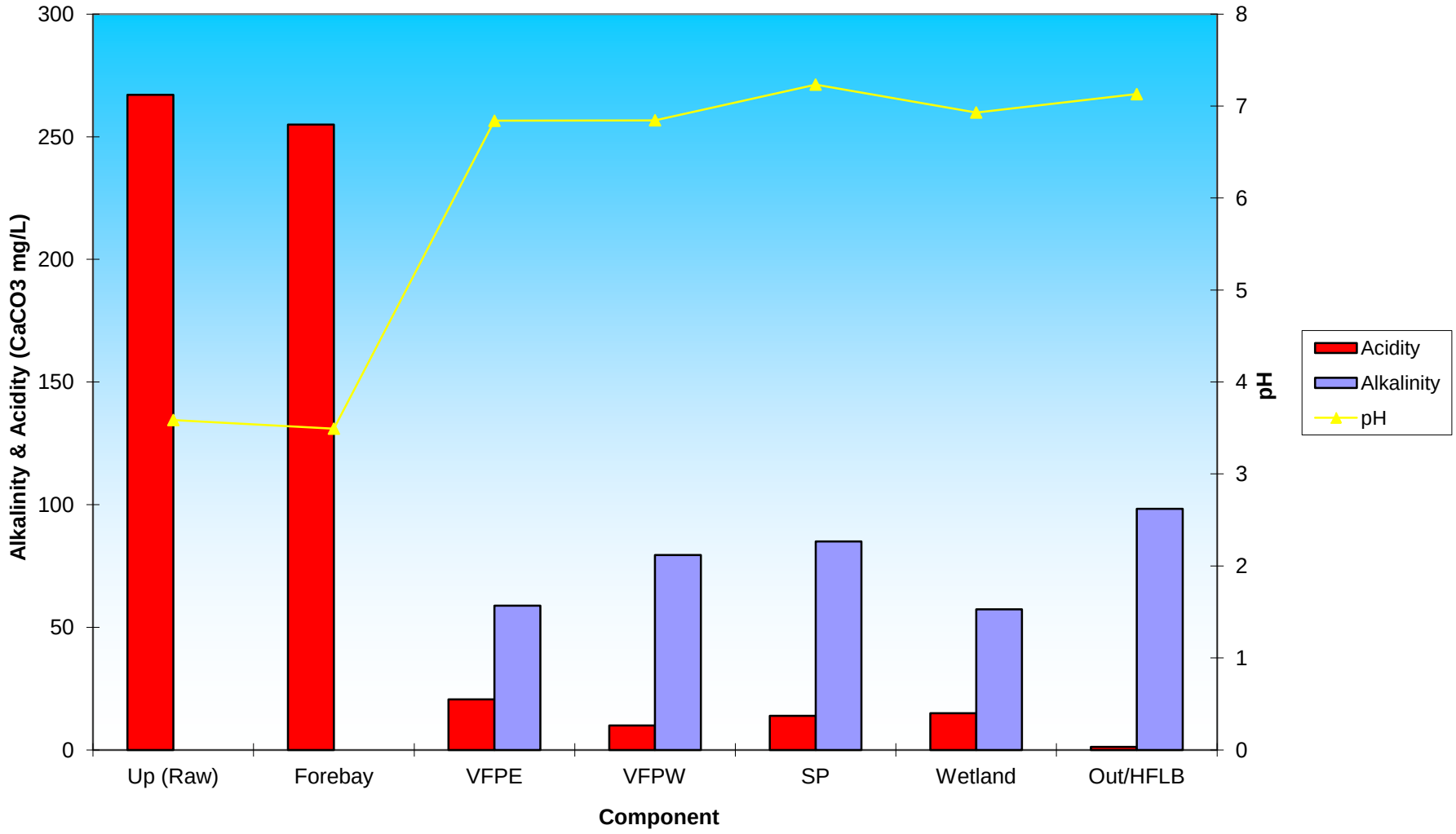
Vertical Flow Ponds: The Vertical Flow Ponds (VFPE & VFPW) have been successfully functioning with a performance comparable to similar systems constructed in western Pennsylvania. Influent to the Vertical Flow Ponds can be described as an acidic, low pH, iron-manganese-aluminum laden discharge while the effluent can be described as an alkaline-manganese discharge with low concentrations of iron and little or no dissolved aluminum. VFPE and VFPW effluent flows and water quality are generally similar. Over 190 lbs/day of acidity are being neutralized and over 33 lbs/day of metals are being retained within the system. This is a decrease in the total iron concentration by approximately 80% and a decrease in aluminum concentration by over 90%.

Settling/Flush Pond: Additional iron-bearing seepage is intercepted by this component. Dissolved iron in the effluent ranges in concentration from 0.2 to 6.7 mg/l. A slight decrease in total manganese has also been observed.

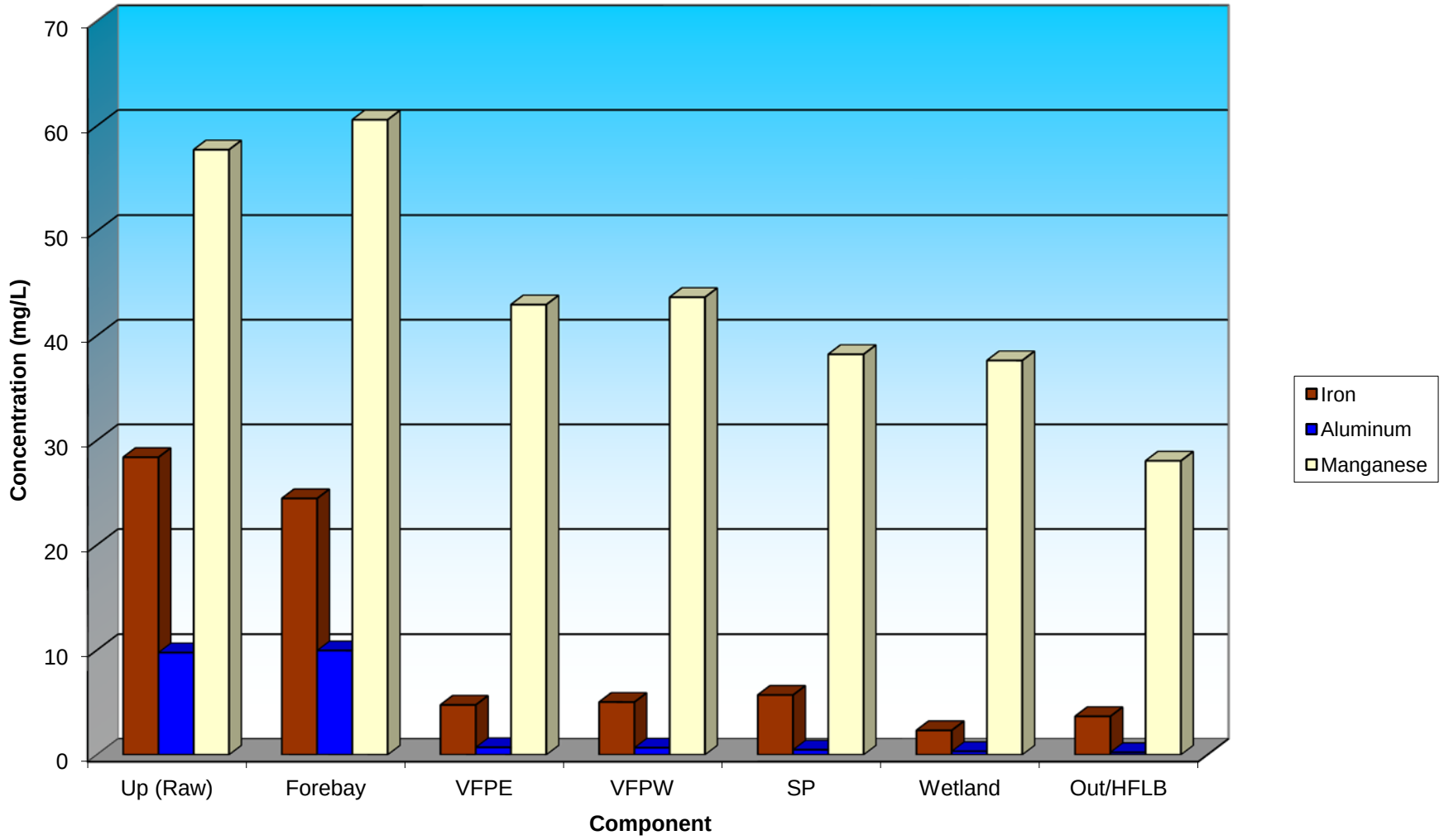
Wetland: Additional plantings are intended for the wetland. Previous activities were conducted at high water levels and at the end of the growing season. Nonetheless, the wetland is currently decreasing the iron concentration. When vegetation is fully established, greater iron removal is expected.

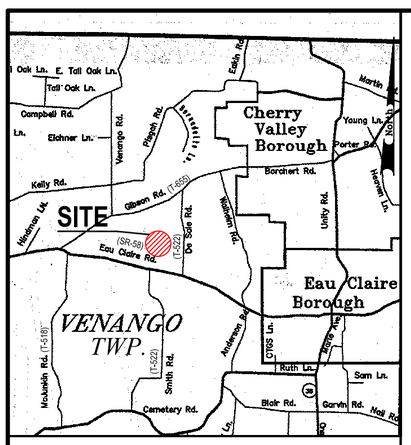
Horizontal Flow Limestone Bed: Often much of the alkalinity generated by the Vertical Flow Ponds is consumed through the precipitation of metals, which produces metal acidity. On average the alkalinity in the HFLB effluent is at least 40 mg/L higher than the influent. The additional alkalinity generated from the Horizontal Flow Limestone Bed generally provides sufficient buffering capacity to the final effluent to improve other acidic discharges downstream. Although the system has a removal average of 10 mg/L of manganese, since February 2002 there has been a removal of over 30 mg/L manganese. This is up to a 94% decrease in manganese. If the process is biological, time may be needed to establish a significant manganese bacteria colony and/or substrate. Only long-term monitoring and additional research will be able to determine the actual mechanism(s).

Comparison of pH, Alkalinity, & Acidity Throughout De Sale Phase II Passive Treatment System (Avg Values)



Comparison of Total Metals Throughout the De Sale II Passive Treatment System (Avg. Values)





LOCATION MAP

1" = 1 MILE 1 1/2 0 1

NOTE: MOST POST-CONSTRUCTION CONTOURS NOT SHOWN
POST-CONSTRUCTION CONTOURS TO BE SHOWN ON FINAL AS-BUILT PLAN
ONLY LOWER TIER UNDERDRAIN SHOWN - UPPER TIER IS CONSTRUCTED IN SIMILAR MANNER WITH 30' LATERALS
UPPER TIER UNDERDRAIN WILL BE SHOWN ON FINAL AS-BUILT PLAN.

PASSIVE TREATMENT SYSTEM SUMMARY CHART

COMPONENT	DESCRIPTION	COMMENTS
INTAKE	CONTROLLED-FLOW STREAM INTAKE	8" & 6" INTAKE PIPES
FB	7,500 SF FOREBAY	SOLIDS SETTLING/IRON OXIDIZING
VFPW	2,200 T VERTICAL FLOW POND - WEST	2 TIERED UNDERDRAIN/FLUSH SYSTEM INCL. 4 OUTLET CELLS PER TIER; 90% CCE LS
VFPE	2,200 T VERTICAL FLOW POND - EAST	2 TIERED UNDERDRAIN/FLUSH SYSTEM INCL. 4 OUTLET CELLS PER TIER; 90% CCE LS
SP	10,000 SF SETTLING POND	PARTICULATE SETTLING FACILITY WITH DRAW-DOWN DEVICE FOR FLUSH EVENTS
WL	1 1/3 ACRE AEROBIC WETLAND	PARTICULATE SETTLING FACILITY INCLUDING WILDLIFE HABITAT; APPX 1050 CY WETLAND SUBSTRATE
HFLB	2,900 T HORIZONTAL FLOW LIMESTONE BED	MANGANESE REMOVAL AND ALKALINITY GENERATION

PIPE SCHEMATIC

DISCHARGE PIPES

LAYER:	U	U	U	U	L	L	L	L	L	L	L	U	U	U	U
QUADRANT:	A	B	C	D	A	B	C	D	D	C	B	A	D	C	B	A
VFP:	W	W	W	W	W	W	W	W	E	E	E	E	E	E	E	E

NOTE:
Pipe discharge schematic drawn as if standing on the berm between the Settling Pond and Vertical Flow Pond looking northwest towards the discharge pipes.

FLUSH PIPES

VFPW								VFPE							
LAYER	L	L	L	L	U	U	U	U	L	L	L	L	U	U	U	U
QUADRANT	D	C	B	A	D	C	B	A	A	B	C	D	A	B	C	D

NOTE:
Pipe flush schematic drawn as if standing in the Settling Pond looking northwest towards the flush pipes.

Layer: L - Lower Tier; U - Upper Tier
Quadrant: Corresponds to VFP labels

Notes:
Base map and As-Built Survey by Earthtech, Inc. from EDM surveys 4/00 through 9/00 with additional information provided by Amerikohl Mining, Inc. and BioMost, Inc.

Property lines as shown are approximate only. Locations based on Butler County Tax Assessment Map 3F-16.

All pipe is Schedule 40, Solid-Core PVC unless otherwise noted.

Water surface areas and elevations subject to change based on passive component permeability and/or spillway outlet conditions.

As-Built survey is a reasonable representation of field conditions.

All dimensions are in feet unless otherwise noted.

INTAKE
CHECK DAM
FB
UNNAMED TRIBUTARY TO SEATON CREEK
1430
1420
1410
1400
1390
A
B
C
D
VFPW
VFPE
SP
WL
HFLB
1390@TOP10"
ACCESS ROAD
580' TO SR-58
North
40 20 0 40 80

LEGEND

- PASSIVE SYSTEM COMPONENT
- CONTOUR - INDEX (POST-CONSTRUCTION)
- CONTOUR - INTERMEDIATE (POST-CONSTRUCTION)
- WATER
- UNIMPROVED ROAD
- 4" PVC SCH 40 SOLID (UPPER TIER)
- 4" PVC SCH 40 PERFORATED (UPPER TIER)
- 4" PVC SCH 40 SOLID (LOWER TIER)
- 4" PVC SCH 40 PERFORATED (LOWER TIER)
- 10" SCH 40 PVC SOLID
- 10" SCH 40 PVC PERFORATED
- 8" PVC SCH 40 SOLID
- 6" PVC SCH 40 SOLID
- PROPERTY LINE (APPX.)
- CONTOUR - INDEX (PRE-CONSTRUCTION)
- CONTOUR - INTERMEDIATE (PRE-CONSTRUCTION)
- CONSTRUCTED WETLAND AREA
- RIP RAP (R-4)
- 30" CMP CULVERT
- 10" PERFORATED RISER
- 10" VALVE
- 6" VALVE
- 4" VALVE
- ADJUSTABLE OUTLET RISER
- RAW — WATER SAMPLE POINT
- A — UNDERDRAIN QUADRANT
- DIVERSION DITCH

PIPE DATA CHART

LATERAL LOCATION	LENGTH
VFPE & VFPW LOWER TIER	25'
VFPE & VFPW UPPER TIER	30'

SHEET 1 OF 2 - PLAN VIEW

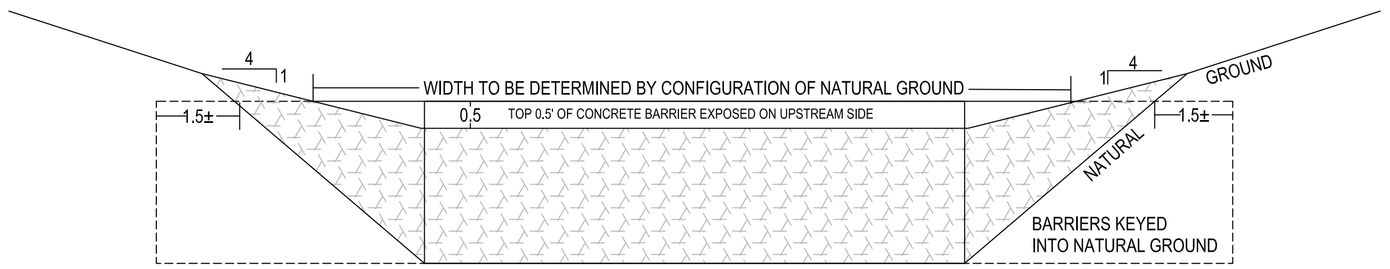
AS-BUILT (WORKING DRAWING)
PASSIVE TREATMENT SYSTEM
DE SALE RESTORATION AREA
PHASE II

Venango Township
Butler County, PA

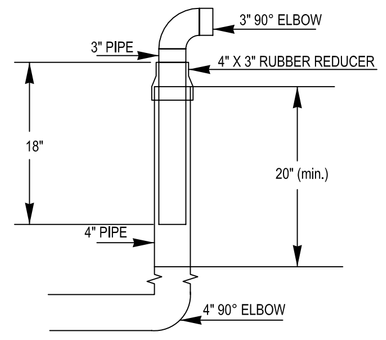
Slippery Rock Watershed Coalition
in cooperation with
Stream Restoration Incorporated

Scale: 1" = 40' Date: 6/2002
BioMost, Inc., Cranberry Twp., PA

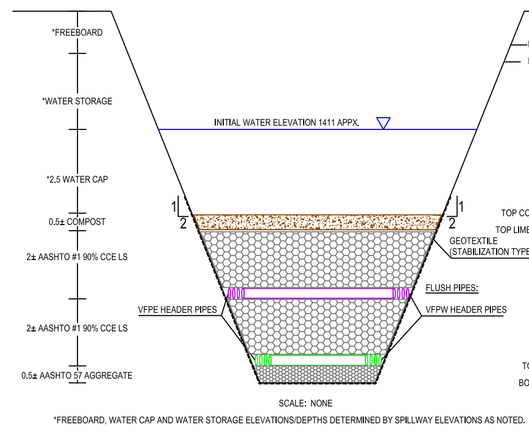
101004AB/AB1



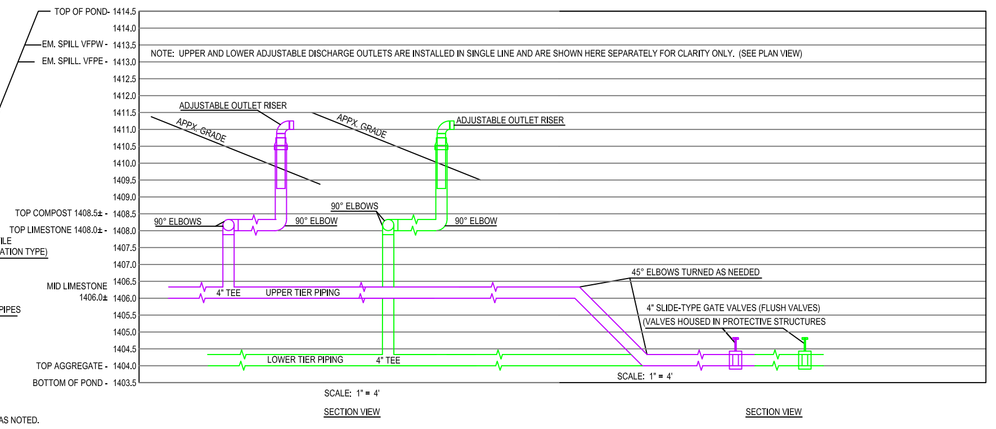
CHECK DAM UPSTREAM VIEW



OUTLET RISER DETAIL

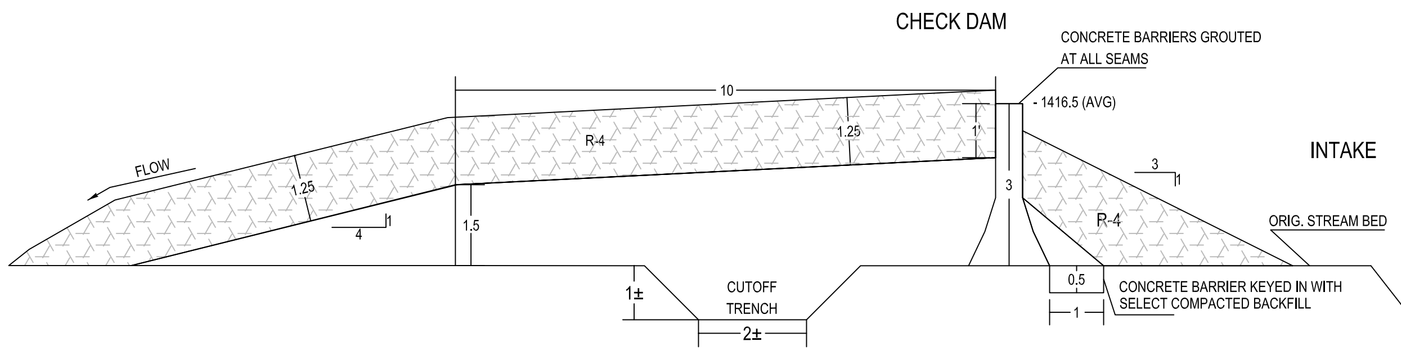


VERTICAL FLOW POND SECTION

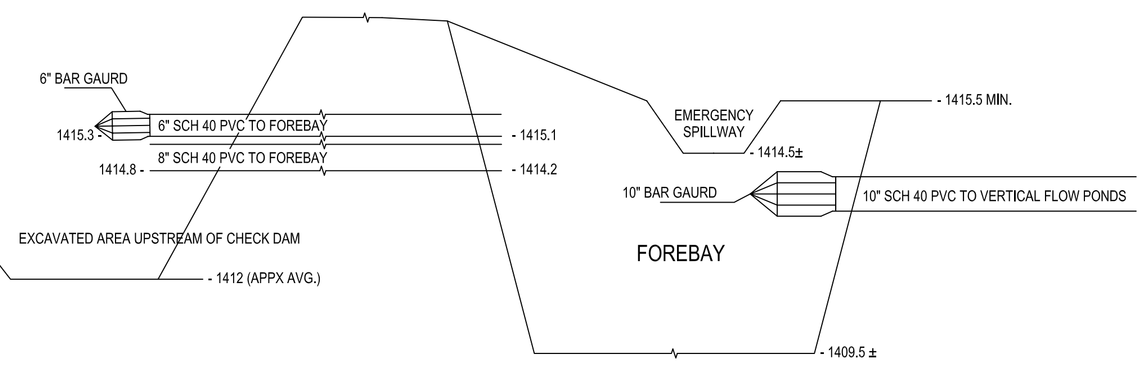


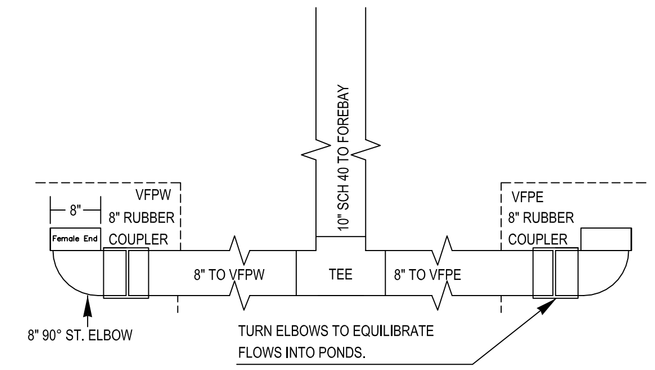
OUTLET RISER SECTION

FLUSH SYSTEM SECTION

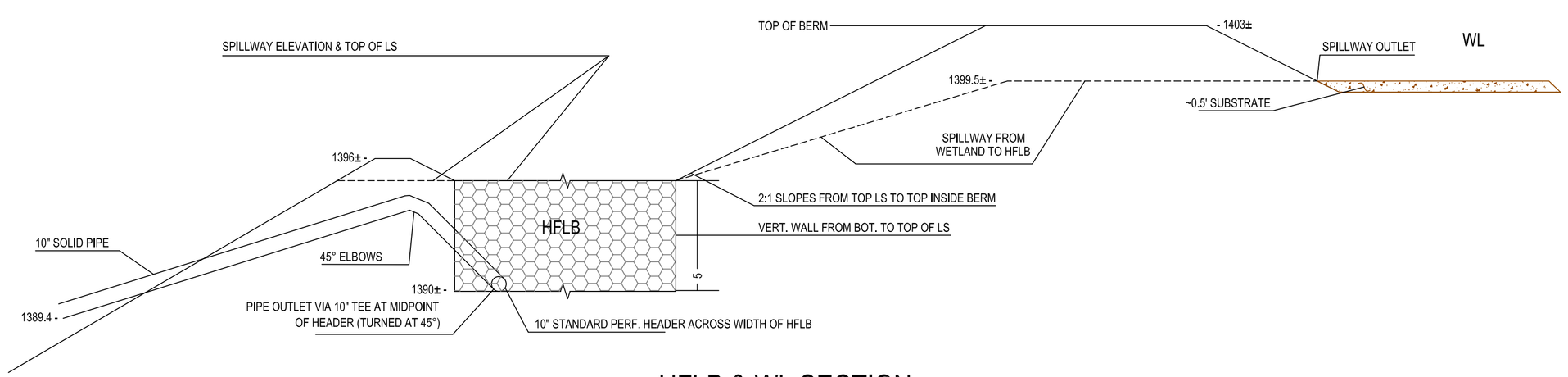


CHECK DAM SIDE VIEW

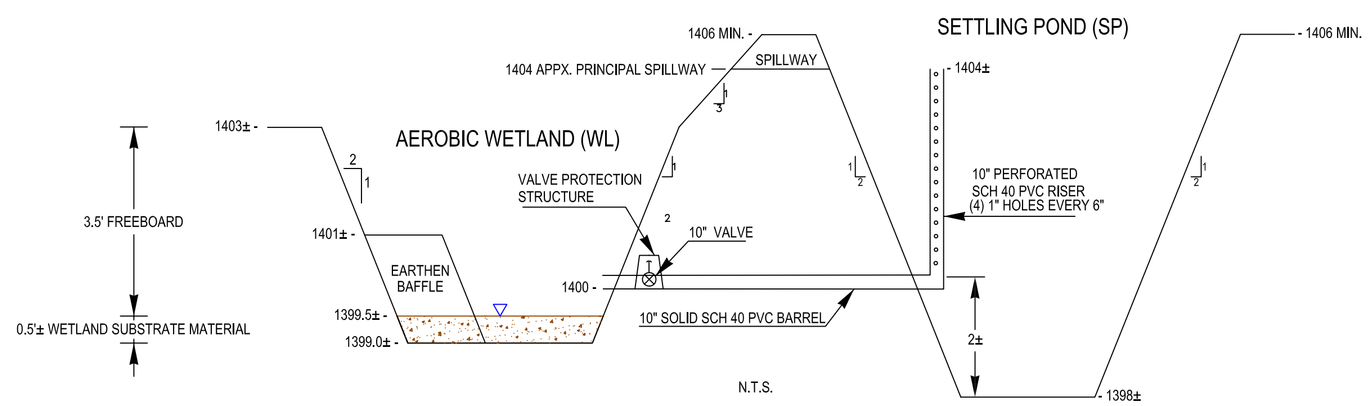




VFP INLET CONTROL DETAILS



HFLB & WL SECTION



SETTLING POND - WETLAND SECTION

Notes:

Base map and As-Built Survey by Earthtech, Inc. from EDM surveys 4/00 through 9/00 with additional information provided by Amerikohl Mining, Inc. and BioMost, Inc.

Property lines as shown are approximate only. Locations based on Butler County Tax Assessment Map 3F-16.

All pipe is Schedule 40, Solid-Core PVC unless otherwise noted.

Water surface areas and elevations subject to change based on passive component permeability and/or spillway outlet conditions.

As-Built survey is a reasonable representation of field conditions.

All dimensions are in feet unless otherwise noted.

SHEET 2 OF 2 - DETAILS

AS-BUILT (WORKING DRAWING)
PASSIVE TREATMENT SYSTEM
DE SALE RESTORATION AREA
PHASE II

Venango Township
Butler County, PA

Slippery Rock Watershed Coalition
in cooperation with
Stream Restoration Incorporated

Scale: 1" = 30' Date: 6/2002
BioMost, Inc., Cranberry Twp., PA

101004AB/AB2

MEASURABLE ENVIRONMENTAL RESULTS

Based on the last 18 months of water quality data collected by various project partners, the De Sale Phase II passive treatment system is successfully treating the abandoned mine drainage at the site. The system was first noted to be discharging on September 28, 2000. Water samples were taken at this time including the raw untreated water, passive treatment components, and stream samples. The improvement in the stream quality was immediate.

Comparison of Water Quality Before/After Passive System Construction

Sample	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum
raw/treated	3.6/7.0	0/98	267/0	28/4	58/28	10/<1
410 (before/after)	4.3/6.8	0/55	152/0	7/2	35/23	7/1
48 (before/after)	4.8/6.5	0/26	54/0	1/<1	15/8	4/<1

Average values; flow in gpm; alkalinity, acidity, and total metal concentration in mg/L; pH not calculated from average H-ion concentrations; (See attached analyses.)

410 is the westerly unnamed tributary to Seaton Creek sampled at State Route 58 about 500' downstream of the passive system.

48 is Seaton Creek at the bridge on McJunkin Road about 1½ miles downstream of the passive system.

Note that the final system effluent has contained < 7 mg/l manganese during the most recent 5 sampling events.

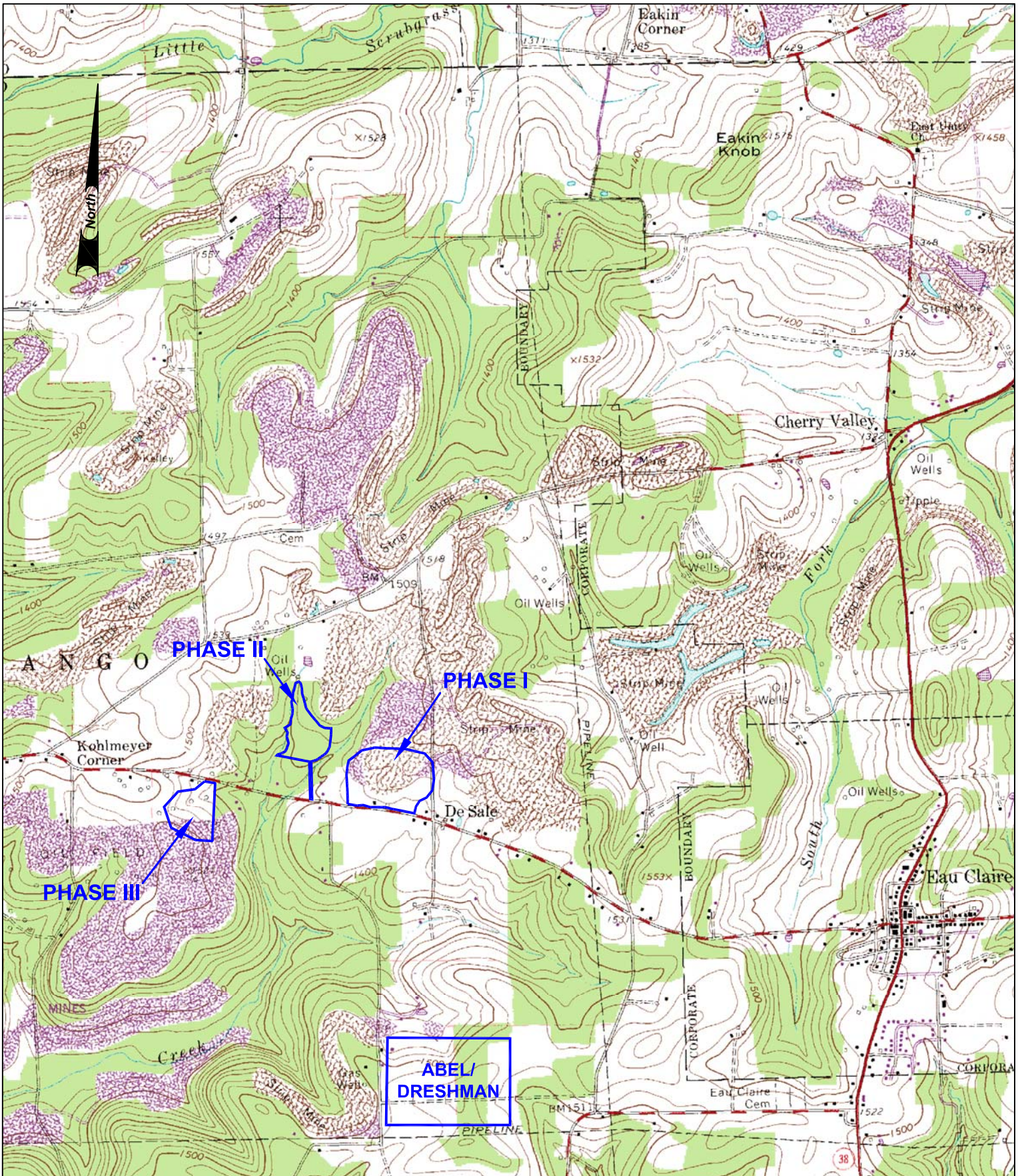
Passive Treatment System: The final effluent can be characterized as a net alkaline-manganese discharge with low concentrations of iron and aluminum. The total iron concentration meets standard surface mine permit effluent limits. On average, the system is neutralizing about 35 lbs/day of acidity and preventing about 47 lbs/day of metals from entering the unnamed tributary to Seaton Creek.

Impact Upon Receiving Stream: The effect upon the westerly unnamed tributary (receiving stream) to Seaton Creek was practically instantaneous on September 28, 2000 when the system began discharging as can be seen by both the chart below and accompanying graphs. Sample point 410, which is also known as DEP sampling point 23, is located at the culvert along State Route 58 which is downstream about 500 feet from the passive treatment system effluent. The stream, which had been an acidic, low pH, iron-aluminum-manganese-laden watercourse, is now circumneutral and net alkaline, containing significantly lower concentrations of metals.

Collective Impact Upon Seaton Creek: De Sale Phase I and Phase II were online within only a few months of one another. Due to a lack of sampling data between the completion of the two systems, the individual improvements from each system to Seaton Creek are rather difficult to discern. The combined affect, however, can be addressed. Seaton Creek sample point 48 is located at the bridge along McJunkin Road. The point is downstream of the De Sale Restoration Area and upstream of the

Erico Bridge Restoration Area. Again the impact was almost instantaneous, changing from a deteriorated acidic low pH, metal-laden, stream to a net alkaline low-metal stream. (See attached graphs.) A fish survey conducted in late summer of 2001 revealed that fish are now present in this section of Seaton Creek. Previous aquatic surveys by Grove City College students indicated that there were essentially no macroinvertebrates and no fish.

Long-Term Impact: Water monitoring of the systems and associated streams would continue to document the long-term effectiveness of passive technology to treat abandoned mine discharges. An annual electrofishing program would also document the biological and substrate recovery of these streams.

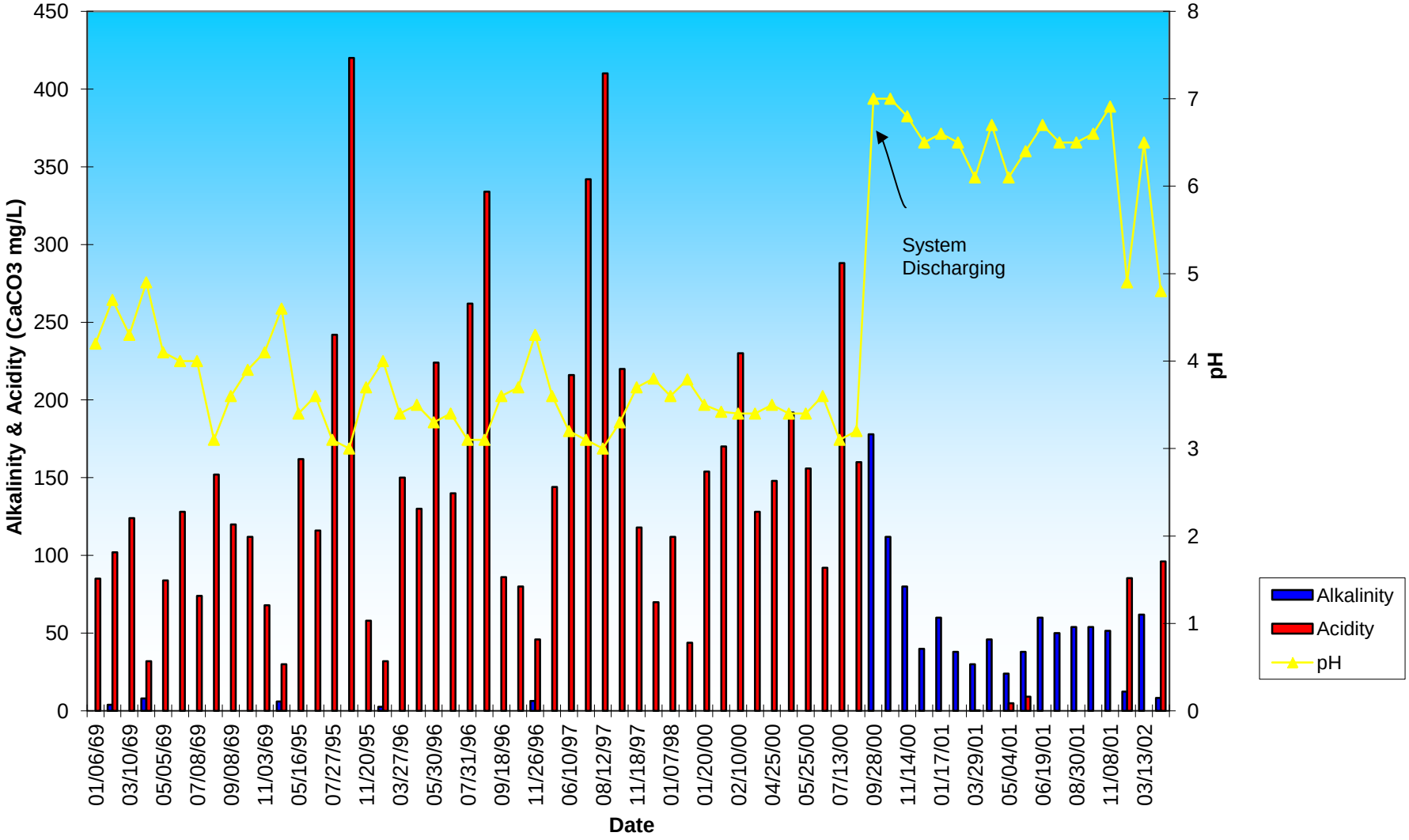


PROJECT LOCATION - USGS 7.5' EAU CLAIRE, PA (PR1979)
DE SALE RESTORATION AREA - PHASE I, PHASE II, AND PHASE III

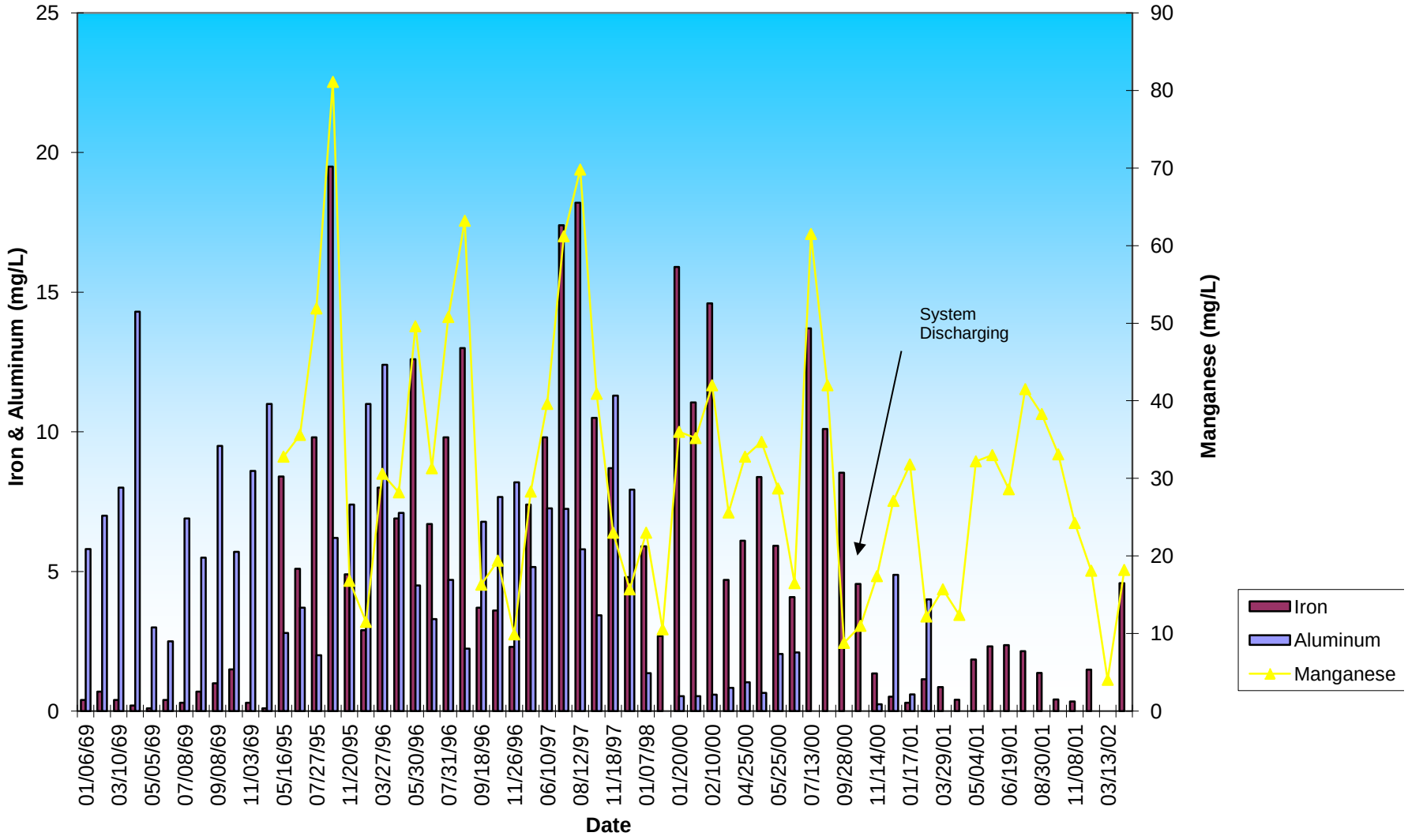
Slippery Rock Watershed Coalition
Venango Township, Butler County, PA
Stream Restoration Incorporated
January 2007, Scale 1" = 2000'

BioMost Inc/1110102/De Sale Location Map

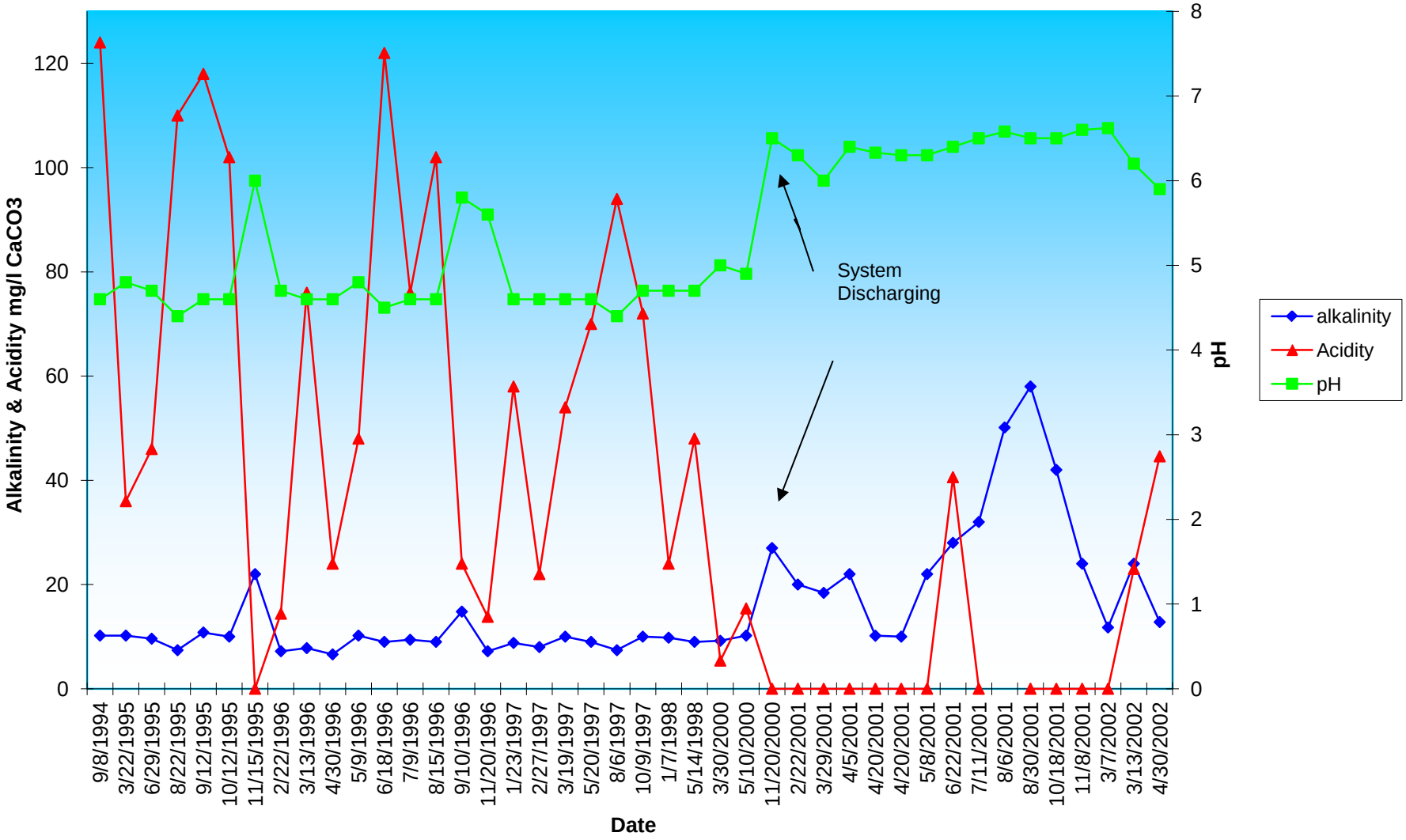
Comparison of pH, Alkalinity, & Acidity of Sampling Point 410 Over Time



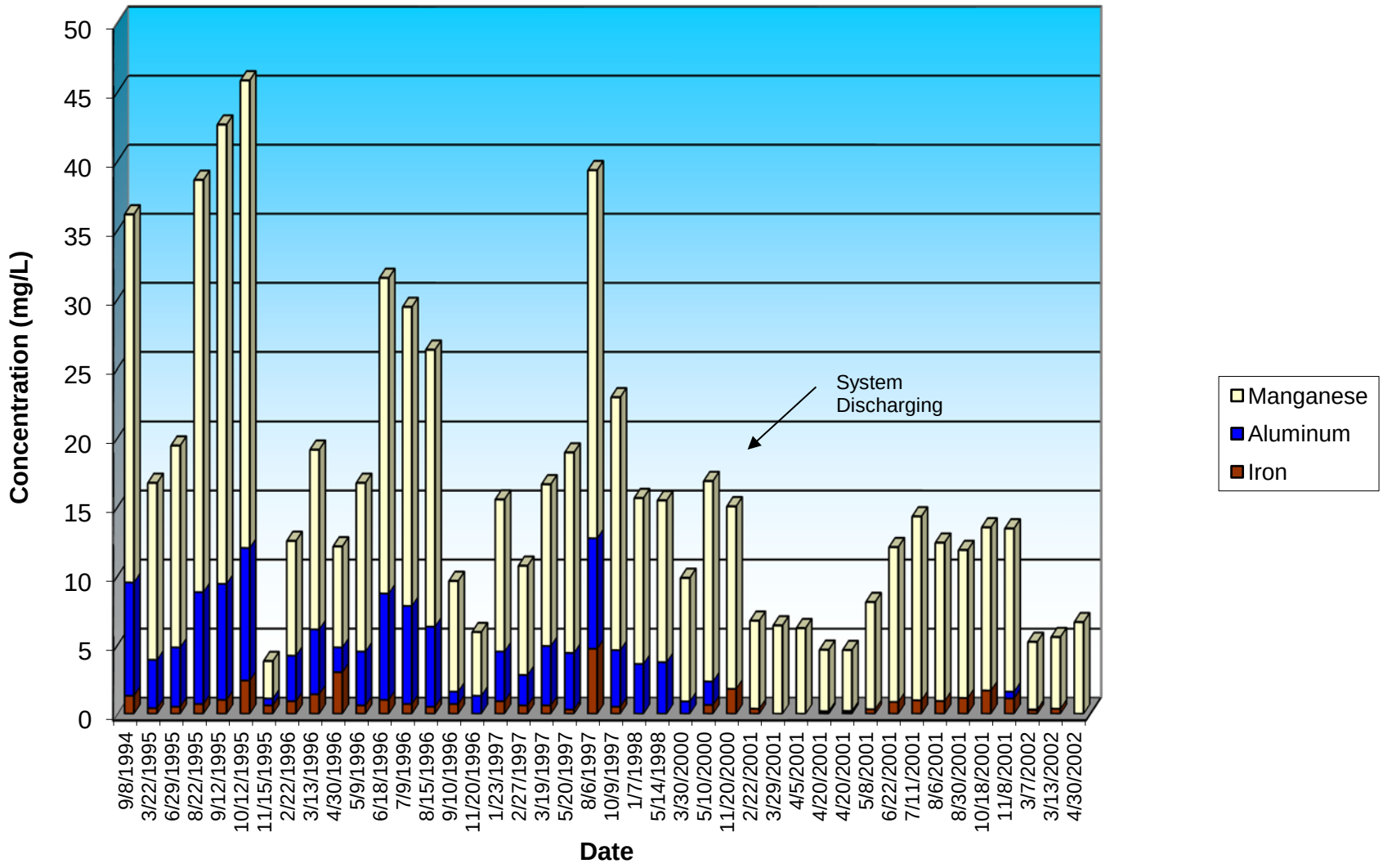
Comparison of Metals at Sampling Point 410 Over Time



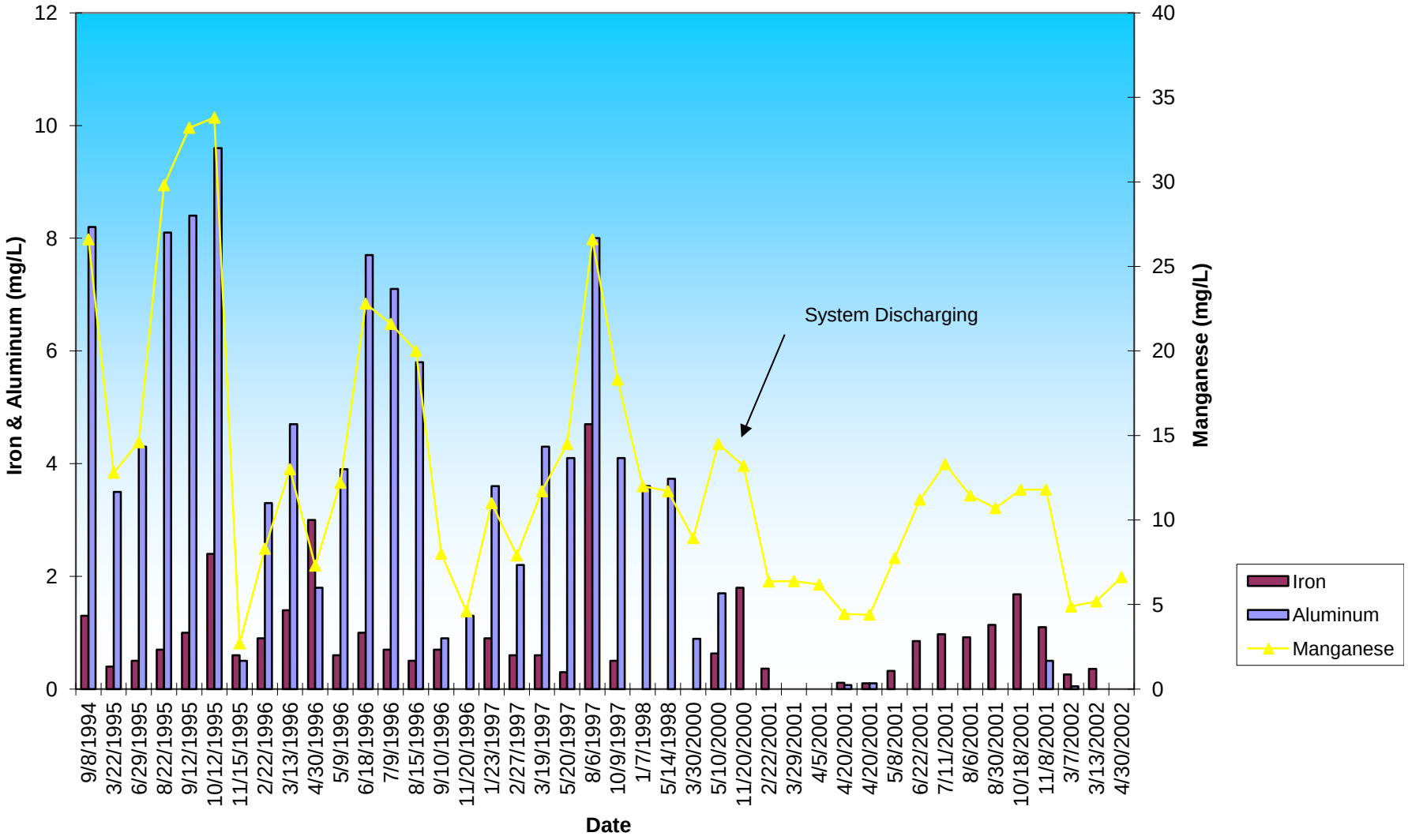
Comparison of pH, Alkalinity, and Acidity of Sample Point 48 Over Time



Comparison of Metals at Sampling Point 48 Over Time



Comparison of Metals at Sampling Point 48 Over Time



EDUCATIONAL OPPORTUNITIES

The De Sale Restoration Area Phase II site has been utilized for significant educational studies with interest nationally from abandoned mine restoration professionals and students.

Grove City College biology students under the direction of Dr. Fred Brenner are utilizing the site for both education and research. Here, the students not only gain "hands-on" experience with passive treatment systems but also have the opportunity to conduct unique research. One area of research that is being conducted by Grove City College involves examining the relationship between bacteriological activity and water quality. (See attached table showing results.) A summary of the data completed to date has been included. Additional research that is being conducted by Grove City College students involves the use of small jack dams constructed of limestone placed within the easterly and westerly unnamed tributaries of Seaton Creek. (See photos.) Aquatic life surveys including electrofishing have documented the return of fish to Seaton Creek. (See attached brief report.)

Another partner conducting research at the site is the United States Department of Energy National Energy Technology Laboratory (US DOE NETL). The lead for this effort is George Watzlaf, Research Engineer. Not only is DOE examining the effectiveness of passive treatment systems, but also the group is conducting research on the innovative underdrain system designed by Tim Danehy of BioMost, Inc. George Watzlaf has published a paper based on his research entitled *Quantitative Results From the Flushing of Four Reducing and Alkalinity-Producing Systems* published in the Twenty-Third West Virginia Surface Mine Drainage Task Force Symposium proceedings. This paper is included in this section of the Final Report.

BioMost, Inc, another partner of the Slippery Rock Watershed Coalition, has also conducted research on their innovative two-tiered flushing system. A result has been two papers, one of which is included in this final report entitled *Vertical flow Pond Piping System Design Considerations* that was presented and published in the proceedings of the 19th Annual National Meeting of the American Society for Surface Mining and Reclamation.

In addition, the site has been utilized for other educational purposes, including numerous tours given by participants of the Coalition. The site has also been described in lectures, posters, and Power Point presentations at various conferences, symposia, and workshops held locally, regionally, and nationally while various articles have been written that included the site. As education/outreach has always been an important goal, the Slippery Rock Watershed Coalition will continue to encourage use of the site for these purposes. (See Photos and Outreach section of this report.)

SEATON CREEK: BRIEF UPDATE

August 6, 2001

Participants: Dr. Fred Brenner, Nick Morgan; Grove City College
Shaun Busler, Cliff Denholm; Stream Restoration Incorporated
John Lawrence; volunteer, Slippery Rock Watershed Resident
Chris Treter; Grove City College, OSM Intern, SRI

Site	Description
De Sale Phase II Raw 	Seaton Ck. Headwaters above restoration pH – 3.2 D.O. – 8 Substrate - mud, leaves, iron precipitate Accumulation of sediment Scattered riffle and pool areas - 3 pools & 1 riffle Modified channel - mining and oil wells No fish were observed No macroinvertebrates observed
McJunkin Road 	Downstream of De Sale passive systems & Chernicky reclamation: pre-restoration pH 4.5 pH - 6.8 Temp - 24 Alk – 32 Acid – 66 DO – 7 Not much precipitate, but still much accumulated sediment Wetland mixed throughout stream Fish Survey - 4 five-spine stickleback, 1 crayfish, 1 common shiner, 1 pumpkinseed
Seaton Creek @ Erico Bridge 	Future restoration area – Growing Greener Round 3 pH - 6.2 Alk - 14 Acid - 62 DO – 6 Thick iron precipitate deposits - too deep to enter Seaton Ck. under bridge Iron content in the stream too high to conduct electro fishing. Kept shorting out generator No fish observed

Murrin Run 	Near where gob removed at Goff Station pH - 7.2 Temp - 23 Alk – 69 Acid – 26 DO – 3 Well-developed riparian buffer on the right (when looking upstream). Insects - midge larva, caddisfly (Hydropsyche?), water strider Fish Survey - 2 crayfish, 1 bullhead, 8 common shiner, 1 johnny darter, 1 big green frog
Seaton Creek @ Goff Station Road 	Downstream of all restoration areas pH - 6.9 Temp - 22 Alk – 30 Acid - 32 DO – 7 Sediment accumulation in every pool Scattered pools and riffles - 1 pool & 1 riffle Insects - caddisfly (Hydropsyche?) Fish Survey - 1 johnny darter, 4 common shiner, several green frogs

Bacteriological and Chemical Analysis of Water Samples from the De Sale Phase II Passive Treatment System

Sample Point	Date	Temp (C)	Coliform			Iron Bacteria		Manganese Bacteria		BOD mg/l	Cond. Ohms/ cm	TDS mg/l	pH (F)	pH (L)	DO mg/l	PO_4 (mg/l)	NH_4 -N mg/l	NO_3 mg/l	TSS mg/l
			MPN/ 100 ml	Range	Plate Count	Aerobic /ml	Anaerobic/ ml	Aerobic/ ml	Anaerobic/ ml										
UP	01/08/01		ND	-	10	2	26	24	101	5.1	1500	960		4.04	7.8	1	3.8	<1	2.4
VFP	01/08/01		ND	-	125	52	86	25	146	3.3	1300	880		5.83	4.8	8.8	2.8	<1	2.1
WETLAND	01/08/01		11	4-29	135	6	40	112	90	2.7	1000	890		6.16	5.5	10.1	1.5	<1	2.5
HFLB	01/08/01		ND	-	35	8	2	65	30	2.8	1500	900		6.61	5.2	2.2	0.64	<1	1.2
UP	03/28/01	10	ND	-	3	18	3	1	ND	0.94	1300	1360	4.5	4.47	1.48	0.5	1	ND	13.2
VFP	03/28/01	5	5	<0.5-13	27	37	11	14	5	1.01	1300	1500	6.3	6.64	1.51	8	0.4	0.5	1.8
WETLAND	03/28/01	5	ND	-	30	45	9	23	7	2.31	1300	1700	6.8	6.76	4.51	2	0.2	0.5	1.6
HFLB	03/28/01	4	ND	-	74	36	6	51	33	2.73	1400	1740	7.2	6.8	4.12	1	0.2	ND	1.1
UP	04/30/01	8	23	7-70	7	3	20	9	6	0.58	1000	756	3.6	4.7	1.82	<0.8	0.6	0.5	16.1
VFP	04/30/01	11	8	1-19	92	36	26	173	98	0.52	1200	789	6.5	6.2	1.6	0.8	0.4	<0.5	15.3
WETLAND	04/30/01	9	79	25-109	55	40	35	147	70	0.5	1000	769	7	6.96	1.64	<0.5	0.4	<0.5	14.1
HFLB	04/30/01	8	ND	-	117	20	25	151	80	0.52	1100	788	7.2	6.95	1.5	<0.5	1	<0.5	15.2
UP	06/21/01	17	ND	-	40	8	3	50	70	3.6	2100	1875	4.5	3.26	5.4	0.5	0.6	ND	2.8
VFP	06/21/01	24	ND	-	127	11	2	67	46	1.4	1800	1797	6.3	6.16	2.2	20	1.2	ND	5.5
WETLAND	06/21/01	23	23	9-56	155	10	5	63	27	1.9	1000	1126	6.8	6.41	3.6	8	0.5	ND	1.9
HFLB	06/21/01	22	2	1-10	107	2	12	74	97	1.6	1000	1244	7.3	6.51	2.6	6	0.6	ND	2.1

QUANTITATIVE RESULTS FROM THE FLUSHING OF FOUR REDUCING AND ALKALINITY-PRODUCING SYSTEMS[1]

George R. Watzlaf,[2] Candace L. Kairies,[2] Karl T. Schroeder,[2] Timothy Danehy,[3] and Richard Beam[4]

ABSTRACT

Two reducing and alkalinity producing systems (RAPS) at the De Sale II site in Butler County, Pennsylvania and two RAPS at the Oven Run B site in Somerset County, Pennsylvania were flushed. At the De Sale II site, the right RAPS (two RAPS are configured in parallel) was flushed nine months after construction. Eight flush pipes were flushed sequentially for nine minutes each. A total of 18,400 gallons were removed during the flush, which amounted to 5 % of the total volume of water within the RAPS. Only 3.1 lbs. of iron and 2.0 lbs. of aluminum were removed during the flush. This amounted to 0.2 % and 0.3 % of the iron and aluminum that had been retained within the RAPS, respectively. The left RAPS at the De Sale II site was flushed 14 months after construction. Four pipes draining the upper part of the RAPS were flushed simultaneously for 11 hours. The remaining four pipes that drained the lower part of the system were then opened and allowed to flush for four hours, completely draining the system of 378,000 gallons of water. A total of 22.1 lbs. of iron and 14.4 lbs. of aluminum were removed during the flush. This amounted to 1.1 % and 1.3 % of the iron and aluminum that had been retained within the RAPS, respectively. At the Oven Run B site, RAPS 1 (two RAPS are configured in series) was flushed four months after construction. Three flush pipes were flushed 20 minutes each. A total of 131,000 gallons were removed during the flush, which amounted to about 6 % of the total volume of water within the RAPS. A total of 432 lbs. of iron and 167 lbs. of aluminum were removed during the flush. This amounted to 3.0 % and 2.2 % of the iron and aluminum that had been retained within the RAPS, respectively. Two additional similar flushes were documented at the Oven Run B site. While none of these flushes removed a significant percentage of the metals retained within the system, only a small percentage of the void volume was calculated to be filled with precipitates (0.25 % - 5 %) at the time of the flushes.

INTRODUCTION

Numerous passive treatment systems have been constructed to treat mine drainage over the past two decades. The effectiveness of these systems has varied widely. Many systems receiving net alkaline mine drainage or net acidic drainage that contains very low ferric iron and aluminum concentrations have been very effective. Ponds and aerobic wetlands are used to treat net alkaline drainage to oxidize, precipitate and settle iron. Iron removal rates are typically 10-20 grams per day per square meter of surface area (Hedin et al. 1994). Net acidic drainage with very low ferric iron and aluminum concentrations is directed through anoxic limestone drains which add bicarbonate alkalinity (100 –300 ppm as $CaCO_3$) and in many cases results in net alkaline water (Watzlaf et al. 2000a). Mine drainage containing ferric iron and/or aluminum has been more problematic. Ferric iron is thought to armor limestone, significantly lowering its rate of dissolution. Aluminum, which will precipitate at the higher pH within ALDs, can quickly clog the pore spaces between the limestone rocks and cause the system to fail (Watzlaf et al. 2000a). Compost wetlands have been used to treat this type of water with limited success. These surficial-flow wetlands contain a compost and limestone layer. The required size for effective treatment using compost wetlands can be extremely large. Compost wetlands remove acidity at a rate of 3.5 – 7 grams per day per square meter of surface area (Hedin et al. 1994). Therefore, to treat a modest 25 gal/min flow of pH 3.0 water containing 100 ppm Fe (50 ppm ferric and 50 ppm ferrous) and 20 ppm Al, a wetland of 2 to 4 acres would be required. To reduce the size requirement of compost wetlands, systems were constructed to force the water to flow down though the compost and limestone layers (Kepler and McCleary 1994). These systems are called successive alkalinity producing systems (SAPS) and vertical flow systems.

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[1] Paper presented at the West Virginia Surface Mine Drainage Task Force Symposium; April 16-17, 2002; Morgantown, WV

[2] U. S. Department of Energy; National Energy Technology Laboratory; Pittsburgh, PA 15236

[3] Biomost, Inc.; Cranberry Township, PA 16066

[4] Pennsylvania Department of Environmental; Ebensburg, PA 15931

To be more descriptive, these have been termed reducing and alkalinity producing systems or RAPS (Watzlaf et al. 2000b). RAPS are commonly constructed with 2 – 3 feet of limestone. A network of perforated pipes is placed in the bottom of this limestone layer. On top of the limestone, a 0.5 – 2 feet layer of organic matter is placed. Typically the organic material is spent mushroom compost, which consists of horse manure, hay, straw, chicken manure and gypsum. Mine water flows down through the system, encountering the reducing environment of the compost before contacting the limestone. The compost layer is intended to remove the dissolved oxygen and convert any ferric iron to the ferrous state to avoid armoring of the limestone. It is thought that RAPS may be less prone to plugging with aluminum than ALDs because of their larger cross-sectional areas (perpendicular to flow paths) and higher available head pressures. The systems are generally constructed to allow for at least 6 feet of head to be utilized, if needed, to overcome losses in permeability. Alkalinity generation rates for these systems range from 40 to 60 grams per day per square meter of surface area for the first RAPS and from 15 to 20 grams per day per square meter of surface area for a second RAPS when two RAPS are used in series (Watzlaf et al. 2000b). Both iron and aluminum are removed within these systems. To extend the life of these systems, most are periodically flushed. No guidelines have been developed to guide the frequency, duration, or intensity of the flushes nor has any quantification of the effectiveness of the flushes been reported. In general, the flush valves are opened until the water "runs clear." The cloudy water can persist for a few minutes to a few hours. This study quantified both the metals retained prior to and the metals removed during flushing.

SITE DESCRIPTIONS

De Sale II

The De Sale II site, is located in Butler County, Pennsylvania, within the headwaters of Seaton Creek, a heavily impacted tributary in the Slippery Rock Creek Watershed. The system consists of an equalization pond, two RAPS, an oxidation pond, wetlands, and a horizontal limestone bed. Each RAPS is approximately 325 ft. long and 52 ft. wide and consists of (from the bottom up) 0.5 ft. of limestone for pipe bedding (AASHTO #57), the lower discharge/flush pipes, 2 ft. of limestone (AASHTO #1 (approx. 4 in., 90% calcium carbonate), the upper discharge/flush pipes, 2 ft. of limestone (AASHTO #1), 0.5 ft. of spent mushroom compost, and 2.5 – 3 ft. of water (figure 1a). Networks of piping drain four quadrants at two different vertical levels (upper and lower) within the system. This more extensive underdrain system was developed in an attempt to optimize both the distribution of flow during normal operation and the flushing of accumulated iron and aluminum solids. The underdrain was constructed of 4 in. diameter Schedule 40 PVC pipe. Perforated laterals were placed on 4.5 ft. centers and connected to an un-perforated header with a sanitary-type tee. Perforations were hand-drilled with two, 0.5 in. perforations which were offset approximately 30^{o} from the top of pipe. The perforation spacing was equal to the lateral spacing (4.5 ft.). Four separate header pipes were used for each underdrain level thus dividing the surface area into approximately equal quadrants. The upper and lower underdrain levels effectively divides each RAPS into eight separate "cells", four upper and four lower (figure 1b).

Since its completion on September of 2000 the RAPS have been functioning effectively, increasing pH from 3.1 to 6.9, adding 370 ppm of alkalinity, and decreasing iron and aluminum concentrations from 27 to 5 ppm, and 11 to 0.3 ppm, respectively.

Oven Run Site B

The Oven Run Site B is located in Somerset County, Pennsylvania, in the Stonycreek River Watershed. The system treats water emanating from three underground mine entries and consists of an equalization pond, a RAPS (RAPS 1), a sedimentation pond, a second RAPS (RAPS 2), and a final sedimentation pond, all in series. Each RAPS consists of (from the bottom up), a geotextile liner, 3 ft. of limestone, 1 ft. of spent mushroom compost, and 2 ft. of standing water. Positioned at the bottom of the limestone layer is 6 in. diameter perforated pipe.

RAPS 1 is 950 ft. long and 100 ft. wide. Three perforated pipes are laid out in parallel running the entire length of the system and spaced 20 ft. apart. At 135 ft., 405 ft., and 675 ft. from the influent to RAPS 1, each of the three parallel perforated pipe are connected to an un-perforated, 10 in. diameter pipe that is used for flushing. In effect, this divides the RAPS into three equal areas for flushing. The ends of these flush pipes are approximately 25 ft. below the elevation of the water in RAPS 1.

RAPS 2 is 552 ft. long and 160 ft. wide. Five perforated pipes are laid out in parallel running the entire length of the system and spaced 25 ft. apart. At 130 ft. and 390 ft. from the influent to RAPS 2, each of the five parallel perforated pipe are connected to an un-perforated, 10 in. diameter pipe that is used for flushing. In effect, this divides the RAPS

into two equal areas for flushing. The ends of these flush pipes are approximately 8 ft. below the elevation of the water in RAPS 2.

Since its completion in October 1999, the total system has increased pH from 2.96 to 6.45, added 534 ppm of alkalinity, and lower iron and aluminum concentrations from 68 to 5 ppm and 41 to 4 ppm, respectively.

METHODS

Flushing at De Sale II

The right RAPS was flushed on June 20, 2001, nine months after the RAPS began treating water. Each of the eight pipes was flushed sequentially at full volume (175 – 360 gal./min. per pipe) for nine minutes. A total of 18,400 gallons of water was removed (~ 4 % of the total volume of water in the RAPS). Samples were collected at 15, 30, 45 seconds, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, and 9 minutes. Dissolved oxygen, temperature, and pH were monitored continuously and recorded at each sample interval. Flows were measured periodically (~ every 1-3 minutes) using three different methods: horizontal pipe discharge method, time volumetric method, and water level changes in RAPS. All three flow measurement techniques were in fairly good agreement (within ~ 15%). Samples were not filtered and consisted of an unacidified and acidified sample. Samples were analyzed in the laboratory for concentrations of standard and trace mine drainage metals and sulfate.

The left system was flushed December12-13, 2001, after 14 months of treatment. Based on the results of the first flush, it was decided to flush the left system much more aggressively and to drain the system completely. The pipes draining the four upper quadrants were opened at the same time. After these pipes had drained for 11 hours, at which time the flow had diminished to a trickle. After closing the valves to the upper pipes, the lower flush pipes were opened and drained for an additional 4.5 hours (fig 3). Flows were measured periodically (every 10-20 minutes) using the horizontal pipe discharge method which had compared favorably to the timed volumetric method and water level changes method during the previous flush. A total of 378,000 gallons of water were removed from the system. Unfiltered samples were collected from each pipe at 10-minute intervals. Temperature, pH and flow measurements were taken between sample collection.

Samples were acid digested in the analytical laboratory and analyzed for standard and trace metals using standard methods. For unacidified samples, acidity was determined by adding H_2O_2 to the sample, heating, and titrating the solution to pH 8.2 with NaOH (American Public Health Association 1998). If the sample was net alkaline, it was heated with H_2O_2, and then the solution was titrated with H_2SO_4 to a pH of 4.5. Net alkalinity was reported as a negative net acidity. Metal concentrations in the acidified samples were determined using inductively coupled argon plasma - atomic emission spectroscopy (ICP-AES). Sulfate concentrations were determined by ICP-AES (as total sulfur) on water samples that had been acidified and boiled to remove any hydrogen sulfide.

Flushing at Oven Run Site B

The RAPS have been flushed 13 times (about every 2 – 4 months) since their construction in October 1999. This paper reports on the flush of RAPS 1 on February 24, 2000 and February 1, 2001 and the flush of RAPS 2 on February 1, 2001. The February 24, 2000 flush occurred after 4 months of treatment. The February 1, 2001 flush occurred 1.5 months after a prior flush.

In February 2000, RAPS 1 was flushed during two separate days. Pipe 1 was flushed on February 3 and pipes 2 and 3 were flushed on the February 24. During the flush of pipe 1, the valve was opened fully and samples were collected at 2, 12, and 20 minutes after which the vale was closed. For the flush of pipes 2 and 3, both valves were opened and samples were collected at 2, 10, and 20 minutes. For both of the RAPS 1 and RAPS 2 flushes in February 2001, all flush pipes were opened with samples being collected at 6, 20, and 30 minutes. A raw and an acidified sample were collected. None of the samples were filtered.

No flow measurements were taken during the reported flush, however, flows were estimated by measuring the depression in the water level in the RAPS during a subsequent flush. Flow averaged 6535 gal/min for all three flush pipes in RAPS 1 and 3048 gal/min for the two flush pipes in RAPS 2. All samples were analyzed by the Pennsylvania Department of Environmental Resources using standard methods.

RESULTS AND DISCUSSION

Flushing at De Sale II

The two RAPS at the De Sale II site are essentially equivalent. They were constructed in parallel, have the same dimensions, contain the same type and amount of media (limestone, compost, etc.) and receive water from a common source. However, the effluent water quality produced by the two systems has differed somewhat, most notably in the iron concentration. While both the right and left RAPS have been retaining iron, the effluent from the right RAPS has been higher in iron than that from the left RAPS. Effluent aluminum levels have been equivalent and low (<1 ppm) for both systems. In this study, the right RAPS was flushed first and the left was flushed 5 months later. Based on the laboratory analyses of the water samples obtained during the right SAPS flush, a more thorough flushing of the left SAPS was attempted and the system was completely drained.

Right System Flush

The right RAPS was flushed nine months after it began treating water. From available monitoring data, including flow measurements and water quality analyses, it was calculated that the RAPS had accumulated 1710 lbs. of iron and 688 lbs. of aluminum during these first nine months of operation. The basic criterion used during this flush was that the water should be allowed to flow until it ran clear. In practice, the flush was continued for some additional time. During the flush, a total of 18,400 gallons of water was removed. Figure 2 shows the average Fe and Al concentrations from the upper and lower flush pipes. The maximum metal concentrations shown in the first few minutes corresponded to visibly discolored water. Both the visual observations and the lab analyses indicate that the initial slug of material is quickly removed from the system. The iron and aluminum concentrations after seven minutes of flushing were the same as the dissolved metal concentration indicating that no solid material was eluting.

Numerical integration of the loads corresponding to the concentrations shown in Figure 2 provided the total amount of iron and aluminum removed during the flush. This amounted to only 3.1 lbs. of iron (0.2 % of the iron retained since construction) and 2.0 lbs. of aluminum (0.3 % of the aluminum retained since construction). If one assumes that the water flowed into the pipe uniformly from every direction, the range of influence of this flush can be estimated from the pipe dimensions, the gallons flushed, and by assuming a limestone porosity of about 50% (Hedin and Watzlaf 1994). It is estimated that the last water through each pipe had been, on average, only 4 inches from the pipe before the flush began. Thus, it is doubtful that much, if any of the metal oxyhydroxide laden water actually entered the pipes during this limited flush. Our conclusion is that “flushing until the water runs clear” is probably not a sufficient criterion for effective flushing.

Left System Flush

The left RAPS was flushed 14 months after it began treating water. From available monitoring data, including flow measurements and water quality analyses, it was calculated that the RAPS had accumulated 2090 lbs. of iron and 1100 lbs. of aluminum during these first 14 months of operation. Because of the low amount of metals removed during the flushing of the right RAPS, the criterion used during this flush was that the water should be allowed to flow as long as possible, i.e., until the system was drained. In practice, the four pipes draining the upper quadrants were flushed until the flow slowed to a trickle, then the pipes draining the lower four quadrants were opened and allowed to flow until the system was totally drained. During the flush, a total of 378,000 gallons of water was removed. Figure 3 shows the flows measured from the eight pipes. To a first approximation, the flows in both the upper and lower sections decrease going from quadrant 4 to quadrant 1. Qualitatively, this is consistent with the pressure drop expected due to the increasing length of 4 in. diameter pipe draining the quadrants. However, it would also be consistent with a clogging mechanism in which the settling of suspended material, such as clays, predominated in the quadrants closest to the RAPS inlet. The flows dropped slowly at first and then more rapidly after the first 7 to 8 hours. At about 11 hours the upper quadrants had drained and the valves to the lower quadrants were opened. Flows were higher and longer for the upper quadrants than for the lower quadrants because these pipes drained the standing water, the compost water, and the top limestone layer (total of 5 ft. of head), whereas the lower quadrant pipes drained only the bottom limestone layer (2 ft. of head) (see Figure 1).

The temperature and pH were monitored throughout the flush and these data are shown in Figure 4. The trends for both parameters are the same; both decrease as the cooler, more acidic surface water penetrates the lower strata faster than

the chemical and thermal equilibration can occur. At about 7 hours the values began to climb toward their earlier levels. This is at the same point at which the flow was seen to sharply decrease in Figure 3 (and residence time increase) indicating that the thermal and chemical equilibration rates were now becoming competitive with the flow rate. At a little over 8 hours (where the breaks in the upper quadrant trend lines occur) it was necessary to shut off the flow due to darkness. The next morning the temperature and pH continued to increase further to near their initial values. The pH actually attained somewhat higher values, perhaps because of the overnight stop-flow during which extended contact with the limestone occurred.

Figure 4 also shows total iron and aluminum concentrations at selected times in the upper and lower pipes within the first quadrant, during the flush. The maximum metal concentrations shown in the first few minutes corresponded to visibly discolored water similar to what was seen for the right RAPS flush. The graphs from the three other quadrants were similar except that the spike in the Fe and Al concentrations seen at about nine hours in Figure 4 did not occur in the other quadrants. That Al and Fe occurred in the same spike was curious but analysis of the Fe to Al ratio showed that it changed as the spike eluted and thus the spike was probably not due to a single iron-aluminum compound. However, in total, little additional material was removed from the system even after prolonged flushing. Of the retained 2090 lbs. of iron and 1100 lbs. of aluminum, the flush removed 22.1 lbs. of iron (1.1 % of the iron retained since construction) and 14.4 lbs. of aluminum (1.3 % of the aluminum retained since construction).

Prior to the flush, no decrease in the permeability of the RAPS had been observed. There was less than a 0.05 ft. difference in the elevation between the RAPS water level and the level of the discharge pipe, indicating that very little head was necessary to push the water though the RAPS. The system was probably maintaining permeability because very little void volume had been lost up to that time. The 2090 lbs. of retained iron corresponds to 4000 lbs. of $Fe(OH)_3$. Previous measurements have indicated that a cubic centimeter of iron sludge contains 0.17 grams iron (Watzlaf et al., in press). Using this value, approximately 197 cubic feet of iron sludge was retained in the RAPS. Making similar assumptions for the aluminum sludge results in 103 cubic feet of aluminum sludge, for a total sludge volume of 300 cubic feet. Assuming a 25 % void in the compost and a 50 % void in the limestone, the RAPS contains about 21,000 cubic feet of void space, with the precipitated sludge occupying only about 1.4 % of this void. Thus, it may be argued that too little material had accumulated to be flushed effectively. Larger masses of material would present a larger cross sectional area to the rapidly flowing water and would be more likely to be transported down-flow.

Flushing at Oven Run Site B

The RAPS at the Oven Run site, which are somewhat older than those at De Sale II, have been flushed 13 times since their construction. This paper reports on two of those flushes (February 2000 and February 2001). The criterion used during these flushes was that the water should be allowed to flow until it ran clear, similar to what was used during the flush of the right RAPS at the De Sale II site.

The first flush of RAPS 1 occurred four months after it began treating water. From the available monitoring data, including flow measurements and water quality analyses, it was calculated that the RAPS had accumulated 6522 kg of iron and 3440 kg of aluminum during these first four months of operation. During the flush, a total of 131,000 gallons of water was removed.

The second flush of RAPS 1 considered here occurred about a year later (16 months after construction) but it had been treating water for only about 7 weeks since the prior flush. A number of flushes had occurred between the first and second flush for which we have data. From the routine monitoring data, it was calculated that the RAPS had accumulated 2410 lbs. of iron and 1200 lbs. of aluminum during the 7 weeks since its last flush. During the flush, a total of 196,000 gallons of water was removed.

Figure 5a and 5b show the Fe and Al concentrations from the 3 flush pipes. The high metal concentrations seen in the first few minutes corresponded to visibly discolored water. Both the visual observations and the lab analyses indicate that the initial slug of material is quickly removed from the system, as was seen at De Sale II.

The amount of metals removed during the first flush of RAPS I amounted to 432 lbs. of iron (3.0 % of the iron retained since construction) and 167 lbs. of aluminum (2.2 % of the aluminum retained since construction). The amount of metals removed during the second flush of RAPS I amounted to 166 lbs. of iron (6.9 % of the iron retained since the previous flush, 7 weeks before) and 88.2 lbs. of aluminum (7.2 % of the aluminum retained since the previous flush, 7 weeks before). Thus, on a percentage basis, the efficiency of the flushing in RAPS I appears to increase over time,

however, the actual amount of metals held within the substrates may be considerably greater than the value that had accumulated in the 7 weeks since its last flush.

The flush of RAPS 2 considered here occurred after it had been receiving water for about 16 months. However, it had been treating water for only about 7 weeks since the prior flush. From the routine monitoring data, it was calculated that the RAPS had accumulated 2810 lbs. of iron and 2200 lbs. of aluminum during the 7 weeks since its last flush. During the flush, a total of 91,000 gallons of water was removed. Figure 5c shows the Fe and Al concentrations from the 2 flush pipes of RAPS 2. Of the 2810 lbs. of retained iron and 2200 lbs. of retained aluminum, 12.7 lbs. of iron (0.5 %) and 28.7 lbs. (1.3 %) of aluminum where removed during the flush. Unlike RAPS 1 where higher incremental metal removals were found (~ 7 %), RAPS 2 flushed poorly.

The percentage of void volume that the retained metals had occupied can be calculated for the Oven Run RAPS as well. Using the fact that a cubic centimeter of iron sludge contains 0.17 grams iron (Watzlaf et al., in press) and assuming a 25 % void in the compost and a 50 % void in the limestone, RAPS 1 and RAPS 2 can be estimated to contain approximately 135,000 cubic feet of void each. For RAPS 1, the 14,400 lbs. of iron and 7580 lbs. of aluminum retained prior to the February 2000 flush would result in 2070 cubic ft. of sludge which amounts to 1.52 % of the void volume available. Similarly, for the February 2001 flush, the 2410 lbs. of iron and 1200 lbs. of aluminum would result in 340 cubic ft. of sludge which amounts to an incremental loss of 0.25 % of the void volume available. For the flush in February of 2001 of RAPS 2, the 2810 lbs. of iron and 2200 lbs. of aluminum would result in 472 cubic ft. of sludge which amounts to an incremental loss of 0.35 % of the void volume available. Even if you consider that all of the material retained since construction (assuming no removal in previous flushes) the void volumes of RAPS 1 and 2 were still < 5 % filled with precipitates at the time of the February 2001 flush. Thus, it may be argued that too little material had accumulated to be flushed effectively.

It is important to note that it is unlikely that the precipitates are distributed uniformly throughout the available void volume. It is more likely that precipitation is occurring in a band (Watzlaf 1997). The width and position of the band would be determined by the pH gradient and rates of precipitation and agglomeration. Therefore, the permeability of the RAPS could be significantly reduced long before 100 % of the void volume was occupied.

It is interesting to note that, although the clogging of RAPS is thought to be due to Al precipitation, Fe is being retained as well. The amounts of iron and aluminum being retained in these systems are shown in Table 1. In addition to the RAPS studied here, the Jennings ALD, which eventually failed, is included for comparison. In 4 of the 6 cases studied here, the molar ratio of Fe to Al is close to 1, in the other 2 the ratio is close to ½. This raises the question of whether a stoichiometric iron aluminate may be forming under the conditions prevalent in these systems. The predominate aqueous-phase Al species present at the pH values seen in these effluents (6.4-6.9) is expected to be $Al(OH)_4^-$ (Cravotta 2001). But, to our knowledge, insoluble ferrous or ferric aluminates such as $Fe(Al(OH)_4)OH$ (molar ratio of 1) or $Fe(Al(OH)_4)_2OH$ (molar ratio of ½), have not been reported. At least 2 RAPS systems that have exhibited major decreases in permeability, one at Jennings and one in the Tangascootack watershed, will undergo autopsies in the near future. Perhaps data from those will assist in the interpretation of this data.

Table 1. Amounts of retained iron and aluminum prior to flushes.

Flush or Failure	Accumulation Type	Fe Retained (lbs.)	Al Retained (lbs.)	Fe/Al Molar Ratio
De Sale II Left RAPS	Total	1710	708	1.17
De Sale II Right RAPS	Total	2090	1100	0.92
Oven Run B, RAPS 1, Feb 2000	Total	14,400	7580	0.92
Oven Run B, RAPS 1, Feb 2001	Incremental	2410	1200	0.97
Oven Run B, RAPS 2, Feb 2001	Incremental	2810	2200	0.62
Jennings (Watzlaf et al. 2000b)	Total	1260	1280	0.48

CONCLUSIONS

Of the flushes documented here, none removed very much of the retained iron or aluminum. The most efficient achieved only 7 % removal of the incremental amount of metals accumulated since the previous flush (Table 2). None of the systems were experiencing any loss of permeability prior to the flushes. In fact, only a very small percentage (0.25 % – 5 %) of the void volumes were calculated to be filled with iron and aluminum precipitates. Lack of efficiency

has not yet led to failures of these systems and, in one case, efficiency may be improving with time. However, the long-term prospects for these systems appear questionable at best, if the current levels of metal removal via flushing continue.

Table 2. Amount of water, iron, and aluminum flushed for the five flush events reported in this paper.

Flush	Water Flushed		Iron Flushed		Aluminum Flushed	
	gallons	% of total	lbs.	% of retained	Kg	% of retained
De Sale II Right RAPS	18,400	5	3.11	0.2 %	2.03	0.3 %
De Sale II Left RAPS	378,000	100	22.1	1.1 %	14.4	1.3 %
Oven Run B, RAPS 1, Feb 2000	131,000	6	432	3.0 %	166	2.2 %
Oven Run B, RAPS 1, Feb 2001	196,000	9	166	6.9 %	88.2	7.2 %
Oven Run B, RAPS 2, Feb 2001	91,000	4	12.7	0.5 %	28.7	1.3 %

REFERENCES

American Public Health Association. 1998. Standard methods for the examination of water and wastewater. 20th ed. APHA, Washington, DC.

Cravotta, C. 2001 "Chapter 5. Speciation and Solubility of Metal Ions -- Graphical Methods (supplement for Cravotta lecture examples, 7/5/2001)." Cravotta's calculations use data from: Ball, J.W., and Nordstrom, D.K., 1991, User's manual for WATEQ4F with revised database: U.S. Geological Survey Open-File Report 91-183, 189 pp. and Stumm, Werner, and Morgan, J.J., 1996, Aquatic chemistry--chemical equilibria and rates in natural waters (3rd): New York, Wiley-Interscience, 1022 pp.

Hedin, R. S., R. W. Nairn and R. L. P. Kleinmann. 1994. Passive treatment of coal mine drainage. U.S. Bureau of Mines IC 9389.

Hedin, R. S. and G. R. Watzlaf. 1994. The effects of anoxic drains on mine water chemistry. p. 185-194. In: Proceedings of the International Land Reclamation and Mine Drainage Conference and the Third International Conference of the Abatement of Acidic Drainage, Volume 1. (Pittsburgh, PA, Apr. 24-29, 1994). U.S. Bureau of Mines Special Publication SP 06B-94.

Kepler, D. A. and E. C. McCleary. 1994. Successive alkalinity-producing systems (SAPS) for the treatment of acid mine drainage. p. 195-204. In: Proceedings of the International Land Reclamation and Mine Drainage Conference and the Third International Conference of the Abatement of Acidic Drainage, Volume 1. (Pittsburgh, PA, Apr. 24-29, 1994). U.S. Bureau of Mines Special Publication SP 06B-94.

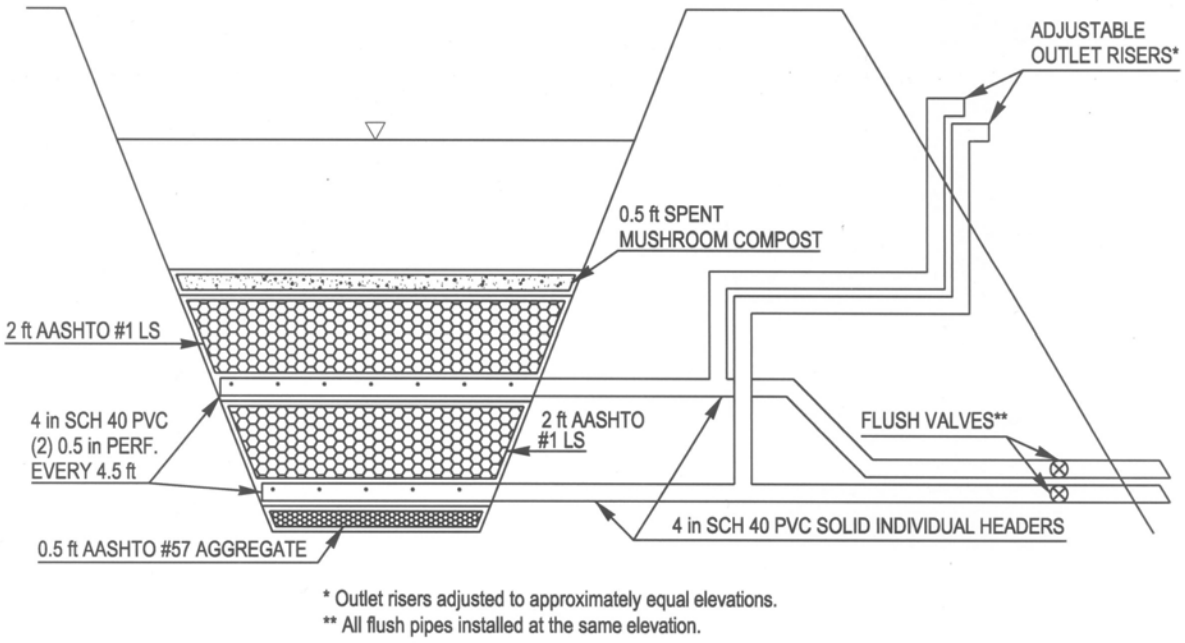
Watzlaf, G. R. 1997. Passive treatment of acid mine drainage in down-flow limestone systems. p. 611-622. In: Proceedings of the 1997 National Meeting of the American Society of Surface Mining and Reclamation (Austin, TX, May 10-15, 1997).

Watzlaf, G. R., K. T. Schroeder, and C. L. Kairies. 2000a. Long-term performance of anoxic limestone drains. Mine Water and the Environment. 19:98-110.

Watzlaf, G. R., K. T. Schroeder, and C. L. Kairies. 2000b. Long-term performance of alkalinity-producing passive systems for the treatment of mine drainage. p. 262-274. In: Proceedings of the 1991 National Meeting of the American Society of Surface Mining and Reclamation (Tampa, FL, June 11-1, 2000).

Watzlaf, G. R., K. T. Schroeder, C. L. Kairies, R. S. Hedin, and R. W. Nairn. In press. Passive Treatment of Mine Drainage. U. S. Department of Energy.

(a)



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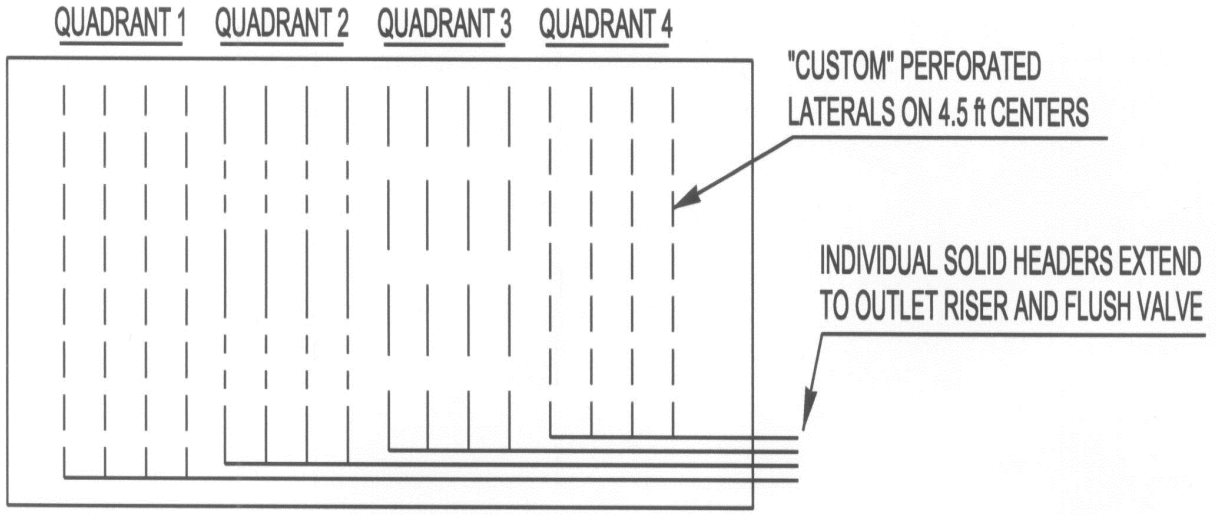

Figure 1. Schematics of the De Sale II RAPS; (a) cross section showing layers of substrate and location of upper and lower flush pipes and (b) plan view showing general layout of flush pipes (in actuality, over 130 laterals were used). Both right and left RAPS are identical.

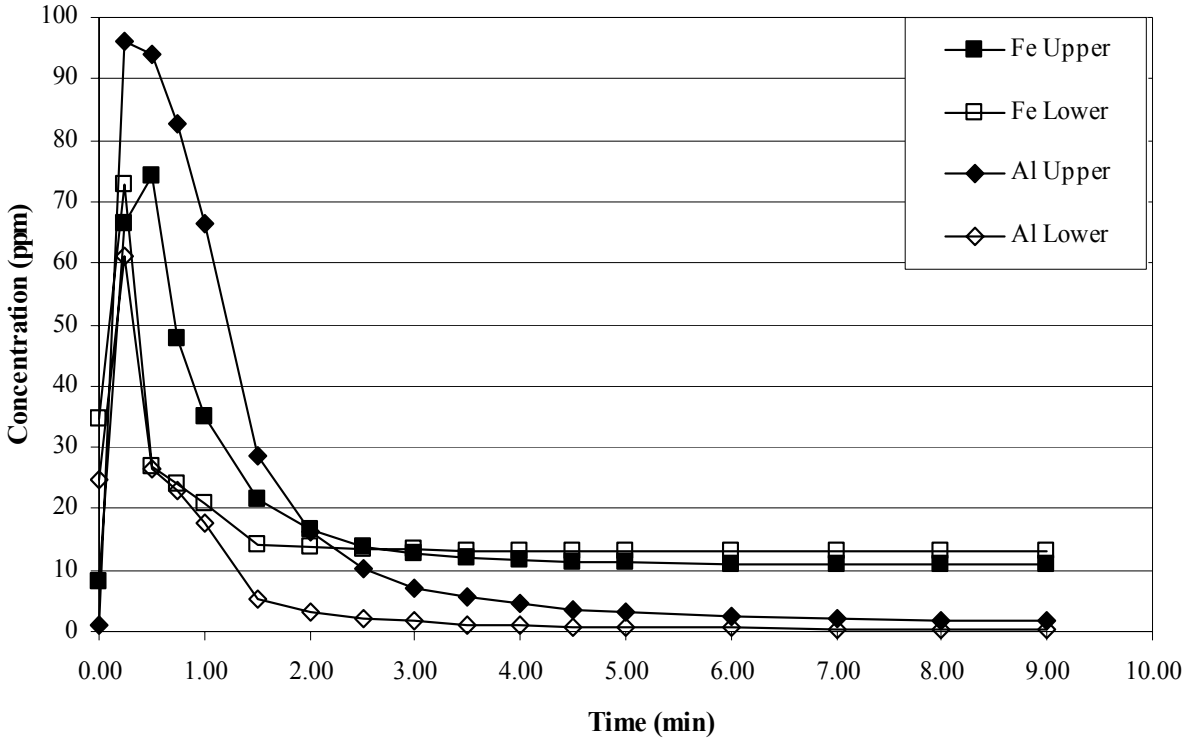

Figure 2. Iron and aluminum concentrations during the flush of the right RAPS at the De Sale II site. Each line represents average concentration from four upper or lower flush pipes.

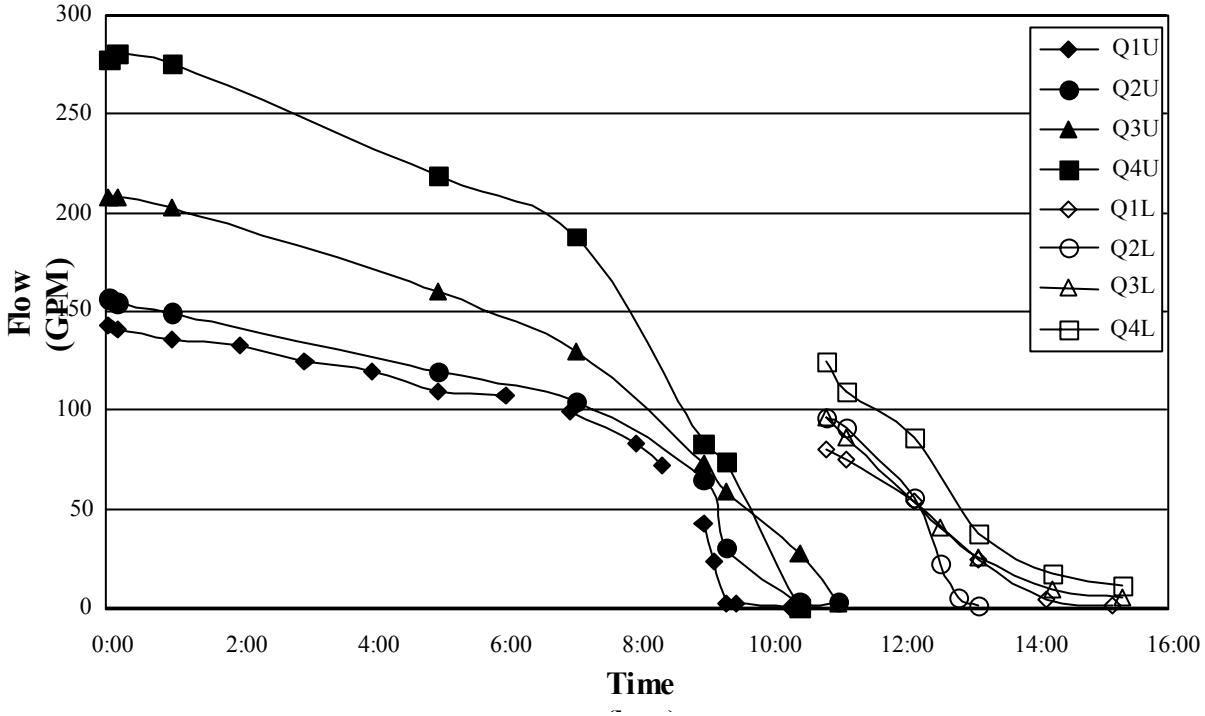

Figure 3. Flow from each flush pipe during the flush of the left RAPS at the De Sale II site. Q = quadrant; U = upper; L = lower.

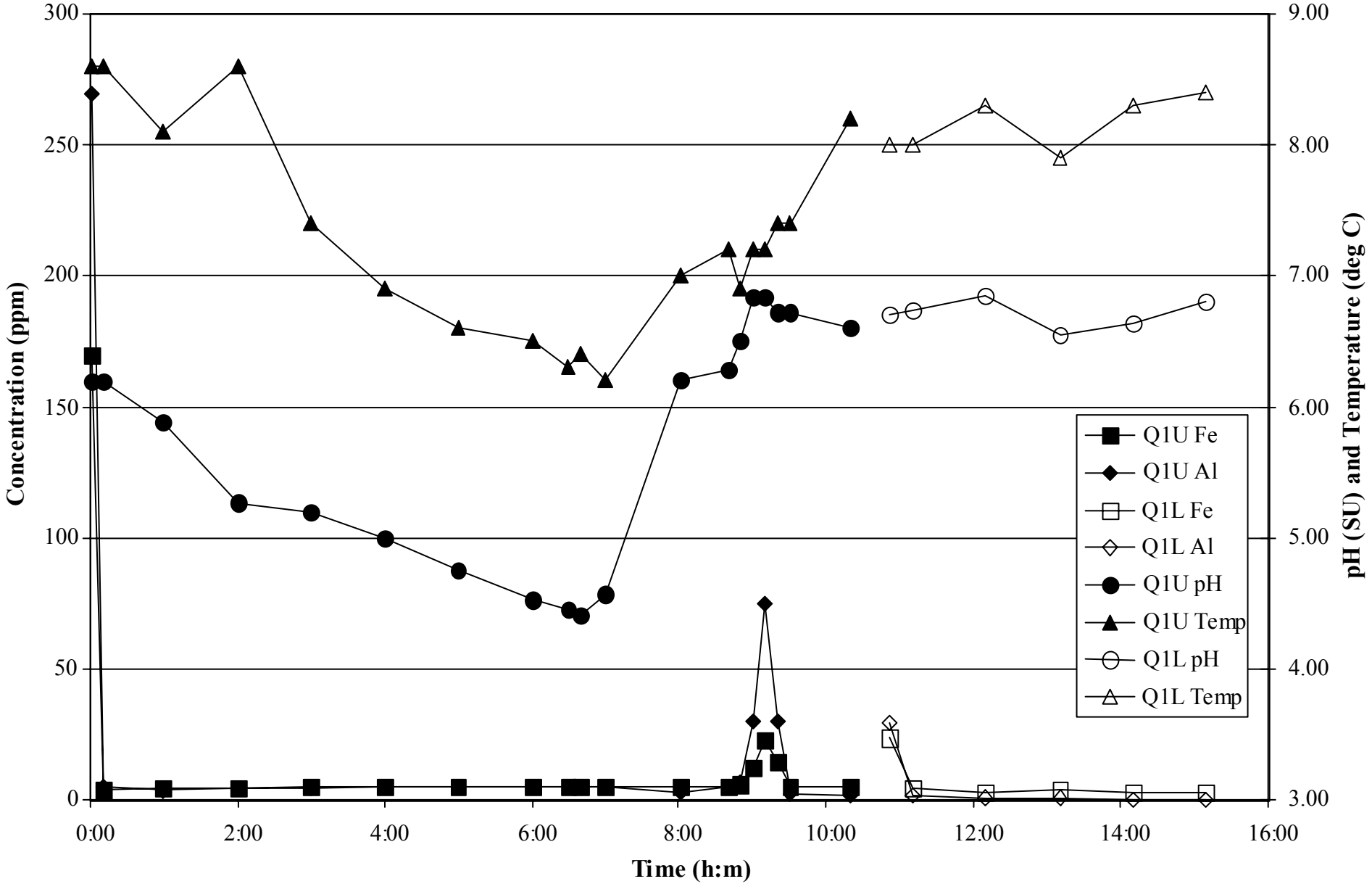

Figure 4. Iron and aluminum concentrations, pH, and temperature from the upper (U) and lower (L) flush pipes in quadrant 1 during the flush of the left RAPS at the De Sale II site.

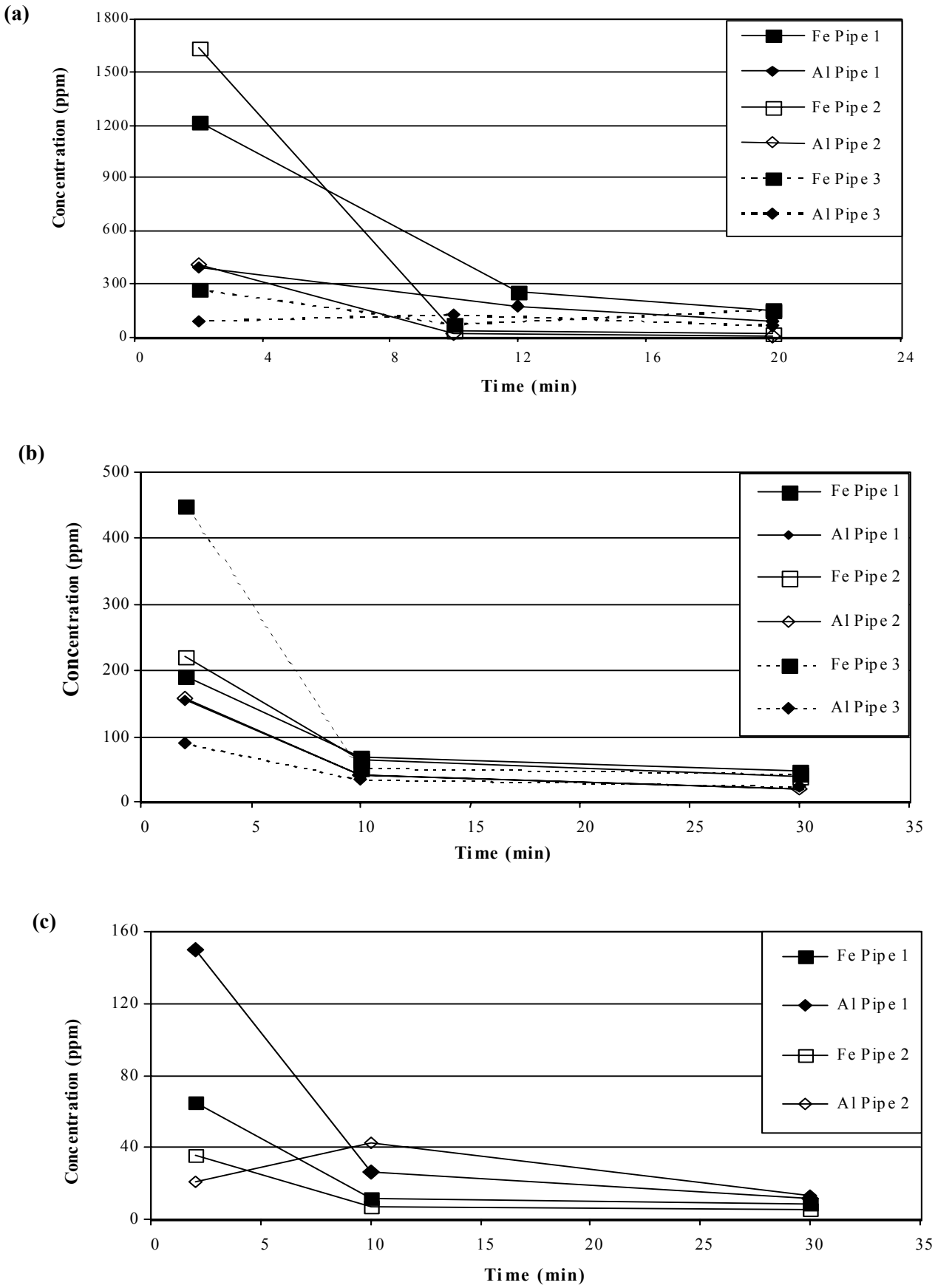

Figure 5. Iron and aluminum concentrations during the Oven Run B flush: (a) RAPS 1, Feb. 2000; (b) RAPS 1, Feb. 2001; (c) RAPS 2, Feb. 2001.

VERTICAL FLOW POND PIPING SYSTEM DESIGN CONSIDERTATIONS[1]

Timothy P. Danehy[2], Tiff Hilton, George R. Watzlaf, Fred Johnson, Shaun L. Busler, Clifford F. Denholm, Margaret H. Dunn

Abstract. Abandoned mine drainage is a major source of water pollution in Pennsylvania, West Virginia, and other historical mining districts. Technology which utilizes no harsh chemicals and no electricity, and requires minimal maintenance known as passive treatment is being developed to address this pollution problem in a relatively cost-effective manner. Specifically, acidic drainage with dissolved aluminum and/or high iron content is now being successfully abated utilizing a916 type of passive system which uses a component known as a Vertical Flow Pond (VFP). VFPs are also referred to as Reducing and Alkaline Producing Systems or RAPS. Numerous papers and technical investigations have provided documentation on the effectiveness of these systems in treating discharges of various qualities and flow rates. Very little information, however, is available regarding the piping systems used for the collection of the water after passing through the treatment media. These piping systems are often referred to as underdrains. Experience gained during installation and from on-going monitoring of successful VFPs at the Jennings Environmental Education Center and Ohiopyle State Park (PA Dept. of Conservation and Natural Resources) and within the Slippery Rock Creek Watershed has led to the development of an innovative double-tiered, multiple-quadrant, underdrain system. This type of underdrain has been recently installed at the De Sale Restoration Area - Phase II (De Sale II) site in Venango Township, Butler County, PA. This underdrain system is expected to aid in eliminating "dead areas" and in maintaining the hydraulic conductivity of the treatment media by improving flow distribution and by improving the ease and thoroughness of the flushing operation to remove accumulated metal solids.

Additional Key Words: Passive Treatment, Constructed Wetlands, Acid Mine Drainage, Flow Distribution, Flushing

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Introduction

Vertical Flow Ponds are flexible in design and can passively treat acidic discharges which contain dissolved aluminum, dissolved oxygen, ferric iron, or any combination thereof. In order to maintain hydraulic conductivity in the treatment media, however, accumulated metal solids require removal on a periodic basis. Recent tests documenting dye migration in various passive treatment system components also indicate that short-circuiting is a consideration (Peart and Cooper, 2000). The presentation of this paper is an effort to share information regarding promising developments including design considerations, installation and preliminary performance of vertical flow-type and other passive treatment system components in order to contribute to the on-going improvement of passive treatment technology. A recently installed system is included as an example.

De Sale Restoration Area - Phase II: System Overview

Location

The De Sale Restoration Area - Phase II (De Sale II) site is located in Venango Township, Butler County, PA within the headwaters of Seaton Creek, the major tributary, most heavily impacted by abandoned mine drainage, in the Slippery Rock Creek Watershed (Gwin Engineers, 1970). See Figure 1.

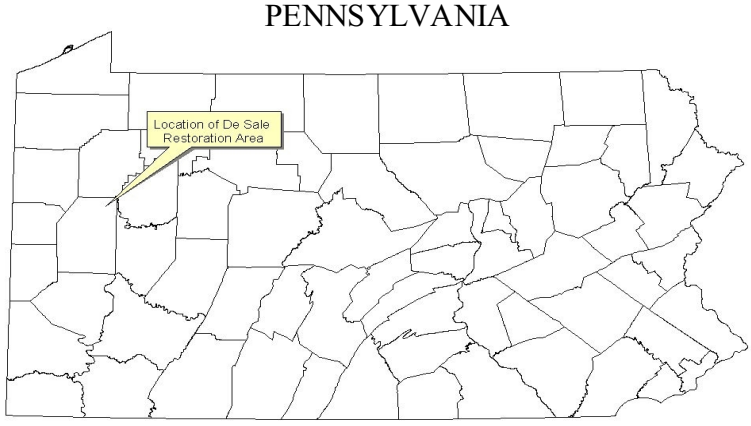

Figure 1. Location map.

Water Quality

Table 1. Representative pre-construction raw water data.

Statistical Summary	Flow (gpm)	Lab. pH	Acidity (mg/l)	T. Fe (mg/l)	T. Mn (mg/l)	T. Al (mg/l)
mean	134	3.5	179	9	36	7
range	22 - 338	3.0 - 4.3	32 - 420	2 - 20	10 - 81	2 - 14
75th percentile	204	3.7	233	10	50	8

Notes: n[flow] = 12 (Gwin Engineers, 1970); n[water quality parameters] = 23 (PA DEP, 1998); pH not averaged from H ion concentration; Observations and measurements of flow during pre-construction and monitoring for the CMRS report indicated that the Scarlift flow data was applicable. Comparison of individual flow measurements with corresponding water quality parameter readings indicates dilution at higher flows.

System Design

Overview

The discharge is conveyed through the following components in series: Stream Intake → Forebay → Vertical Flow Pond (2 in parallel) → Settling/Flush Pond → Wetland → Horizontal Flow Limestone Bed. See Figure 2.

Stream Intake

Due to extensive mining in the headwaters and the diffuse nature of the seep zone, the major contributor of flow to the unnamed tributary was abandoned mine drainage. This channelized flow provided the necessary collection of the drainage for the passive system. In order to prevent overwhelming the system during high-flow and precipitation events, a controlled-flow, stream intake was installed. The intake was designed to allow the 200-gpm design flow to enter the system, any excess flow crests a 16 ft wide concrete weir and remains in the stream channel. The design flow was based on the 75th percentile flow, determined from Operation Scarlift monitoring data. The flow to the system is restricted by the pipe diameter and length with the maximum available head controlled

by the weir.

Forebay

The site provided a limited amount of drop (difference in elevation) within the preferred construction area. In order to obtain the needed drop, the stream intake was installed approximately 400 ft from the VFP. This required the drainage to be conveyed with very little elevation change. A long forebay was installed to inhibit settleable solids and some iron solids from entering the VFPs (Watzlaf et al., 2000). The pond-like configuration of this component allows for a small difference between inlet and outlet elevations and minimizes the maintenance issues associated with conveying abandoned mine drainage utilizing nearly flat pipes or open channels. The forebay was constructed with a 5 ft bottom width, 29 ft top width, 2:1 inside slopes, about 4.5 ft design water depth, and about 6 ft total depth. The outlet of this component is a single 10 inch pipe that terminates in a 10 inch x 8 inch x 8 inch tee. From each side of the tee the 8 inch pipe extensions discharge into respective VFP. Flow rate is controlled by rotating a 90° elbow attached to the 8 inch pipe with a rubber coupler.

Vertical Flow Ponds

The primary purposes of this component are acid neutralization and alkalinity generation (PA DEP, 1999). A parallel configuration was utilized allowing for continual treatment of water during future maintenance of this component. To address hydraulic conductivity, flow distribution and flushing,an innovative, two-tiered, quadrant-type underdrain system was installed. Both ponds were lined with geotextile fabric to provide ground stabilization for placement of a 0.5 ft layer of AASHTO #57 (1.5 inch) "bedding stone" and to minimize loss of treatment media. The "bedding stone" was overlain by the lower tier of the underdrain. Two feet of AASHTO #1 (4 inch) limestone (90% calcium carbonate) aggregate was spread over the first layer of pipes. A second (upper tier) underdrain similar to the first was installed and covered by a second, two-foot thick, layer of limestone. Spent mushroom compost (0.5 ft thickness) was then spread over the limestone. Individual flush valves and outlet controls were installed for each "cell" of the underdrain. Approximately two feet of water caps

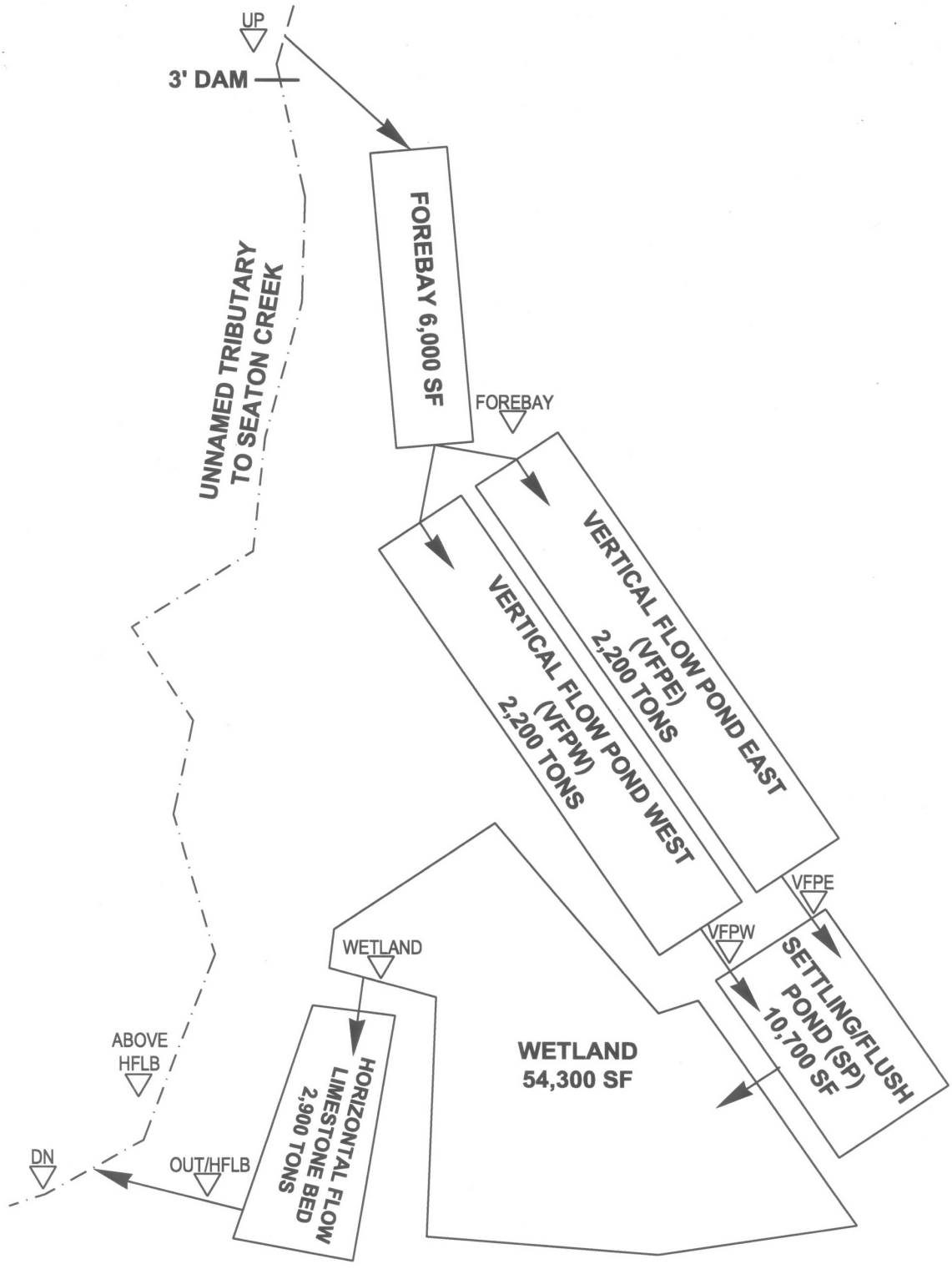

Figure 2. Flow diagram of De Sale II Passive Treatment System.

the treatment media. (For a more detailed description of the underdrain, see VFP Underdrain Design Considerations.)

Settling/Flush Pond (SP)

VFPs are typically followed by a settling pond to allow for the oxidation and/or settling of metal precipitates. This convention was applied to the De Sale II site with modifications. A valved, draw-down device (10 inch diameter) was added to the design. This allows the water level to be lowered about 2 ft prior to a flushing event. About one week prior to flush the water level in the settling pond is to be lowered by opening the valve on the draw-down device. Just before the flush is to occur, the valve is to be shut. Sufficient capacity was designed into the volume of the settling pond to allow the entire flush volume to be retained to allow for settling and accumulation of solids.

Wetland (WL)

The WL component is included to allow additional oxidation and/or settling of solids (Waztlaf et al., 2000). To encourage natural function and maximize effective retention, microtopographic relief, directional earthern baffles, and vegetation with high species diversity and density were included in the wetland design.

Horizontal Flow Limestone Bed (HFLB)

To encourage oxidation and removal of manganese (Hellier, 1999) as well as additional alkalinity generation, a HFLB was included as the final treatment component in the system. The design is straightforward with the discharge being directed into the HFLB (containing five feet of limestone aggregate) from the WL via a rock-lined spillway. The drainage is encouraged to flow horizontally through the limestone to a perforated header along the outlet end near the base of the component. A riser pipe extends to within one foot of the top of the limestone, the design water level.

VFP Underdrain Design Considerations

Background of Underdrain Development

Underdrains have been installed in a variety of configurations. Reportedly, the standard design utilizes a single, solid header installed on the short side of the VFP with perforated laterals extending parallel to the longitudinal axis of the pond. The laterals are generally standard perforated pipe installed on 6 ft to 10 ft centers. A VFP utilizing this configuration was installed at the Harbison Walker Restoration Effort - Phase I (Harbison Walker I) site in Ohiopyle State Park (PADCNR), Stewart Twp., Fayette Co., PA (Stream Restoration, 2000). Other systems have utilized multiple header configurations such as the system installed at Jennings Environmental Education Center (PADCNR), Brady Twp., Butler Co., PA. The laterals at Jennings are connected to three separate headers which are combined into a common outlet device. Both systems have successfully treated water to the anticipated water quality, or better, since installation.

The outlet device at the Jennings site incorporates a flexible design which allows the outlet water level to be readily adjusted. At the time of installation, the Jennings VFP was anticipated to retain aluminum with the majority of iron passing through the system; however, continued monitoring indicates higher than expected levels of iron retention (Watzlaf et al., 2000; Jennings, 1999). In order to maintain sufficient hydraulic conductivity, the Jennings VFP has been periodically flushed by lowering the outlet control device.

In order to facilitate periodic flushing, the outlet device at the Harbison Walker I site included a solid, straight, flush pipe extending from the header pipe near the bottom of the VFP to a settling pond. As noted at the Jennings site, the Harbison Waker I VFP has retained significant quantities of iron (Stream Restoration, 2000). The original design utilized a threaded plug at the outlet of the flush pipe.

Both the Jennings and Harbison Walker I systems have a single-tier, underdrain system installed near the treatment media base.

De Sale II Underdrain Overview

A more extensive underdrain system was developed for the De Sale II VFP in an attempt to

optimize flow distribution and flushing of accumulated iron and aluminum solids. The underdrain was constructed of 4 inch Schedule 40 PVC pipe. Perforated laterals were placed on 4.5 ft centers and connected to a solid header with a sanitary-type tee. Perforations were hand-drilled with two, 0.5 inch perforations approximately 30° from the top of pipe. The perforation spacing was equal to the lateral spacing (4.5 ft). Four separate header pipes were used for each underdrain thus dividing the surface area into approximately equal quadrants. Two underdrains are installed in each vertical flow pond, one at the base of the AASHTO #1 layer and one in the middle of the four-foot thick layer of limestone aggregate. This effectively divides each VFP into eight separate "cells", four upper and four lower. Two VFPs are installed in parallel producing a total of sixteen separate cells with individual discharge locations and flush valves. See Figures 3 & 5.

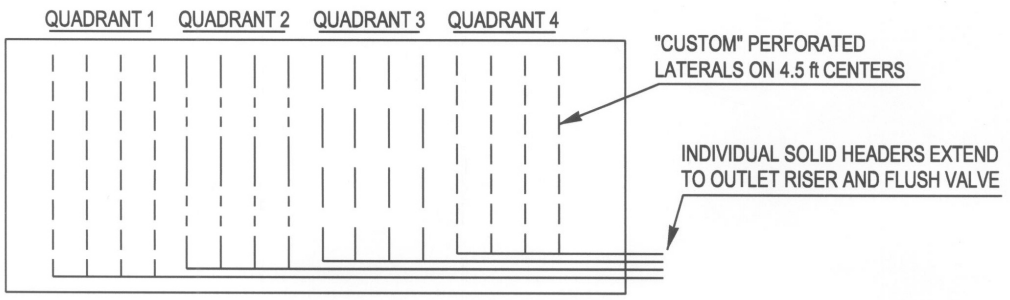

Figure 3. Typical installation of quadrant-type underdrain system.

Each header pipe extends from the treatment media through the breastwork to an individual 4 inch slide-type gate valve. Prior to the gate valve, a tee was installed about mid-way through the breastwork to create a riser which leads to the primary outlet for that cell. Each outlet included a 4 inch by 3 inch rubber reducer into which a 3 inch riser (1.5 ft section with 3 inch 90° elbow) was inserted. The reducer was equipped with two stainless steel hose clamps. The 4 inch hose clamp fastens the reducer to the 4 inch riser pipe. The 3 inch clamp was used to vertically adjust the 3 inch riser. See Figure 4.

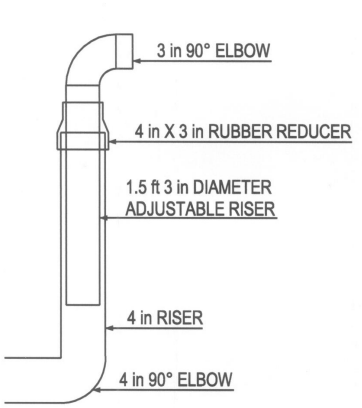

Figure 4. Typical outlet riser detail.

Flow Distribution

During normal operation of the Vertical Flow Ponds all sixteen cells discharge. This is intended to reduce short circuiting and maximize effective retention time. Short circuiting has been documented as a potential issue in the efficacy and long-term operation of vertical flow-type passive systems. This was investigated by participants in the Jennings Water Quality Improvement Coalition through the construction of an overdrain system and subsequent dye testing at Jennings and other sites. The dye testing indicated that the flow was not evenly spread throughout the system. Two separate dye tests at Jennings documented that the flow had a maximum disbursement covering less than 20% of the total treatment media surface with the momentum of the influent potentially responsible for the observed amount of distribution (Peart and Cooper, 2000).

To overcome this situation, the underdrain installed at the De Sale II site includes individual outlet controls for each cell. The individual outlets allow flow rates to be controlled in each cell within the VFP. With all sixteen outlets discharging approximately equal flow volumes, distribution throughout the system can be assumed; however, this does not take into account distribution variability within individual cells.

Perforation Size and Spacing

Standard perforated pipe has two, 0.625 (5/8) inch perforations every 5.25 inches. This is a good design for customary applications (i.e. foundation drains); however, this type of perforation configuration may not be particularly well suited for the distribution of acid mine drainage within the treatment media of a VFP. According to standard orifice flow calculations, relatively few linear feet of standard perforations are required to reach the maximum flow volume capacity of a 4 inch pipe. Based on accepted formulae for Orifice and Pipe Flows, at a minimal given head (<0.1 feet), standard 4 inch PVC perforated pipe reaches maximum carrying capacity within approximately 10 linear feet.

Through the utilization of smaller orifices which are less frequently spaced, the length of perforated 4 inch pipe required to reach maximum carrying capacity is extended. At a minimal given head (<0.1 ft), two 0.5 inch perforations every 4.5 ft requires about 150 linear feet to reach the maximum carrying capacity of a 4 inch pipe. This potentially could increase the effective retention time within the treatment media.

To summarize, a quadrant underdrain with less frequently spaced perforations is expected to decrease short circuiting thus increasing the effective retention time within the treatment media.

System Flushing

Vertical Flow Ponds typically retain significant amounts of iron and aluminum (Watzlaf et al., 2000; Stream Restoration, 2000; Jennings, 1999). The accumulation of solids in the treatment media has a potential adverse effect on hydraulic conductivity. A simple method of removing these accumulated solids is head-driven flushing. Individual flush valves were installed for each cell at De Sale II. These valves are located at approximately the same elevation as the bottom of the VFP. See Figure 5.

With a separate valve for each cell, a specific portion of the VFP can be flushed. Here again, the total volume of water which can pass through a 4 inch pipe at a given head is the limiting factor, not the number of orifices. During flushing, removal of the maximum amount of accumulated precipitate throughout the entire treatment media is desired. Through smaller orifices and less frequent perforation spacing, the length of perforated pipe needed to achieve the maximum carrying

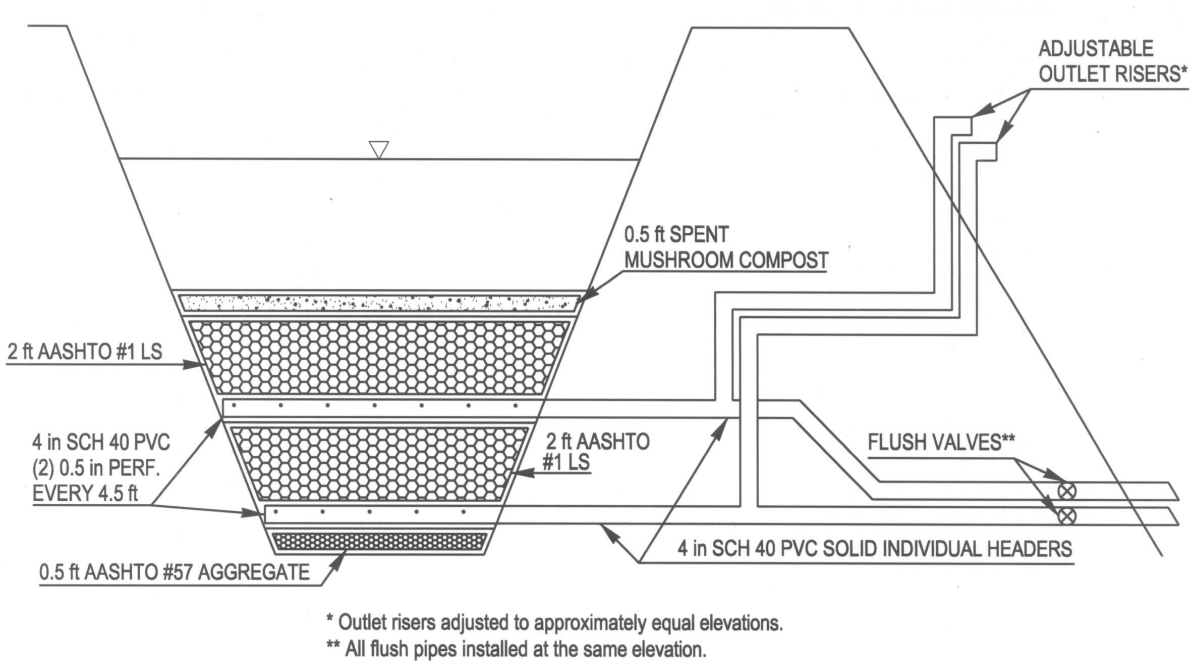

Figure 5. Typical cross section of vertical flow pond.

capacity of a single 4 inch pipe is increased. At the De Sale II site, this increase is about 15 fold.

By decreasing the total amount of treatment media volume being flushed per valve, flushing efficacy should be increased. Reducing the volume of treatment media being flushed was achieved in two ways: 1) dividing the surface area of the treatment media into quadrants and 2) installing two tiers of piping within the treatment media. This reduces the total number of orifices feeding a single 4 inch pipe and subsequently increases the velocity of water traveling through each orifice. This higher velocity would tend to dislodge more metal solids in the media during a flushing event.

By increasing the number of laterals within a VFP, the average distance from within the

treatment media to a perforation is decreased. In a typical VFP with three feet of treatment media underlain by laterals installed on 10 foot centers having two perforations every 5.25 inches, the maximum distance from a perforation is about 6 feet. The De Sale II design has a maximum distance of about 3.5 feet from any point within the treatment media to a perforation.

Based on preliminary test flushing of other VFPs with similar underdrain systems, a flushing event takes 15 to 20 minutes per cell. This is based on the amount of time required for the discharge to "run clear" once the valve is opened. Also, in order to increase the amount of solids removed from the underdrain system during flushing, the valve may be opened and shut several times to "agitate" the system. Due to "water hammer", brief, yet notable discharge has been observed at the primary discharge outlet for the cell being flushed when the valve is shut rapidly. Visual observation indicates that a significant amount of solids are expelled through the primary outlet as well as the flush pipe during this procedure. This phenomena is expected to be beneficial in long-term system performance.

Work is currently being coordinated with the US Department of Energy, National Energy Technology Laboratory in Pittsburgh, PA to quantify metals retention during operation and amount of release during flushing events.

Preliminary System Performance of Each Component

Intake & Forebay

On January 31, 2001, a flow of 187 gpm was measured using a calibrated 14-gallon bucket. Due to the relatively short time needed to fill the container, this flow is subject to notable sampling error. Flows were measured on the same date at each individual VFP inlet, the sum was 203 gpm. The depth of flow over the 16' wide dam was also measured with a calculated flow of 267 gpm. This indicates the 200-gpm design flow can be achieved without overwhelming the system while excess flow remains within the stream channel. Within the forebay, slight decreases in metal concentrations have been observed.

Vertical Flow Pond

The preliminary performance of the De Sale II site follows patterns observed at other Vertical Flow Ponds (VFPs). Both influent and effluent water quality data at the two parallel VFPs are extremely similar. For the first month of operation, sulfate, sodium and potassium concentrations were greater in the effluent than in the influent. Only in the last month or two are sulfate concentrations lowered as the water passes through the systems. However, a consistent odor of hydrogen sulfide indicates that sulfate reduction has been occurring since the beginning of operation. Dissolved oxygen concentrations have been at saturation levels in the influent (9-13 mg/L) and near zero in the effluent (<0.2 mg/L). Manganese was removed in an initial two-month period. The removal ceased, presumably due to a filling of the available adsorption sites.

Changes in other parameters have been more consistent. Influent pH values averaged 3.2 compared to 7.0 in the effluent. Total alkalinity measured in the field has been at 50 to 100 mg/L (as $CaCO_3$) in the effluent over the last four months (no alkalinity was in the influent). Influent net acidity has averaged 250 mg/L (as $CaCO_3$). The effluent water has always been net alkaline and has averaged 120 mg/L (as $CaCO_3$). Most of this generated alkalinity has been used to neutralize acidity due to hydrogen ions (low pH) and acidity generated upon hydrolysis of metals. Iron and aluminum concentrations are decreased from 34 to 4 mg/L and from 12 to <0.5 mg/L, respectively. Other trace metals, cobalt, nickel and zinc have been lowered from 0.7 to <0.02 mg/L.

Rates of acidity removal on an area basis have ranged from 6 to 44 g/day/meter squared and have averaged 27 g/day/meter squared. These values are consistent with several other VFPs (Watzlaf et al., 2000). Regardless of flow, iron and aluminum are removed to low levels and pH is increased to about 7.0. Therefore, these acidity removal rates are dependent on flow and are greater at higher flows.

Settling Pond & Wetland

The settling pond component was installed primarily for use during flushing events. The combined surface area of both components are considered during evaluation. Monitoring is conducted of the wetland effluent. The settling pond and wetland were constructed within a groundwater discharge zone and preliminary monitoring and visual observation indicate the

interception of degraded, shallow subsurface drainage. The quality and quantity of this drainage impacts the effluent.

Horizontal Flow Limestone Bed

To date, the HFLB has consistently generated an average of about 20 mg/l of alkalinity. Some manganese, 2 to 6 mg/l, has been removed by this component. A similar system installed at the Harbison Walker I site was observed to remove significant amounts of Mn after approximately 8 months of operation.

Conclusion and Recommendations

Based on the preliminary monitoring data, the double-tier underdrain allows for a potential increase in flushing efficacy of accumulated iron and aluminum solids without affecting the treatment performance of the Vertical Flow Pond. Additional demonstration is required in order to determine long-term function relating both to flushing and flow distribution. Variations in water quality require specific design consideration in the configuration and application of underdrains, outlet controls, and flushing devices. Systems installed to treat discharges with high metal concentrations may require more piping and more frequent flushing than those discharges with low metal concentrations. Ideally, passive systems require minimal maintenance, this means low maintenance *not* no maintenance. These maintenance requirements should be sufficiently addressed in the initial system design.

Acknowledgments

The restoration projects cited in the paper were completed through a public-private partnership effort. The authors wish to express their appreciation to the Pennsylvania Department of Environmental Protection for the Reclaim PA and Growing Greener initiatives and the US Environmental Protection Agency for the 319 program.

The authors wish to thank the Slippery Rock Watershed Coalition, Jennings Water Quality Improvement Coalition and other volunteers who donated substantial resources and numerous hours

in the installation and monitoring of the systems, including Theresa Elicker, MCI, Roger Bowman, and Tim Gillen, PG, PA DEP, Knox District Mining Office; Ron Horansky, MCI, PADEP, Greensburg District Mining Office; Fred Brenner, PhD, Biologist, Grove City College; Valentine Kefeli, PhD, Soil Scientist; PADEP Bureau of Abandoned Mine Reclamation; Will Taylor, Env. Ed. and Dave Johnson, Mgr., Jennings Environmental Education Center, PADCNR; Doug Hoehn, Mgr., Dan Bickel, Env. Ed., and Barbara Wallace, Env. Ed., Ohiopyle State Park, PADCNR; Pressley Ridge School; Robert Beran, Wetland Ecologist, and Jeff Reidenbaugh, Sustainable Systems,Aquascape; Charles D. Cooper, PE, PLS, CDS Associates, Inc.; Dale Hockenberry, Land Mgr., PA Game Commission; Dennis Noll, PG, Earthtech, Inc.; Venango Twp. Supervisors; Butler County Commissioners; Butler County Planning Commission; The Chuck Malinski, Jr. Family; Janice Belgredan; Steve Smith; Jeff Ankrom, VP Operations, Quality Aggregates Inc.; and Todd Lawton, Fuels Mgr., Scrubgrass Generating Plant.

Literature Cited

Gwin Engineers, Inc., unpublished 1970, Slippery Rock Creek Mine Drainage Pollution Abatement Project - Operation Scarlift: PA Department of Mines and Mineral Industries, 163 pp. with appendices.

Hedin, Robert S., Robert W. Nairn, and Robert L. P. Kleinmann, 1994, Passive Treatment of Coal Mine Drainage: US Department of the Interior, Bureau of Mines, IC9389, 35 pp.

Hellier, William W.,1999, An Integrated Design Model for Passive Treatment Systems to Abate Water Pollution for Post-Mining Discharges: *in* Proceedings of the National Association of Abandoned Mine Land Programs (Champion, PA, Aug. 22-25, 1999) 10pp.

Jennings Water Quality Improvement Coalition, unpublished 1999, Passive Treatment of Acid Mine Drainage, Vertical Flow System, Jennings Environmental Education Center, PA Department of Conservation and Natural Resources: report funded in part by the PA Department of

Environmental Protection, Bureau of Watershed Conservation, US EPA 319 program, 135 pp.

Water Monitoring Data

Table 2. Preliminary System Function (range in values after system on-line 9/00).

Station	n	Flow	pH		Alkalinity	Acidity	Fe(mg/l)		Mn(mg/l)		Al(mg/l)	
		(gpm)	lab	field	(mg/l)	(mg/l)	total	diss.	total	diss.	total	diss.
Forebay (raw)	15	21 - 203	3.1 - 3.8	2.8 - 4.5	0	42 - 331	5 - 39	4 - 30	13 - 75	13 - 74	2 - 13	2 - 13
VFPE (east)	11	6 - 118	6.4 - 7.2	6.3 - 7.3	50 - 450	0 - 83	2 - 13	1 - 13	8 - 61	8 - 63	<1 - 2	<1
VFPW (west)	11	6 - 99	6.6 - 7.3	6.8 - 7.3	47 - 222	0 - 52	2 - 5	1 - 5	6 - 67	6 - 68	<1 - 1	<1
Wetland	3	NM	6.8 - 7.9	6.5 - 7.9	38 - 160	0 - 27	2 - 6	<1 - 5	16 - 46	15 - 43	<1 - 1	<1
Horizontal Flow LS Bed	10	23 - 200	7.0 - 7.3	6.8 - 7.5	64 - 157	0	<1 - 15	<1 - 3	16 - 47	16 - 41	<1	<1

Notes: Degraded, untreated, shallow, subsurface flow entering Settling Pond/Wetland; limited field alkalinity monitoring similar to lab results.

Johnson, Fred, 1999, personal communication, Reclamation Mgr., Amerikohl Mining, Inc.

PA Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, 1999, The Science of Acid Mine Drainage and Passive Treatment: 12 pp.

PA Department of Environmental Protection, Knox District Mining Office, 1998, Slippery Rock Creek Watershed Comprehensive Mine Reclamation Strategy: 192 pp.

Peart, Darcy and Charles D. Cooper, PE, PLS, 2000, Preliminary Investigation of Influent Distribution in a Vertical Flow System: (A PA DEP Reclaim PA project) *in* Proceedings of the 2000 National Meeting of the American Society of Surface Mining and Reclamation (Tampa, FL, June 11-15, 2000), . p. 427-437.

Skousen, Jeff, 1997, Overview of Passive Systems for Treating Acid Mine Drainage: Green Lands, p. 34 - 43.

Skousen, J., A. Rose, G. Geidel, J. Foreman, R. Evans, W. Hellier, et al, 1998, Handbook of Technologies for Avoidance and Remediation of Acid Mine Drainage: The National Mine Land Reclamation Center, 131 pp.

Stream Restoration Inc., unpublished 2000, Final Report Harbison Walker Restoration Area Mine Drainage Abatement Phase I, Ohiopyle State Park, Stewart Twp., Fayette Co., PA: (A PA DEP Reclaim PA project), Bureau of Mining and Reclamation, 75 pp.

US Department of the Interior, Bureau of Mines, 1994, Passive Mine Drainage Treatment Systems: Technology News, AML #12A, No. 407A, 4p.

Watzlaf, G. R., K. T. Schroeder, and C. L. Kairies, 2000, Long-term performance of alkalinity-producing passive systems for the treatment of mine drainage: *in* Proceedings of the 2000 National Meeting of the American Society of Surface Mining and Reclamation (Tampa, FL, June 11-15, 2000), . p. 262-274.

Younger, Paul L., 2000, The Adoption and Adaptation of Passive Treatment Technologies for Mine Waters in The United Kingdom: Mine Water and the Environment, Journal of the International Mine Water Association, Vol. 19, No. 2, p. 84 - 97.

Thursday,
July 5, 2001
Page N3 **

Governor rewards coalition's efforts

Watershed one of 25 groups to receive award

By Lawrence Sanata
TRIBUNE-REVIEW

A familiar name among environmental organizations in Butler County is the recipient of a new award from Gov. Tom Ridge.

The Slippery Rock Watershed Coalition, based in Cranberry, was one of 25 groups presented the Governor's Award for Watershed Stewardship during a ceremony last week in Harrisburg.

Margaret Dunn, co-founder of the local nonprofit coalition, said she was delighted with the honor and grateful to the many volunteers who continue to work toward improving the county's environment.

Cranberry

"This is one of the exciting things — the increase in the volunteering and the increase in the awareness of the importance of watersheds and restoring watersheds," she said.

In presenting the awards on behalf of the governor, David E. Hess, secretary of the Pennsylvania Department of Environmental Protection, mentioned Dunn by name, as well as some other environmentalists from across the state.

"I've seen their work firsthand," said Hess, specifying that he "toured treatment ponds with Margaret Dunn.

"These are Pennsylvania's new environmental heroes," he noted later in the ceremony.

An embarrassed Dunn said she was caught completely off guard by Hess' mention of her. "I kind of looked at my feet," she said, when she heard her name.

On the other hand, she commended Hess for visiting with her and Slippery Rock Watershed Coalition volunteers. Hess landed by helicopter May 15 at the DeSale Restoration Area in Venango Township, where a passive water treatment system was built to help filter stream water. Hess toured the site, including treatment ponds, for about 15 minutes, Dunn said.

"This may have been the first time that a secretary of the Department of Environmental Protection has ever visited our area. And that was a big deal to us," she said.

Hess said organizations chosen for awards took action to correct environmental problems.

"These award winners represent a new breed of environmentalist in Pennsylvania — people who don't want to make a point, they want to make a difference," Hess said in commending award winners.

"The key to the success of these organizations has been partnerships," he said. "Among the 25 award winners, 261 partnerships were formed with local governments, businesses, conservation districts, colleges and nonprofit groups," he said.

"Without cooperation from these diverse groups, we wouldn't see this kind of success," the secretary said.

Dunn said the work done by the Slippery Rock Watershed Coalition would not have been possible with-

PLEASE SEE COALITION/N5

TRIBUNE-REVIEW

Coalition recognized for environmental efforts

COALITION FROM/N3

out involvement of companies such as Aquascape Wetland and Environmental Services, Amerikohl Mining and Quality Aggregates, each of which has lent machinery, manpower and expertise to the group.

It is an interesting form of cooperation, she said, because those same companies still are heavily involved in mining in western Pennsylvania.

"We're bringing in partners that are not necessarily thought of as participating in environmental programs," Dunn said. "But they have contributed immensely to the success of the program. Without them, we would not have been successful."

The Slippery Rock Watershed Coalition was formed in December 1994 to restore a 27-square-mile area near the Jennings Environmental Education Center in Brady Township that was devastated by toxic runoff from abandoned underground and surface coal mines.

Since restoring that site, the group has tackled nearly a dozen other projects the county, all of them involving toxic runoff from mines and most of which have been abandoned for decades.

Through these efforts, about 150 tons a year of acid and about 50 tons a year of metals no longer enter the streams of the Slippery Rock Watershed, Dunn said.

In addition, about 100 acres of abandoned mine lands have been reclaimed and are used today for farming and wildlife habitats, she said. Fish also have been observed in a four-mile section of the main branch of Slippery Rock Creek, an area where fish have not existed for more than a century, the environmentalist said.

"We are seeing bluebirds coming back and songbirds coming back because of the work we have done," she said.

The coalition's efforts also are helping people who live downstream of the Slippery Rock head waters and depend on the creek and its tributaries as a source of drinking water, Dunn said.

"We have taken out tons and tons of metals, and that should help to benefit the use of the water downstream," she said.

Altogether, 25 organizations in Pennsylvania were recognized for outstanding achievements in environmental protection at the first-ever Governor's Awards for Watershed Stewardship ceremony.

Collectively, Hess said the award winners have:

- Helped clean 127 streams impacted by abandoned mine drainage.
- Installed five acid mine drainage treatment systems.
- Created 1,190 acres of wetlands.
- Planted 16,151 trees and shrubs.
- Stabilized 3,700 feet of stream bank.
- Installed 35,781 feet of stream bank fencing.
- Removed 1,000 pounds of trash.
- Preserved 9,450 acres of green space.
- Formed 12 watershed organizations.
- Educated 16,951 students and teachers.

Lawrence Sanata can be reached at lsanata@tribweb.com or (724) 779-7109.

Construction Complete for 'Growing Greener' Treatment System

Construction of a passive treatment system to treat acid mine drainage in the Slippery Rock Creek watershed, which was funded through "Growing Greener," has been completed nearly two months ahead of schedule.

Stream Restoration Inc. received a "Growing Greener" grant for $815,751 to construct Phase II of the DeSale Restoration Area. With a design flow of 200 gallons per minute, the recently installed passive system is expected to substantially restore and improve the water quality of an unnamed tributary that was heavily impacted by abandoned mine drainage, and will prevent more than 100,000 pounds per year of acidity and 30,000 pounds per year of metals from entering Seaton Creek.

This construction was completed on Sept. 5 - nearly two months ahead of schedule - and allows the wetland planting to be completed by the end of the year, more than eight months ahead of the projected timeline. Stream Restoration partnered with DEP's Knox District Mining Office and Bureau of Abandoned Mine Reclamation, as well as the mining industry, environmental professionals and students to complete construction.

The DeSale Restoration Area in Venango Township, Butler County, is one of the most heavily impacted areas of abandoned mine drainage in the 27-square-mile Slippery Rock Creek headwaters. Phase I of the passive treatment project, which was completed in just five weeks by Stream Restoration, was funded by a grant through the "Reclaim PA" program.

<> For more information on this project and other "Growing Greener" projects, visit http://www.GrowingGreener.org .

Return to Main Update Page

Individuals & Families | Students | Educators | Farmers | Local Government | Business
PA Home Site | GreenWorks.tv | Ask DEP | Plug-Ins | Home Page

Contact Webmaster Last Modified on 09/18/2000 15:17:10.

Slippery Rock Watershed Coalition Holds Annual Symposium

On April 6, more than 200 people packed the Jennings Environmental Education Center in Slippery Rock, Butler County, for the Slippery Rock Watershed Coalition's annual watershed symposium. Deputy Secretary for Mineral Resources Management Jeffrey Jarrett was one of a distinguished list of speakers that also included college professors and students, local government officials, mining industry representatives, and members of the coalition.

Jarrett spoke about the need for private-public partnerships to accomplish successful watershed restoration projects. He also commended the Slippery Rock Watershed Coalition for its efforts. The coalition has built a team of volunteers, academia and local mining companies to complete large passive treatments in only months. Jarrett's predecessor, Robert Dolence, received a lifetime appreciation award from the coalition for his support.

For the first time, the annual symposium also featured a question and answer session with a panel of experts. The symposium concluded with a tour of the coalition's DeSale Restoration Area and Goff Station Project, which are treating acid mine drainage in the Slippery Rock Watershed and were funded through the Reclaim PA and Growing Greener programs. The coalition has constructed a number of projects in the watershed to reclaim abandoned mines and treat acid mine drainage.

<> For more information on the Slippery Rock Watershed Coalition, visit http://www.srwc.org .

Return to Main Update Page

Individuals & Families | Students | Educators | Farmers | Local Government | Business
PA Home Site | GreenWorks.tv | Ask DEP | Plug-Ins | Home Page

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Last Modified on 04/26/2001 15:08:56.

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday September 14 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!!

SRWC Meetings will be held on the second Thursday of every month here on!!!

Kim Kosick Received Award in TriBeta Competition

Kim Kosick received **SECOND PLACE** at the regional **Beta Beta Beta** competition at Ganon University in May. TriBeta is a national biological honorary dedicated to improving the understanding and appreciation of biological study and extending boundaries of human knowledge through scientific research. Kim presented a paper co-authored by **Corey Gardener** and **Shaun Busler** concerning the treatment of acid mine drainage with a test tank Vertical Flow Pond and test bed wetland. Under the guidance of **Dr. Fred Brenner** and **Charles Cooper**, Kim, Corey, and Shaun have worked for over two years at Jennings Environmental Education Center constructing the pilot scale Vertical Flow Pond and test bed wetland and analyzing samples. Through this research, larger scale passive treatment systems can be more effectively designed to treat acid mine drainage.

During this past summer, Kim was an Ecology/Conservation director at the French Creek Boy Scout camp. She has received a full scholarship to Clemson University and plans to study Aquatic toxicology.

Completed Reclamation Projects Summary

The Slippery Rock Creek Watershed has seen a lot of action this summer. Several projects have been completed and Final Reports have been submitted to the PA DEP. **Charlie Cooper, Darcy Peart, and Shaun Busler** finished dye tests on several Vertical Flow Ponds within the watershed, including Jennings, the Ferris Complex (pictured below), and SR109.

De Sale Phase I was amazingly constructed in five weeks by **Amerikohl Mining, Inc.** consisting of two Vertical Flow Ponds with **innovative** flush pipes (pictured below), a settling pond/wetland, and a Horizontal Flow Limestone Bed. This passive treatment system treats one of the worst discharges within the Seaton Creek sub-basin.

At Goff Station (below), coal refuse extending into Murrin Run has been removed, neutralized, and placed within an abandoned strip pit. A total of over 78,000 cubic yards of coal refuse was removed, **approximately four times the amount originally estimated!!** Because of the strong partnerships and in-kind contributions from **Quality Aggregates Inc.**, this project was completed.

Modernizing Catalyst Distribution

The Slippery Rock Watershed Coalition is experimenting with distributing *The Catalyst* via email. For anyone who has access to HTML based email and is interested in receiving *The Catalyst* in this form, please send us an email requesting to change the method of delivery.

Photo of the Month

Photo of the Month

The Slippery Rock Watershed Coalition was honored to host a field tour organized by Chuck Cravotta, PhD, (USGS) of several passive treatment systems within the watershed, including the Goff Station Restoration Area (pictured above). Professors and students from Australia, who have similar problems with acidic discharges, toured the watershed with personnel from PA DEP, USGS, EPA, Aquascape, Amerikohl Mining, Inc., Quality Aggregrates Inc., Susquehanna River Basin Commission, U.S. Department of Energy, Ohio State University, University of Pittsburgh, Penn State University, Hedin Environmental, BioMost, Inc., and Stream Restoration Inc. (Notice everyone wearing Slippery Rock Watershed Coalition hats. Some of these hats are going to travel to the land Down Under!)

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., and Allegheny Mineral Corporation for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@salsgiver.com. September Distribution: 533 copies

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday November 9 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 10/12/00 meeting attendance: B. Beran, S. Busler, C. Cooper, T. Danehy, D. DeNicola, M. Dunn, D. Johnson, V. Kefeli, J. Reidenbaugh, and W. Taylor.

DCNR Award Given to Coalition and Jennings!

The Slippery Rock Watershed Coalition and the Jennings Environmental Education Center were recognized by the PA Dept. of Conservation and Natural Resources as one of the community partnerships in the state that exemplify successful efforts with partners to work toward improvements in state parks and forests.

The award was showcased by Geralyn Umstead, DCNR director of community relations at the DCNR managers conference in State College. DCNR Secretary, John Oliver stated at the presentation, "I believe very strongly in recognizing new and creative ideas in our ongoing bid to build community partnerships."

This coalition effort has brought many diverse partners from government, the private sector, and the community together to make this outstanding collaboration one of the most innovative and promising environmental partnerships in Pennsylvania.

DE SALE PHASE II WETLAND PLANTED

Students from Slippery Rock University, under the direction of professor **John Constable**, spent their afternoon Aquatic Plants Lab at De Sale Phase II planting a portion of the acre wetland. **Bob Beran** and **Jeff Reidenbaugh**, Aquascape, explained the function of the expansive wetland and planting procedures. **Tim Danehy**, BioMost, Inc., discussed the design of the passive treatment system, which consists of a forebay, two Vertical Flow Ponds in parallel, a settling pond, wetland, and Horizontal Flow Limestone Bed.

Do not worry if you were unable to attend the first stage in the wetland planting at De Sale Phase II. Come help the Girl Scouts plant the **Goff Station Restoration Area** on **October 21, 2000 between 9 AM and noon**. **Lunch will be provided!** Please contact the Coalition for more information.

ATHENS, GREECE… !!?

Dean DeNicola, Professor of Biology at Slippery Rock University, joined other algae enthusiasts at the International Diatom Symposium in Athens, Greece. There he presented his findings on Slippery Rock Creek from the last six years in a paper titled Changes in Benthic Diatoms in a Stream Treated for Acid Mine Drainage. This research is a value to the scientific community and the Coalition appreciates all the hard work Dean has done within the watershed. It is exciting to think that our efforts can benefit similar projects in Europe and elsewhere!

Dean DeNicola will be giving a seminar summarizing the last six years of chemical and biological monitoring data for Slippery Rock Creek. The seminar will be on **Friday October 13, 2000 at 4 PM in Vincent Science Hall, Room 204**.

COMING NEXT MONTH: Two exciting articles by Larry Sanata featured in the Pittsburgh Tribune Review titled "Ripple Effect" and "Industry Left Its Mark on Township."

PHOTO OF THE MONTH

PHOTO OF THE MONTH

FARM TOUR 2000 - COMING TO YOUR LOCAL TV STATION!

On September 28, 2000, active participants in the Slippery Rock Watershed Coalition were interviewed by local cable network reporter, Scott Lowe, concerning the De Sale Phase I Restoration Area. De Sale Phase I received the honors of being a featured location in the Butler County Farm Tour on October 7. (Participants interviewed include Bob Beran, Jeff Reidenbaugh, John Stilley, Shaun Busler, Tim Danehy, and Margaret Dunn. Special thanks to Donna Zang, PSU Extension agent. Much appreciation to Ted Kopas from the PA DEP, who traveled all the way from Harrisburg to represent the State's "Reclaim PA" and "Growing Greener" initiatives.)

☺ **Keep an eye out for the special on CABLE CHANNEL 10** ☺

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., and Allegheny Mineral Corporation for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724) 776-0161, fax (724)776-0166, sri@salsgiver.com. October Distribution: 533 copies

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday February 8 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 1/11/01 meeting attendance: L. Ansell, F. Brenner, S. Busler, C. Cooper, T. Danehy, C. Denholm, M. Dunn, D. Johnson, V. Kefeli, W. Taylor, and B. Beran.

YEAR 2000 IN REVIEW - WHAT A YEAR IT WAS!!!!!

Abandoned Mine Drainage Projects Completed

Site	Flow (avg. gpm)	Tons of Pollutant Removed Per Year Acidity	Metals
De Sale Phase I	34	25	6
De Sale Phase II	34	21	3
Goff Station (ST38 & ST39)	164	34	4
Total	232	80	13

Reclamation Projects Completed

- De Sale Restoration Area Phase I (June) - 8 Acres of Abandoned Minelands Restored
- Goff Station Gob Pile Removal (June) - Over 60,000 cubic yards of coal refuse removed and neutralized

Conferences Attended (Presentations Given)

$ Society for Mining, Metallurgy, and Exploration Annual Meeting - Salt Lake City, UT, 2/28-3/1 (Receive award)
$ Amer. Inst. of Mining, Metallurgical, and Petroleum Engineers Annual Mtg.- Nashville, TN, 3/12-3/14 (Receive award)
$ West Virginia Surface Mine Drainage Task Force Symposium Annual Meeting - Morgantown, WV, 4/4-4/5 (Poster)
$ American Society for Surface Mining and Reclamation Annual Meeting - Tampa, FL, 6/11-6/15 (2 professional papers - 1 by Darcy Peart at the tender age of 18!!, 3 posters - related to work completed at Jennings Env. Ed. Center
$ Harrisville Community Days - Harrisville, PA, 7/1 (Poster Presentation)
$ International Diatom Symposium - Athens, Greece (Presentation)
$ PA Watershed Conference: Restoration and Protection - State College, PA 10/12-10/13 (Oral /Poster Presentation)
$ 2nd Annual Southwest Watershed Workshop - University of Pittsburgh, Greensburg, PA, 10/21 (Presentation given)
$ Mining and Reclamation Advisory Board - Harrisburg, PA, 10/26 (Presentation)
$ 8th Annual Monastery Run Project Symposium - Saint Vincent College, Latrobe, PA, 11/16

Public Outreach/Volunteer Activities

$ Scrubgrass Power Plant Reclamation Site Tour - Numerous sites within watershed, 3/30
$ Slippery Rock Watershed Coalition Annual Symposium - Jennings Env. Ed. Center, Slippery Rock, PA, 4/6 -4/7
$ Slippery Rock Watershed Coalition Annual Get-Together - Epiphany Catholic Church, Boyers, PA, 4/12
$ Earth Day Tree Planting - Quality Aggregates Princeton Limestone Quarry, Princeton, PA, 4/29
$ Testimony to House Subcommittee on Energy and Mineral Resources by Margaret H. Dunn - Washington, D.C.,5/17
$ De Sale Restoration Area - Phase I Wetland Planting - De Sale, PA, 6/3
$ Site Visit of De Sale Phase I & II, Goff Station, and Jennings - Visited by Robert Narin, PhD., Oklahoma Univ., 8/15
$ Field Tour-De Sale Phase I & II, Goff Station, & Jennings- USGS, Australian Professors/Researchers & others attended, 8/24
$ Local Television Interview - De Sale Restoration Area - Phase I, Aired on local cable channel 10
$ De Sale Restoration Area - Phase II Wetland Planting - De Sale, PA, 10/2
$ Science Presentation - Evangel Heights Christian Academy, Science classes learn first hand about impacts of AMD and current restoration efforts, Sarver, PA, 10/5
$ Butler County Annual Farm Tour - Approx. 400 people visited De Sale Restoration Site, De Sale, PA,10/7
$ Girl Scout Wetland Planting - Goff Station Restoration Project - Goff Station, PA, 10/20-10/21
$ Stream Releaf Tour - De Sale and Goff Station Restoration Areas, 11/9

Recognition Received

$ Army Corps Recognize PA DEP, Knox District Mining Office - AInteragency cooperation, partnership, and environmental contribution@ (For their work in Elk County, PA)
$ Environmental Conservation Distinguished Service Award - Margaret H. Dunn, PG - Presented by American Institute of Mining, Metallurgical and Petroleum Engineers
$ Volunteer Group Award - Jennings Env. Ed. Center - Presented by Butler County Parks and Recreation Society
$ Letter of Congratulations from Tom Ridge, Govenor - Margaret H. Dunn - Presented by Robert C. Dolence, Dept. Secretary for Mineral Resources Management
$ TriBeta Competition Recognition of Kim Kosick, Grove City College - Presented by Beta Beta Beta honorary fraternity
$ Governors Award for Environmental Excellence - Jennings Env. Ed. Center - Presented on behalf of Governor Tom Ridge by James Seif, Secretary and Robert Barkanic, Deputy Secretary for Pollution, Prevention and Compliance Assistance, PA DEP

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Center receives education award

Environmental efforts recognized

By Lawrence Sanata
TRIBUNE-REVIEW

Many consider it a shining star tucked away in the rolling, wooded hills of Butler County. It is the Jennings Environmental Education Center, which last week received a Governor's Award for Environmental Excellence.

The award recognizes the state-operated center in Brady Township for its enterprising efforts in educating people from throughout the world about the impact of acid mine runoff and what can be done to resolve it.

Brady Township

Visitors learn by seeing a polluted stream running from an abandoned coal mine at the center, as well as some of the most advanced methods in the world for treating acid mine runoff, said Margaret Dunn, a Cranberry geologist and environmentalist who was among a handful of people to nominate Jennings for the award.

"This (award) is a great thing. "We're just very excited about it," said Dunn, who is involved with a variety of nonprofit environmental organizations that have been active in cleaning acid mine runoff in the county.

Fred Brenner, a professor of biology at Grove City College, said there is no question that Jennings is worthy of recognition. "They've been a major player," in helping understand acid mine runoff and helping clean acid mine runoff in the region, he said.

Many of the acid mine treatment systems that have been studied at Jennings are being used in this country and other countries, the biology professor said.

In addition, the center's involvement with elementary and secondary students, as well as college students, has helped more people to understand the environmental dangers caused by abandoned mines, he said.

Will Taylor, an environmental educator at the center, said a public-private partnership born in 1989 at Jennings has led to miles of polluted streams and acres of polluted soil being restored in Butler County. "I think what makes us unique is that we were one of the first people to do this," he said.

Companies such as Amerikohl Mining in Butler and Quality Aggregates in Neville Island have played an essential role in helping address acid mine runoff problems by lending their expertise and equipment, he said.

"I think the people who have been involved in some of the projects had their eyes open to what could be accomplished by working together," Taylor said.

In the beginning, Taylor said, he was skeptical of the effort to reclaim water and land affected by acid mine runoff.

"By 1992, or 1993, I started to get a clue that this is a big deal. If these systems work, this could be incredible. This could be the answer to some pretty major problems that we have," he said.

PLEASE SEE **CENTER/N4**

JENNINGS RECEIVES GOVERNOR'S AWARD!!!!!!!!

Jennings Environmental Education Center received the Governor's Award for Environmental Excellence in the category of Education and Outreach. On behalf of the center, **Will Taylor** and **Dave Johnson** accepted the award. Pictured above are **Will Taylor, Tanya Rucosky, Dave Johnson, Senator Mary Jo White, Darcy Peart, Cindy Shirley, Margaret Dunn, Tim Danehy, and Shaun Busler.** The following article is from the December 24, 2000 issue of the **Pittsburgh Tribune-Review.**

Center nets education award for efforts

CENTER FROM/**N3**

Work at Jennings also inspired the creation of the Slippery Rock Watershed Coalition, which has been instrumental in addressing acid mine runoff problems in the county, he said. The nonprofit group has been awarded hundreds of thousands of dollars in government grants to help restore streams and land, he said.

The coalition estimates that about 4,000 acres, or 25 percent of the headwaters of Slippery Rock Creek, are underlain with abandoned underground coal mines. The headwaters are located in northern Butler County and southern Mercer County, with Slippery Rock Creek running south through Butler County.

Gov. Tom Ridge honored 43 Pennsylvania organizations, individuals and companies from 27 counties for their environmental initiative.

The Governor's Environmental Excellence Award honors organizations, businesses and individuals for positively affecting Pennsylvania's environment. The awards are presented in nine categories: pollution prevention, energy efficiency/renewable, technology innovation, management systems, technical assistance provider, land use, industrial recycling, recycling and market development and education and outreach.

The Jennings Environmental Education Center was the only winner in Butler County.

Many of the awards, Dunn said, went to businesses that have reduced manufacturing wastes or developed new environmental processes. Jennings is different in educating, researching and cleaning the environment, she said.

The center was presented with the governor's award specifically for its education and outreach efforts. Even before the presentation of the award, Jennings was recognized by the Pennsylvania Department of Conservation and Natural Resources in one of its publications for its work in environmental education and outreach, Dunn said.

Jennings operates essentially "a public laboratory," she said. The passive treatment systems, which have been developed at Jennings, are on display and constantly are being studied, she said.

National and international environmental experts have visited Jennings to discover some of the methods being used locally to treat acid mine drainage, Dunn said.

Jennings, which is overseen by the Department of Conservation and Natural Resources, is one of 116 state parks within Pennsylvania. It is one of only four environmental education centers in the state and the only one in western Pennsylvania, according to state officials.

Last year, more than 167,000 people visited the center. Among those visitors were students from 260 elementary and secondary schools and 11 colleges and universities, state officials said.

Dunn estimated that about 2,400 miles of streams in Pennsylvania are affected by acid mine runoff. No one government agency will ever be able to restore those streams, she said.

A public-private partnership, like the one developed at Jennings, is the only viable way for streams like this to be reclaimed, she said.

6th Annual Slippery Rock Watershed Coalition Symposium!!!!!!

The 6th Annual Symposium will be held on **Thursday, April 5** and **Friday, April 6** at the Jennings Environmental Education Center. The date for the Get-Together at the Epiphany Church in Boyers, PA is scheduled for **Wednesday May 9.**

THE KIDS CATALYST

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITIES

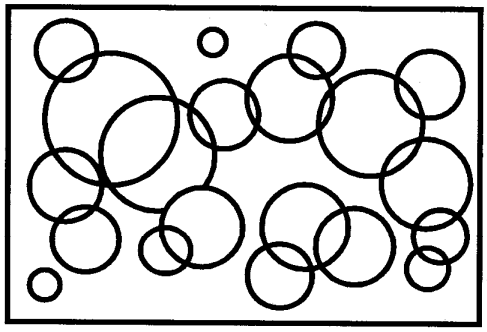
Coal is just one of the natural resources within many watersheds. By using these resources wisely we can help protect our watersheds from being impacted. Learn more about coal and why we use it on the back page. We hope you have fun with the word search below!!!

Thanks to everyone who participated in the coloring contest!!! If you haven't sent your coloring in to us yet, it is not too late!!! Send it to the Slippery Rock Watershed Coalition at 3016 Unionville Road, Cranberry Twp., PA 16066. For more information or hands on learning call us at (724) 776-0161.

Word Search Coal Challenge

What did one penny say to the other? "Together we make cents."

Can you find all of the hidden words? Complete the word search below by finding all of the bolded words from the paragraph on the back page.



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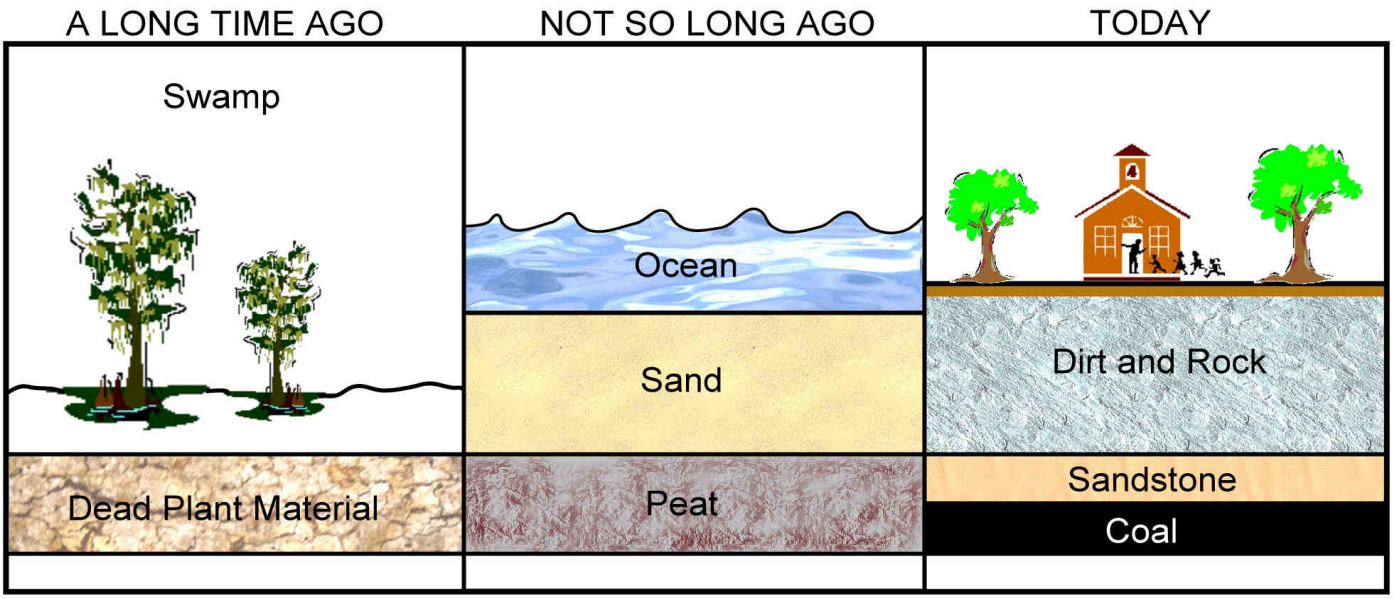

Illustration by: Cliff Denholm and Shaun Busler

How Coal Formed and Why We Use It

Coal, **oil**, and **natural gas** are **fossil fuels**. Fossil fuels formed from dead plants and animals that were buried a long time ago beneath **tons** of **rock** and **soil**. The **heat** and **pressure** created by the rock and soil slowly turned the dead plants and animals into these fossil fuels. Coal formed mostly from the dead plants that collected at the bottom of **swamps** and **bogs**. It took about 10 feet of dead plant material to make 1 foot of coal.

Coal is mainly used for heating, making **electricity**, and making **steel**. 60% of the electricity used in **Pennsylvania** is made by burning coal. Coal is burned to make **steam** which turns turbines which makes electricity.

Coal can also be baked in hot furnaces to make **coke**. This coke is used to make **iron** from iron ore which is needed to make steel for **bridges**, **buildings** and **automobiles**.

The United States mines 1,100,000,000 tons or 1.1 billion tons of coal per year. That is about 1/5 of all the coal mined in the world.

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., and Allegheny Mineral Corporation for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724) 776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. February Distribution: 606 copies

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Cranberry Twp., PA 16066

THE CATALYST-

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday April 12 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 3/8/01 meeting attendance: J. Belgredan, F. Brenner, C. Cooper, C. Denholm, D. Johnson, V. Kefeli, and W. Taylor.

2001 SYMPOSIUM VIRTUAL FIELD TOUR

Come on out and learn about passive treatment technology first hand from participants active in the Slippery Rock Watershed Coalition in a field tour of some projects in the watershed. Below is a brief description of each with a before and after picture of the site. The tour will begin approximately around 1:00 PM on Friday, April 6.

De Sale Phase I

Constructed in Spring 2000 by Amerikohl Mining Inc., the passive treatment system treats one of the worst discharges in the watershed. Amazingly it only took five weeks to construct this system. With full support, projects can be completed quickly and cost effectively.

De Sale Phase II

After seeing the reclamation of De Sale Phase I, an adjoining landowner with a 200 gpm discharge became interested, which resulted in Phase II. This system treats an entire stream! Using only environmentally friendly materials, the two passive treatment systems at De Sale are the first steps to restore Seaton Creek.

Goff Station Restoration Area

Scarred by towering gob piles that form the stream banks of Murrin Run and strip pits filled with acidic mine drainage, Goff Station is one of the largest projects to date within the Slippery Rock Creek Headwaters. Construction will be completed later this year by Quality Aggregates Inc. The construction will include a **bat hibernaculum**, which is first known of its kind east of the Mississippi.

(more on bats inside!)

SRWC ANNUAL SYMPOSIUM

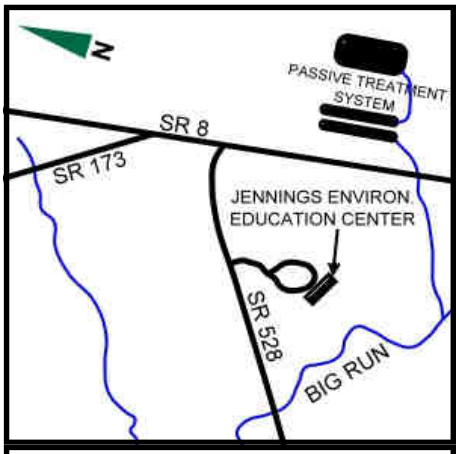
THURSDAY, APRIL 5

6:30 PM - 8:30 PM

Multimedia presentation entitled Hard Coal, Soft Coal: PA Mining in Film and Song by Dr. Philip Mosley, a historical, interpretative entertainer

- Food
- Posters
- Educational
- Family Fun!!

Call Jennings at (724) 794-6011 for more information.



The Symposium will be held at JEEC, which is located at the corner of State Routes 8 and 528 across from the Old Stone House about 8 miles north of Butler.

FRIDAY, APRIL 6

8:30 AM - 3:30 PM

Speakers

- Fred Brenner, PhD, Professor of Biology, Grove City College
- Jeff Jarrett, PA Department of Environmental Protection
- Joan Clippinger, PA Department of Conservation and Natural Resources
- Joe Aloe, President, Quality Aggregates Inc.
- Maurie Kelly, Pennsylvania Spatial Data Access (PASDA)
- Valentine Kefeli, Soil Scientist, Slippery Rock Watershed Coalition
- Students from local universities

As a new feature at our symposium this year, the Slippery Rock Watershed Coalition is having a panel of experts address questions regarding watershed/stream restoration, conservation, and protection. Please prepare questions and **stump the experts!!**

Panel will include:

- Bob Beran, Wetland Specialist, Aquascape
- Dave Johnston, Butler County Planning Commission
- John Stilley, President, Amerikohl Mining, Inc.
- John Oliver, Secretary PA Department of Conservation and Natural Resources
- Margaret Dunn, President, Stream Restoration Incorporated

Lunch will be provided!

A field tour of several recent projects will be conducted after lunch.

NO FEES OR DUES FOR ATTENDING!!

GET TOGETHER!

It is time once again for the annual “Get Together” which will be held at the Epiphany Catholic Church located off of Forestville Road and Rt. 308 in Boyers, PA on May 9, 2001 from 6:00 P.M. to 8:00 P.M. There will be door prizes, great picnic foods and loads of fun for everyone. So, come on out!!! All are Welcome!!! Bring the Family!!! Bring the Kids!!! Smash some Piñatas!!! For directions and more information call (724) 776-0161.

WILDLIFE LECTURE AT GROVE CITY COLLEGE

Jerry Hassinger, Endangered Species Coordinator, Pennsylvania Game Commission, will be presenting a lecture at Grove City College concerning the value of wildlife. The lecture will take place May 2 at 7:00 PM in Room 113, Rockwell Hall.

THE BATTY CATALYST

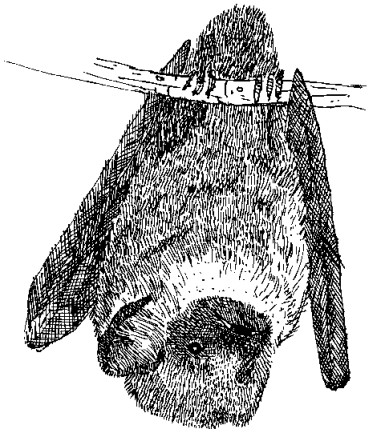
THE UNVEILING OF THE BAT HIBERNACULUM AT GOFF STATION

BAT HIBERNACULUM TO BE COMPLETED ON APRIL 6

Come and see the construction of the hibernaculum for yourself on April 6th as part of the Slippery Rock Watershed Coalition's Symposium Field Tour. That's right! The Slippery Rock Watershed Coalition is celebrating the construction of the bat hibernaculum at the Goff Station Restoration Area. Special thanks goes to Quality Aggregates Inc. who have donated the time, labor, and materials for this expansion project, which will further enrich and support the local ecosystem. Located in ideal bat habitat, this site will be the first manmade hibernaculum east of the Mississippi, that we know of, and will help support and increase the numbers of these vital animals in our area.

BAT FACTS

- Bats consume more than half there own weight nightly in mosquitoes and moths!
- Bats have perfectly good eyesight!
- Some bats can live for more than 30 years!
- Bats make their unnerving swoops over people's heads looking for mosquitoes!
- Less then 1/2 of 1% of bats are rabid, and they do not become aggressive when sick!
- Peaches, plantains, bananas, avocados, cashews, cloves, and mescal are all pollinated by bats!
- Very few bats eat blood, and none that do live in America!



OH GIVE ME A HIBERNACULUM!

Bats survive the harsh Pennsylvania winters by falling into a deep sleep called hibernation. By hibernating, bats can conserve their precious energy and survive for months without food or water. A hibernating bat's breathing and heart rate slows and their temperature drops dramatically. Often, it is hard to tell that they are alive at all!

Although hibernation helps bats conserve energy, it also leaves them helpless and weak. If a bat is disturbed during its hibernation, the energy it uses to wake up is wasted, and it may die before spring. Each time a bat has to wake up, two months worth of energy is consumed. In fact, tens of thousands of bats die every year because of human disturbances.

For these reasons, bats need to find a safe, warm and quiet place to hibernate. A cave or other such place that is used by bats is called a hibernaculum.

However, suitable hibernacula are increasingly hard to come by. Human disturbances have made many hibernacula unfit for bats. Without appropriate areas to hibernate, whole bat populations are at risk. The hibernaculum at Goff Station seeks to provide an ideal hibernating space for a wide range of bat species. Proper ventilation, insulation and predator exclusion have all been considered in our design, which we hope will serve generations of these tiny

PHOTO OF THE MONTH

PHOTO OF THE MONTH

WATERSHED RESTORATION AND LAND USE

The **Growing Smarter: Land Use in PA Conference** was recently held on March 18-20, 2001 at the Hershey Lodge & Convention Center in Hershey, PA. **Margaret Dunn**, **Tim Danehy**, **Shaun Busler**, **and Cliff Denholm**, representing the Slippery Rock Watershed Coalition, were among the **1400 people** in attendance. The conference focused on sound land use practices that are currently being utilized on the state, regional and local levels and how they can be further used and developed to ensure sustainable development and a high quality of life for all citizens. The Coalition presented a poster on the restoration activities at the De Sale Restoration Area and the North Liberty Reclamation sites and how they tied in with sound land use practices. Margaret was one of the speakers at the *Watershed Planning Initiatives at the Community Level* session and did an excellent job. We met lots of wonderful and interesting people from a wide variety of organizations. A great time was had by all!

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., and Allegheny Mineral Corporation for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724) 776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. April Distribution: 651 copies

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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday, June 14 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! There was no May meeting due to the Get-Together.

In the News!

Check out the two recently published newspaper articles regarding the bat hibernaculum at Goff Station. Both articles can be found online. The Pittsburgh Post Gazette published an article entitled "Making a Place For Bats" by Don Hopey on Monday, May 14. The Tribune Review published another article entitled "Going Batty" by Larry Sanata on Thursday, May 10. Also, WPXI Channel 11 local news broadcasted a segment on the bat hibernaculum which aired Monday, May 14. We have received many wonderful comments. The bat hibernaculum is an "outgrowth" of the Growing Greener project to passively treat abandoned mine drainage. **Thanks to Quality Aggregates for donating materials, equipment, and manpower. Thank you to WPXI Channel 11 local news, Tribune Review, Larry Sanata, the Pittsburgh Post Gazette, and Don Hopey for taking the time to look at the Goff Station bat habitat project.**

Where to find the articles on the World Wide Web:

Go to **www.postgazette.com** and search for the article by the title, "Making a Place for Bats"

&

Go to **http://library.triblive.com/interconnect/intercon.dll** and search

Slippery Rock University's Earth Day Celebration

Slippery Rock held a week-long celebration in honor of Earth Day (April 19th). Over 200 high school students came from all over the area to partake in the earth friendly festivities. There were exhibition booths, workshops, and live music! **Shaun Busler** manned the Slippery Rock Watershed Coalition booth while **Cliff Denholm**, an SRU graduate, facilitated a workshop which gave an overview of passive treatment technologies. **The SRU Earth Day project was excellent and thanks to Cliff and Shaun for representing the SRWC!!**

Geological Field Tour

In April, **Valentine and Galena Kefeli** attended a three day geological expedition, with students of Slippery Rock University. On the field tour Valentine studied the geological history of the area and explained soil formation in the Appalachian region. In the photo to the left are several Slippery Rock University Students studying a rock outcrop, "up close and personal."

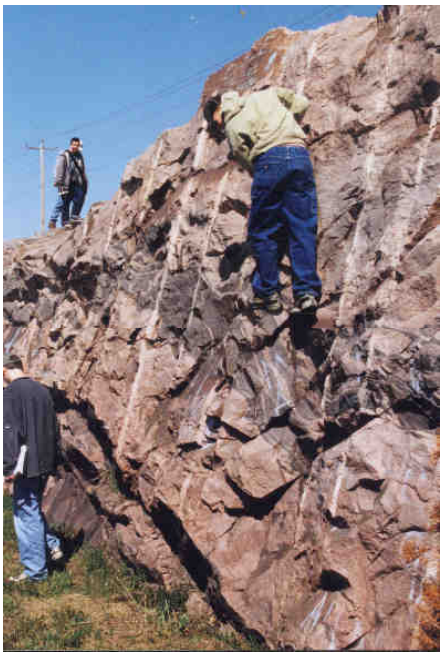

PHOTO OF THE MONTH

PHOTO OF THE MONTH

A Look at the DeSale Restoration Area from the air. Phase I is in the foreground and Phase II is center left.

Helicopter Tour at De Sale Restoration Area

Senator Mary Jo White; Representative Sam Smith; Acting Secretary of DEP, Dave Hess; and President of Amerikohl Mining, Inc., John Stilley toured the watershed on 05/17/01 via helicopter!!!! They viewed Chernicky (Able-Dreshman), North Liberty, and active mining sites from the air. They landed and took a walking tour of the De Sale Restoration Area with **Tim Danehy, Margaret Dunn, and Cliff Denholm**. Thanks to all for taking the time to stop out and especially for taking some wonderful aerial pictures of the watershed. An account of their trip appears in the Secretary's Scrapbook (05/23/01) on the PADEP website at http://www.dep.state.pa.us/dep/hess and click on the Secretary's Scrapbook and follow the links to find

Girl Scout Troop Constructs Bluebird Boxes

Junior Girl Scout Troop 653 from West Sunbury constructed bluebird boxes with the guidance of **Chip Brunst of the PA Game Commission**. **Robert Beran of Aquascape** assisted the members of **Troop 653**, **and troop leaders Deb Bowser and Marian Hall**, with the installation of the nest-boxes at the Goff Station Restoration Area on March 3rd. The girl scouts plan to continue visiting the Goff Station Restoration Area to monitor the bluebird boxes, which will provide additional habitat opportunities on the site. **Many thanks to Troop 653 for their help and hard work!!!!**

The Kids Catalyst

Word Jumble

Place the highlighted letters in the boxes to the left in order from 1-5 to spell a word **(read the definitions for clues).**

☐☐☐☐☐

1. LNDAWTE ☐☐☐☐☐☐☐
2. DACI ☐☐☐☐
3. TBA ☐☐☐

MEIN 4. ☐☐☐☐

MSTAER 5. ☐☐☐☐☐☐

IREVR 6. ☐☐☐☐☐

1. Noun, swamps or marshes, especially as an area preserved for wildlife.
2. Noun, a sour substance or a substance with a low pH
3. Noun, a flying mammal
4. Noun, where coal or other minerals are removed from the earth
5. Noun, a flow of running water along the earth's surface, a small river
6. Noun, a natural flow of water larger than a creek which empties into another body of water.

Remember to mail in the completed word jumble to receive a dollar discount at McDonald's or other local restaurants.
Mail to: Stream Restoration, Inc., 3016 Unionville Rd., Cranberry, Twp., PA 16066

Kid News Corner

If you belong to an organization and want your group to participate in restoration activities, there is always work to be done. Wetland plantings are coming up and help is needed. Contact Stream Restoration Incorporated for more information. You might even get your picture in the Catalyst!

The SRWC "Get-Together "

The kids had a wild and wonderful time with the Piñatas .

Feeding Frenzy

"I'm gonna git it"

Whack the fish, get the candy!

Thanks to everyone who helped with the Get-Together. A good time was had by all and we cannot wait until next year. Maybe we'll have to bring some safety goggles for protection from all the flying candy. **A special thanks to Quality Aggregates for their donations and all their help.** Everyone had lots of food, lots of fun, and we hope to see everyone next year. Special thanks to **Mark and Gloria DeMatteis** for the wonderful time.

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., and Allegheny Mineral Corporation for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724) 776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. June Distribution: 717 copies

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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday July 12 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 6/14/01 meeting attendance: T. Danehy, J. Campbell, J. Campbell, S. Busler, M. Busler, C. Treter, D. Funkhouser, F. Brenner, W. Taylor, V. Kefeli, M. Dunn, B. Beran, C. Cooper

ASSMR CONFERENCE IN NEW MEXICO

Margaret Dunn, **Cliff Denholm**, **Shaun Busler**, and **Tim Danehy** traveled to **Albuquerque**, **New Mexico** June 3-7 to attend the American Society for Surface Mining and Reclamation (ASSMR). During the meeting, they presented 4 posters!!! Their poster topics included *Visual Demonstration of Water Distribution in Vertical Flow Systems*, *Use of Biosolids in the Passive Treatment of Abandoned Mine Drainage*, *Enhanced Flushing of Metal Particulates from Vertical Flow Ponds Using a Multi-Tiered Underdrain*, and *Multi-Component Passive Treatment System: A One Year Study*. Other activities at the conference included technical sessions, panel discussions, and tours of the surrounding country side. The conference also served as an excellent forum for spreading the SRWC name with questions being asked about the bat hibernaculum and 70 SRWC hats being handed out! Congratulations on a successful conference and thank you for representing SRWC so well!

SLIPPERY ROCK WATERSHED COALITION WINS 2001 GOVERNOR'S AWARD FOR WATERSHED STEWARDSHIP

The Slippery Rock Watershed Coalition has been utilizing money that has become available through **PA Governor Tom Ridge's** "Growing Greener" initiative. The SRWC has applied this money to the restoration and reclamation of mine land affecting the Slippery Rock Creek. The actions of the SRWC were recognized and were selected as one of 25 projects across the state to be awarded with the ***2001 Governor's Award for Watershed Stewardship***. Attending the award ceremony for SRWC were **Dr. Fred Brenner**, **Dr. Valentine Kefeli**, **Galina Kefeli**, **Inna Alper, Shaun Busler**, **Melissa Busler, Tim Danehy**, **Margaret Dunn**, **Darcy Peart**, **Charles Cooper**, and **Chris Treter** . Inna came all the way from **California** to attend the award ceremony! Dr. Brenner and Dr. Kefeli accepted the award from **David Hess** Secretary of the Department of Environmental Protection, **David Hogeman** Director of the Department of Environmental Protection Grant Center, and **Robert Barkanic** Deputy Secretary of the Office of Pollution Prevention and Compliance Assistance. The SRWC also received a citation from PA State Senator Mary Jo White, PA State Representative Daryl Metcalfe, and PA State Senator Jane Orie. **Thanks to everyone who has worked hard making these awards possible!** (check out the picture on the last page of the Catalyst!)

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Participants assisting with the flushing of the Eastern Vertical Flow Pond at De Sale Phase II

FLUSHING AT DE SALE PHASE II

On June 20, flushing of the Eastern Vertical Flow Pond at De Sale Phase II was used to further our understanding of passive treatment technology. Participating were **Lauren Avon**, **Candace Kairies**, **George Watzlaf**, **Karl Schroeder**, **Jeff Skousen**, **Jennifer Demchak, Tim Danehy**, **Margaret Dunn**, **Shaun Busler**, **Cliff Denholm**, **Darcy Peart**, and **Chris Treter**. Jeff and Jen came all the way from **West Virginia** to help out! The Vertical flow pond was designed with 2 layers of pipes, with each layer being divided into quadrants. The flushing of the vertical flow pond involved opening valves for the flushing pipes for each quadrant of pipe in the vertical flow pond. The valves were opened one at a time, and sludge samples were taken at timed increments. Flow measurements were also conducted using a "4 inch drop-off" technique and a calibrated 30-gallon bucket. Flow from each pipe sometimes exceeded 300 gallons per minute!!! The purpose of the sample collections and the flushing was to gather information concerning the effectiveness of the Eastern Vertical Flow Pond at De Sale Phase II. Thanks to everyone for all their help and support with the flushing. A special thanks to the **US Department of Energy, National Energy Technology Lab in Pittsburgh** for making this all possible!!!

STREAM RESTORATION INCORPORATED INTERN

Stream Restoration Inc. was recently selected by the **Office of Surface Mining** to receive a grant to sponsor a summer internship. Stream Restoration Inc. selected **Chris Treter** as their summer intern. Chris is currently a student at **Grove City College**, studying biology. He was referred to the internship by **Dr. Fred Brenner**. As an intern, Chris will be accomplishing a variety of tasks. These tasks include helping to write and mail this monthly newsletter (not as easy a task as it seems), to develop and maintain the SRWC web page (you should really check it out at www.srwc.org), and to monitor and maintain the treatment systems installed by Stream Restoration Inc. Chris will also attend and aid in poster presentations at conferences, develop informational handouts, write news releases for local newspapers, and aid in the grant research and writing process.

The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITIES

COLORING CONTEST!

You asked for one, so here it is. Grab your crayons, colored pencils, markers, chalk, or whatever and color the picture below. The first 100 kids that send in a colored picture to the Slippery Rock Watershed Coalition will win a ***GIFT CERTIFICATE TO MCDONALDS OR ANOTHER LOCAL RESTAURANT!*** Good luck and happy coloring.

Picture Colored by:_____ **Age:**____ **School:**_____

Address:_____

A bat flies towards the bat hibernaculum, where it will make its new home.

2001 Governor's Award for Watershed Stewardship Reception

Left to Right: David Hogeman (Director, PA DEP Grants Center), Margaret Dunn, Chris Treter, Darcy Peart, Galina Kefeli, Charles Cooper, David Hess (Secretary, PA DEP), Tim Danehy, Inna Alper, Fred Brenner, Melissa Busler, Shaun Busler, Valentine Kefeli.

Check out all of the improvements that Chris has made to the SRWC web page at

www.srwc.org

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., and Allegheny Mineral Corporation for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724) 776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. July Distribution: 740 copies

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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday September 13 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 7/14/01 meeting attendance: C. Denholm, C. Cooper, J. Belgredan, F. Brenner, V. Kefeli, L. Spencer, W. Taylor, S. Busler, M. Busler, M. Dunn, T. Danehy, J. Reidenbaugh, T. Kennedy

Flushing at De Sale Phase I

On August 10, flushing of a vertical flow pond at the De Sale Phase I site was conducted by **Chris Treter,** OSM intern at Stream Restoration Incorporated, and **Jamie Stilley,** volunteer. The vertical flow pond was designed with two layers of pipe, with each layer being divided into quadrants. The flushing of the vertical flow pond involved a quadrant on the upper layer of pipe and a quadrant on the lower layer of pipe and lasted for over *5 and 1/2 hours!* The valves for each pipe were opened at the same time and several sludge and water samples were taken throughout the flushing. Flow measurements were conducted using the "4 inch drop-off" technique.

This preliminary attempt at extended flushing was conducted to observe the movement of solids through the compost and limestone layers of the vertical flow pond. The information collected from this test will help improve passive treatment technology. *Thanks to Jamie and Chris for conducting the flushing and collecting the samples!*

SITE MAINTENANCE IN THE SLIPPERY ROCK WATERSHED

Last month, **Jamie Stilley,** volunteer, and **Chris Treter,** OSM Intern at Stream Restoration Inc. traveled in the Slippery Rock Watershed and conducted maintenance on several of the passive treatment systems. The sites included **De Sale Phase I**, which is entering its second year of operation, and **SR 114** (also known as **Argentine**) which is entering its sixth year of operation. The maintenance at SR 114 involved the removal of iron precipitate from a trash rack that protects the drain to the wetland. It was a challenging job because the precipitate was extremely soft and had worked its way into every possible crack and crevice. By cleaning the trash rack, flow into the wetland drastically increased from its previous trickle and overflowing the settling pond was avoided! Maintenance at De Sale Phase I involved the cleaning of a pipe that was partially clogged with iron precipitate. Maintenance of these sites took less than three hours to complete! **Thanks to Jamie and Chris for the maintenance effort!**

SHAMOKIN WATERSHED TOURS SLIPPERY ROCK WATERSHED

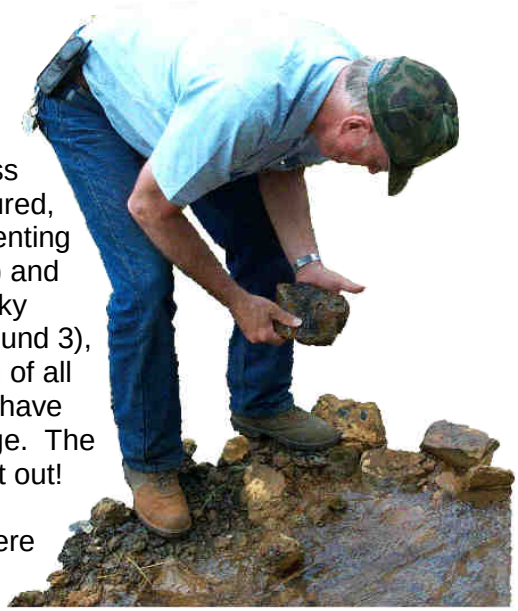
Recently, the **Shamokin Watershed Group** toured several sites in the Slippery Rock Watershed. The tours were conducted by **Will Taylor** (Jennings Environmental Education Center), with help from **Dr. Fred Brenner** (Grove City College) and **Bob Beran** (Aquascape). Fred Brenner assisted in the morning at **Jennings Environmental Education Center** and Bob Beran assisted at **Goff Station**. The tour concluded at **De Sale.** Thank you, Shamokin Watershed Group for praising our efforts!! We can not tell you how much this means to us.

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Dr. Fred Brenner of Grove City College and Shaun Busler of Stream Restoration Incorporated busy themselves with electro-fishing as Nick Morgan and John Lawrence look on.

FISH GET BUZZED ON ELECTRICAL CURRENT



Monday, August 6th, an electro-fishing survey was conducted in Seaton Creek by **Dr. Fred Brenner, Nick Morgan** (Grove City College), **John Lawrence** (Slippery Rock Watershed resident) **Shaun Busler, Cliff Denholm,** and **Chris Treter** (Stream Restoration Incorporated). Electro-fishing is a harmless process that involves stunning fish with a mild electrical current so the fish can be captured, identified, and released back into the stream. The fish survey involved documenting the absence of fish at the raw flow at **De Sale Phase II** (before any restoration) and shocking at **McJunkin Road** downstream of the De Sale systems and Chernicky reclamation), **Erico Bridge** (future restoration area under Growing Greener Round 3), **Murrin Run** (at the Goff Station system), and **Goff Station Road** (downstream of all restoration areas). The water tested prior to entering De Sale Phase II did not have any fish, due to the poor water quality and no fish were observed at Erico Bridge. The iron content in the water at Erico Bridge was so high, the generator would short out! When the survey was completed, 4 five-spine stickleback, 1 pumpkinseed, 2 johnny darter, 1 bullhead, 3 crayfish, 3 green frogs, and 13 common shiners were found. *Special thanks to everyone involved in the testing and thanks to Grove City College for making this possible!*

The *KIDS* Catalyst

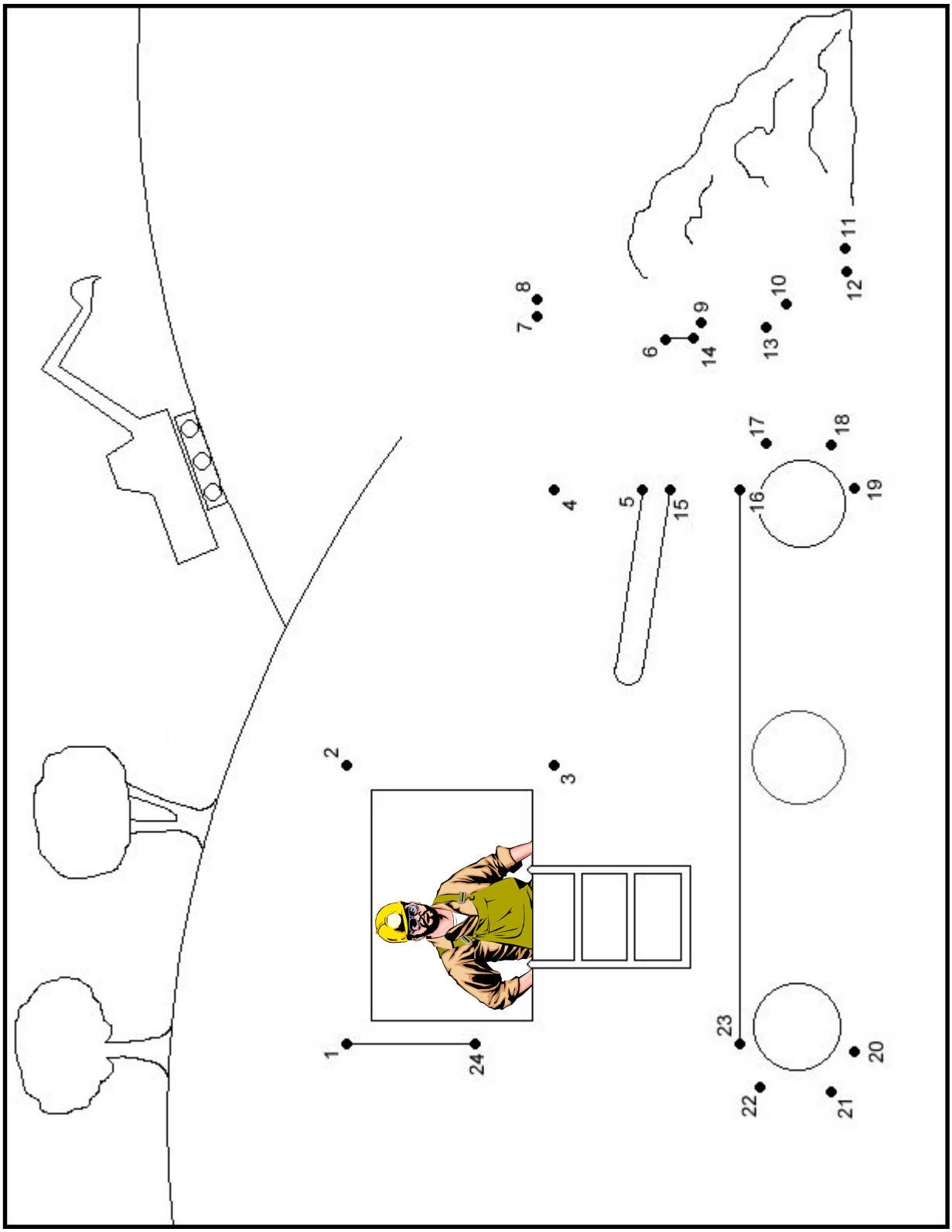
SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITIES

CONNECT THE DOTS

Connect the dots to see what the picture is. When you are done connecting the dots, color the picture. And don't forget to send the colored picture to the Slippery Rock Watershed Coalition for a ***GIFT CERTIFICATE TO A LOCAL RESTAURANT!***

Completed by: _____ **Age:** _____ **School:** _____

Address: _____



Construction equipment, like this bulldozer, is important for the construction of passive treatment systems.

ARRIPA TOUR

On 7/20/01, participants of the Slippery Rock Watershed Coalition had the privilege to attend a tour of reclamation sites in Indiana and Cambria Counties with the Association of Independent Power Producers in the Anthracite and Bituminous Regions of Pennsylvania (ARIPPA). First stop on the tour was the Ernest site where **John Stilley** of Amerikohl Mining, Inc. discussed a current remining operation that will reclaim a previously barren coal waste pile situated between a church and a stream. Amerikohl's project in addition to a major reclamation effort being made by the Cambria Reclamation Corporation, discussed by **Dave Young,** Cambria CoGen, will reduce pollution in the stream, improve the drinking water supply for the town of Ernest, reclaim and revegetate about 250 acres and create about 14 acres of wetlands!! The learning kept moving along as **Barry Scheetz**, PSU & **Roger Hornberger**, PADEP discussed geology, mining, reclamation and coal ash whilst traveling between sites. Next stop was the Colver Power Project where presentations on coal ash utilization were given by **Dennis Noll**, Earthtech, Inc., **Mike Menghini**, PADEP, **Dr. Art Rose**, Prof. Emer. PSU, **Dennis Simmers, Jeff Zick,** and **John Hall**, Colver Power Project. The award winning Colver project utilizes waste coal as fuel and produces alkaline coal ash used in the successful reclamation of the site! Last but not least was a trip to Nanty Glo and Revloc where **Gary Anderson**, General Manager Ebensburg Power Company presented the problems and solutions being applied in the field!! Special thanks goes to **Todd Lawton**, Scrubgrass Generating, for the invite and **Bille Ramsey**, ARIPPA for the hospitality!!!! *It is truly exciting to see reclamation in action!*

FUTURE ARTICLES

- $ Jennings Environmental Education Center hosts Watershed Workshops
- $ Jack Dam construction at De Sale Phase II

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., Allegheny Mineral Corporation and PA DEP for their support.
For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. September Distribution: 743 copies

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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday October 11 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 9/13/01 meeting attendance: C. Denholm, C. Cooper, J. Belgredan, F. Brenner, V. Kefeli, W. Taylor, M. Dunn, T. Danehy, D. Johnson, D. DeNicola

Butler County Commissioners Donate $180,000 to Slippery Rock Watershed Restoration Projects!!!!!!!

The **Butler County Commissioners** have generously donated an amazing $180,000 to two SRWC restoration projects located in Venango Twp., Butler County!!! They gave $120,000 to the Erico Bridge Restoration Project, which will include the removal of gob piles, some of which are situated in Seaton Creek, and the installation of the largest known Anoxic Limestone Drain within PA!!! In addition, large wetlands will also be created at the Erico Bridge site. The County Commissioners also gave $60,000 to the De Sale Phase III project which is planned to be an innovative system to treat abandoned mine drainage with a high metals concentration!!! This funding is in addition to the Growing Greener Funding provided by the PA DEP and the in-kind contributions among the project partners.

To **James Kennedy, Glen Anderson, and Joan Chew** we would all like to say:

THANK YOU, THANK YOU, THANK YOU FOR YOUR SUPPORT AND MAKING THIS PROJECT HAPPEN!!!!!!!

Jack Dams at De Sale

On August 17th, **Shaun Busler** of **Stream Restoration Inc.,** and **Nick Morgan** (see photos below) of **Grove City College** under the direction of **Dr. Fred Brenner,** professor at Grove City College, constructed jacks dams of various sized limestone donated by **Quality Aggregates' Boyers Quarry.** The jack dams were strategically placed in unnamed tributaries of Seaton Creek, with the hope of reducing acidity and increasing alkalinity. Monitoring these jack dams has been and will continue to be conducted by Grove City College students. Monitoring has already indicated a decrease in acidity.

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Saving Slider Turtle!!!

On September 6th, **Paula Langsdale,** a Cranberry Township resident and Mohawk Elementary Special Education teacher, happened to notice while driving home on the PA Turnpike a little turtle trying to cross the road amongst rush hour traffic. Paula, pulled off the side of the road, made a literal mad dash across the two lanes of speeding east bound traffic, picked up the turtle and ran back hoping not to get hit herself. She contacted **Stream Restoration Incorporated** who told her to bring it on in. Stream Restoration in turn handed it over to **Bob Beran** of **Aquascape,** who with the help of his son **Matt** (pictured above holding the turtle) released it into the final polishing wetland of the **Goff Station Restoration Area** on September 9th. **Bob Beran** identified the turtle as being a Pond Slider Turtle. Pond Slider Turtles are typically found from Virginia to Florida and West to New Mexico as well as down into South America; however, they are also very popular as pets and probably had just been dropped off at some convenient location. But thanks to Paula and members of the Slippery Rock Watershed Coalition the turtle has a new home where he should be quite happy. Pond Slider Turtles prefer calm waters, with soft bottoms, and dense vegetation which makes the final wetland an ideal habitat.

SRWC in the Pittsburgh Tribune

We hope you saw **Laura Spencer** and **Bob Beran** of **Aquascape** wading in the iron sludge at the Erico Bridge Restoration Area in a wonderful article written by **Larry Sonata** of the **Pittsburgh Tribune-Review**. The excellent photos were taken by **Joe Appel** also of the Tribune Review. If you missed it, the article appeared in the Butler County section on August 9, 2001. The article can be found at www. Triblive.com/search/. Then under the search enter : Seaton Creek.

SRWC's Dr. Valentine Kefeli Teaches Soils Lab Course

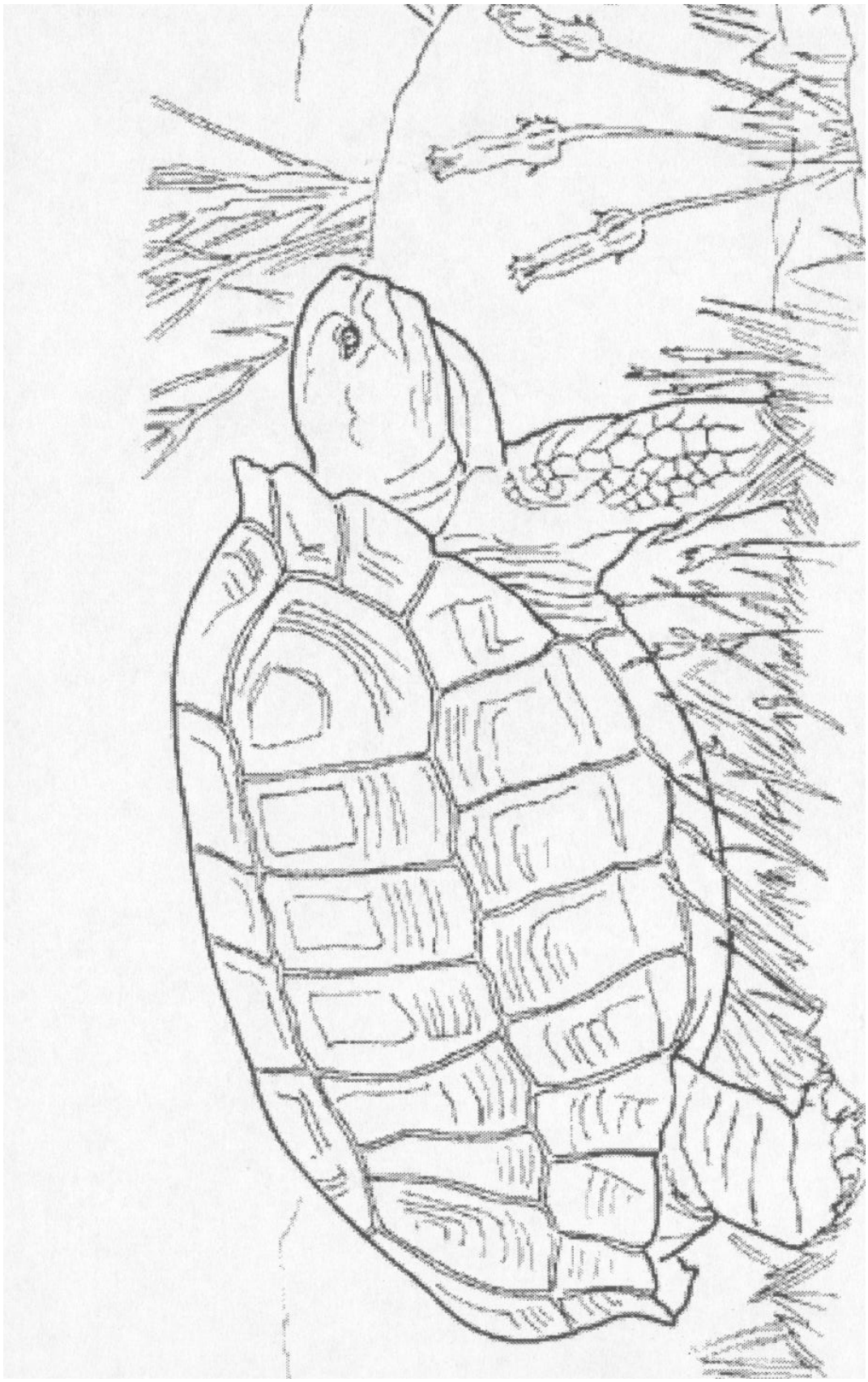
Dr. Valentine Kefeli of the **Slippery Rock Watershed Coalition** has teamed up with **Professor Bruno Borsari** of **Slippery Rock University** to teach a lab course entitled "Soils as a Resource" at the Macoskey Center, Slippery Rock University, for the Fall 2001 Semester. The course will include a wide variety of topics ranging from soil as an ecosystem to Carbon/Nitrogen Ratios to chemical and physical parameters of soil to polluted soils. Dr. Valentine will also include in this course aspects of his work involving fabricated soils for landscape reclamation.

The *KIDS* Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITIES

Turtle Color Page

Color the picture and send it into the Slippery Rock Watershed Coalition to get a free gift certificate.



Turtles are reptiles that have outer shells and lay eggs. There are over 250 different kinds of turtles. Different kinds of turtles live in different kinds of places. Some live in hot dry deserts, while others live in cool mountains. Some live in forests while others live in the oceans. Many like to live in ponds and wetlands. Wetlands are also known as marshes, bogs, and swamps. Check out the article about the pond slider turtle on the opposite page

The largest turtle is the Leatherback Sea Turtle which lives in the ocean and can be 6-8 feet long and weigh between 1,200 and 1,500 lbs. The smallest turtle is the Bog Turtle which is only 3-4 inches long. Different turtles also eat different things. Most turtles eat plants, insects , or small fish. Turtles can live to be about 30-40 years old, but some live to be over 100 years old. The large tortoise that lives on the Galapagus Islands can live to be 200 years old.

Name_____ Age_____ School_____

Address_____

Going Batty...Mist Netting at Goff Station

On a warm summer night in late August, a group of about 25 people representing various organizations and government agencies including members of the **PA Game Commission, PA DCNR, Slippery Rock Watershed Coalition, and students from Slippery Rock University** came together to answer a question: Are there bats at Goff Station and will they use or are they using the bat boxes and hibernaculum? A tour of Goff Station was conducted by **Bob Beran** of **Aquascape** for those unfamiliar with the site. Inspections of the bat boxes revealed a bat was using one of the boxes. As dusk approached, two nets were set up and then we waited. We saw lots and lots of bats……flying around, but no bats were actually caught in the net so we could not identify what type or types of bats were there. The important thing is bats were there and we were very excited about it despite not catching any, besides we all had a great time!!! There are plans to do it again one more time in the next couple of weeks with **Dr. Fred Brenner** of **Grove City College, Will Taylor** of the **PA DCNR's Jennings Environmental Education Center,** and **Bob Beran**.

On a related note **Cal Butchkowski,** of the **PA Game Commission** has installed remote sensing equipment so that we can monitor conditions within the bat hibernaculum such as temperature. This information can then be used to try to maintain optimal conditions for wintering bats.

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., Allegheny Mineral Corporation and PA DEP for their support.
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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: January 10 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! 12/13/01 meeting attendance: C. Cooper, D. Johnson, V. Kefeli, M. Dunn, S. Busler, J. Belgraden, C. Treter, D. Funkhouser, C. Denholm, K. Denholm, W. Taylor, T. Turner, J. Reidenbaugh, L. Spencer

De Sale Phase II Flushing

On December 12, 2001, researchers from the Department of Energy's National Energy Technolgy Laboratory conducted another scientific experiment on the flushing of the De Sale Phase II Vertical Flow Pond System as a continuation of the study that was begun in June of 2001. This time Vertical Flow Pond West was used and a more thorough flushing was conducted, completely draining the pond.

The purpose of the study is to determine the effectiveness of the innovative two-tiered piping system designed to flush out the accumulated metal precipates and other solids retained within the vertical flow ponds. Participants included **George Watzlaf**, **Karl Schroeder**, **Tim Danehy** of SRI and **Candace Kaires**, of the DOE NETL. We are looking forward to seeing the results of this study and hope that they will help to further the development of passive treatment systems!

Accepting The Challenge In The News

Since the release of this remarkable book, local papers have begun to publish articles. On November 30th the Slippery Rock / Grove City Eagle had a short article under Quick Takes on the front page. It was entitled "Book Offers Insight Into Mine Drainage." In the Allied News on December 12th there was an article titled "Book Sheds Light On Effects Of Mine Drainage On Environment." The article, written by Felicia Petro, went into depth about the book and included quotes from Will Taylor and Margaret Dunn. In addition Shaun Busler, Will Taylor, and Margaret Dunn were interviewed by Scott Deacle of the Pittsburgh Post-Gazette. Look for an article on *Accepting The Challenge* to be published soon.

Thank you to all of you who are helping us get the word out about this informative book.

For those of you who have not yet received a copy:

Call us at 724-776-0161
Write us at
3016 Unionville Rd.
Cranberry Twp. PA 16066.
E-mail us at sri@salsgiver.com

We are requesting a donation of $8 to help offset the cost of the printing and postage.

Visit us on the web at www.srwc.org

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Pictured above are members of the PA DEP participating in a stream assessment of Blacks Creek, a tributary to Slippery Rock Creek. **Sherry Carlin** (back left), watershed manager, assists **Tim Gillen** (back right) Hydrogeologist with flow measurements while **Scott Alexander** (front left), Water Pollution Biologist measures pH. Thanks to Sherry, Tim and Scott!!!

Stream Assessments with the PA DEP

Thorough stream assessments are extremely valuable to watershed groups. They help to characterize the ecological health of streams within a watershed which allows you to identify and prioritize problem areas for restoration projects as well as identify those streams which are of good quality.

Scott Alexander, PA DEP Bureau of Mining and Reclamation has been an extremely valuable resource and excellent partner of the Slippery Rock Watershed Coalition. Although not from this area, Scott none the less, has an interest in watershed restoration, AMD issues, and the work of the Coalition. So much so that he is willing, wanting, and able to come all the way out from the Ebensburg office about two hours away to assist us whenever he can.

This past summer and fall Scott assisted **Shaun Busler, Stream Restoration Inc.**, in the assessment of Big Run and Blacks Creek, both tributaries to Slippery Rock Creek. Blacks Creek is affected by abandoned mine drainage and the data collected from the stream assessment will be submitted as part of a Growing Greener grant to reclaim the McIntire site, the prime source of degradation to Blacks Creek.

In addition, **Sherry Carlin** and **Tim Gillen** of the **PA DEP Knox District Mining Office**, came out to assist with the assessment. Just another example of the value of public-private partnerships and what they can accomplish.

Watch For In Next Months Catalyst:
News on the SRWC Symposium in April of 2002

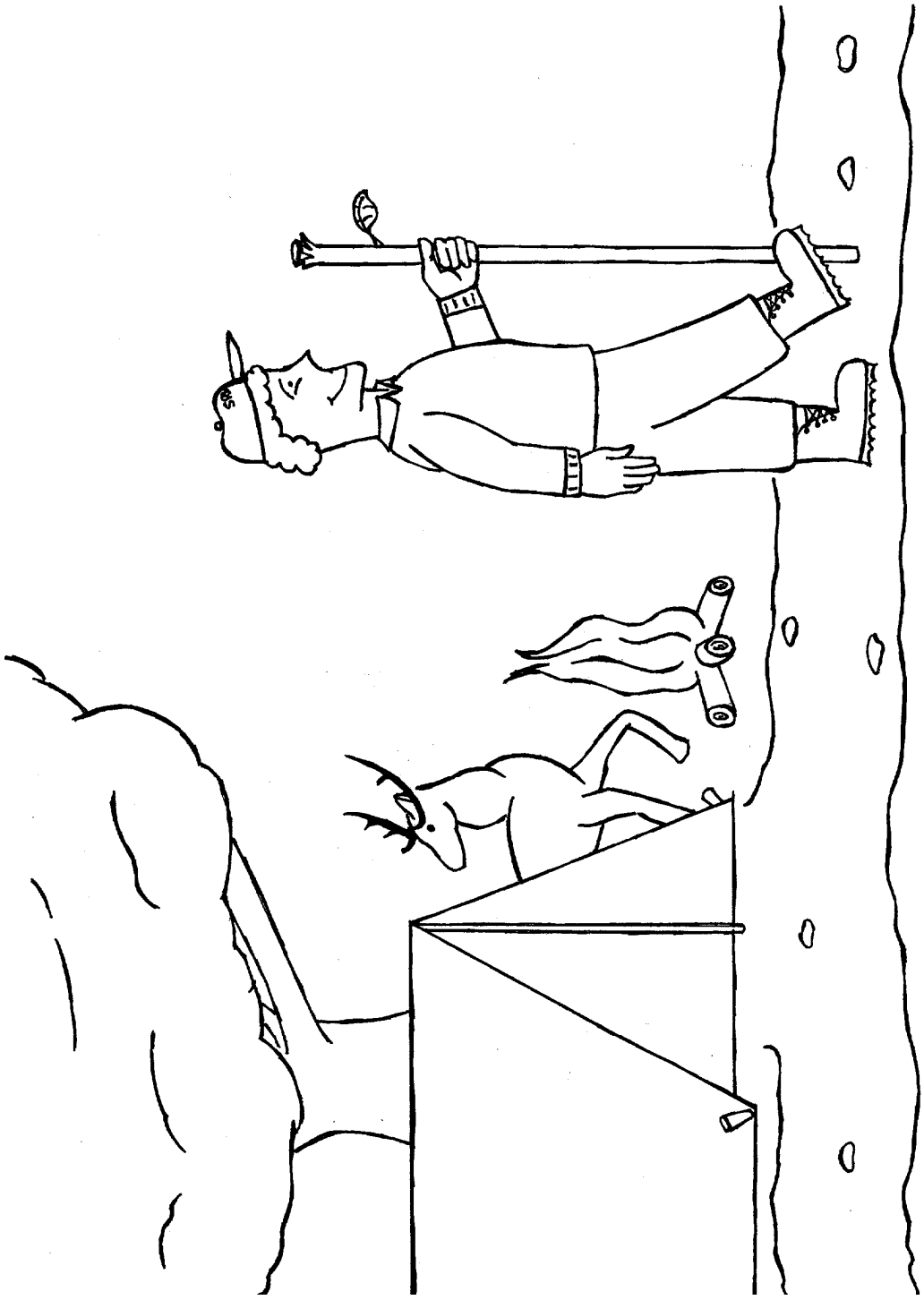
The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY

Hiking The North Country Trail

Here is a picture of Hiker Joe hiking along the North Country Trail. While hiking he came across many different animals and plants. Hiker Joe wants to tell you, you should always hike with a buddy. If you are interested in hiking read the article on the back page.

After you color Hiker Joe send him back to us to receive a gift certificate.



Age _____

Name _____

Address _____

The North Country Trail Association
Third Annual Cherry Pie Hike

The North Country Trail Association is sponsoring a hike to celebrate George Washington's birthday by hiking along the North Country Trail on February 23, 2002. The North Country National Scenic Trail, when completed will be approximately 4,200 miles long making it the longest continuous trail in the United States, starting in North Dakota and ending along the New York/Vermont line.

A section of the trail cuts through the Slippery Rock Creek watershed and passes by several of our passive treatment systems as well as the passive treatment demonstration site at Jennings Environmental Education Center located at the junction of RT8 and RT 528 north of Butler, PA across from the Old Stone House. We hope to put up informative signs explaining these systems in the near future.

If you would like to take part meet at the Old Stone House on RT 8 north of Butler, February 23, 2002 at 9:00 AM. After the hike join us for pie and coffee (there is a $4.00 donation) and tour the Old Stone House. There will be a French and Indian reenactment and campout on the grounds during this time. Talk to people about what life was like in this period when Washington walked through western Pennsylvania. If you need more information, please contact the North Country Trail Association at 724-287-5019 or visit them on-line at www.northcountrytrail.org. Tickets must be purchased in advance. They can be picked up at the Butler County Chamber of Commerce in Pullman Center Business Park, 112 Woody Dr. or by calling 724-287-5019.

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., Allegheny Mineral Corporation and PA DEP for their support.
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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: May 9 @ 7:00 PM, Jennings Environmental Education Center, Pizza and Pop will be provided!! Due To The Symposium Last Month's Meeting Was Canceled.

Come On Down To The SRWC Annual Get-Together!!!

Yes, it is time once again, for the Slippery Rock Watershed Coalition's Annual Get-Together, which will take place on May 1, 2002 from 6 PM to 8 PM. The fun-filled event will be held again this year at the Epiphany Catholic Church, located off of Forestville Road and State Route 308 in Boyers, PA.

We will be having door prizes and last year's favorite...piñatas for the kids. We will also be displaying a variety of the Kids Catalyst Colorings that we have received over the past year. So bring out the entire family for good food and good times. For more information and/or directions call Deanna Funk-houser at (724) 776-0161. Bring the whole family for an evening featuring: FREE FOOD; DOOR PRIZES and MORE!!!

7th Annual Slippery Rock Watershed Coalition Symposium — Yet Another Success

Just when you thought that the Symposium couldn't get any better, it did!! When compared to the very first Symposium in 1996, although some things have stayed the same, many things have grown and improved. This year's symposium, which consisted of three days, definitely was the best so far (!!!), a wonderful tribute to the organizing and planning skills of **Janice Bel-graden, Deanna Funkhouser, and Will Taylor!!!**

On Friday April 12th, the last of the three-day event took place with **Dave Hess, Secretary of the PA DEP**, giving a very warm Key Note Address specifically recalling accomplishments of the SRWC. **Margaret Dunn** gave her traditional "State of the Watershed" address before presenting **Dave Hess** with this year's **Slippery Rock Watershed Coalition's Appreciation Award!!!** Secretary Hess is certainly deserving of this award for his tireless effort, dedication, and support of not only the Slippery Rock Watershed Coalition, but of all watershed groups throughout Pennsylvania. Secretary Hess's dedication can be easily seen through the **Secretary's Scrapbook** on the PA DEP website which chronicles his constant trek throughout the 67 counties of the Commonwealth. And yes, within his first year as Secretary of the DEP he visited at least one if not several Growing Greener watershed projects in every single county.

Following the Appreciation Award, two in-depth presentations were given to chronicle how the Coalition completes complex multi-faceted projects utilizing the public-private partnership effort model from concept through construction to outgrowth projects, education/outreach activities and operation and maintenance. The two projects used to demonstrate these concepts were the **De Sale** and the **Goff Station** Restoration Areas.

After lunch, a field tour was provided to showcase and demonstrate three projects which are in different stages of development. The first stop was Goff Station, a very unique project that has been completed. The second stop was Erico Bridge, a project under construction. The last stop was SR81, a site before construction.

PHOTO OF THE MONTH

Those attending the Symposium on April 12th, posing with Secretary Hess!!!

PHOTO OF THE MONTH

PA CleanWays Earth Day Cleanup!

On April 27, PA CleanWays of Butler County will be removing trash from Big Run, a tributary to Slippery Rock Creek, this stream also flows through Jennings Environmental Education Center. Volunteers will meet in the unpaved parking lot near the Country Corner Store on Rt. 8 at the intersection of Staff and Hall Roads in Brady Twp. between 8:30 and 8:45am. Be sure to wear appropriate clothing! Food will be provided. For more information call Sheryl at 724-284-5305.

Wetland Plantings Are A Great Way To Get Involved!

On May 11th, there will be a wetland planting at DeSale! Wetlands are important for the animals who live in the area and they also remove pollutants from the water. We need all sorts of people and groups to help. Those of you who would like to get involved and help can call Shaun Busler at 724-776-0161 or e-mail him at sri@salsgiver.com A brief tour of the site and explanation of the project will be given.

Bob Beran At MS3 Seminar Series

On Wednesday April 3rd, **Bob Beran** from Aquascape Inc., spoke on *Incorporating Biodiversity into Treatment/Constructed Wetlands* at the MS3 Sustainable Systems Seminar Series. This series is being sponsored by Slippery Rock University. The seminars take place on Wednesdays from 1-2:15 in room 304 in the Physical Therapy Building. The last seminar will take place on May 1st. MaryAnn Frazier, Entomology PSU, will speak on *Honey Bee Biology and the Role of Honey Bees in Agro-Ecosystems.*

SRWC Has Adopted—A—Highway!!!

The Slippery Rock Watershed Coalition now has a portion of I-79 to keep clean. **Chris Treter**, OSM Intern, applied for the program last year and the signs were recently erected between mile markers 100 & 101 heading both North and South on I-79!! Be sure to look for them next time you drive I-79!!! We will need to clean the area four times a year so watch for opportunities to help us keep our watershed clean!!!!

More about…

The 2002 SME Convention

Everything started to happen thanks to **Mike Leon, a Senior Engineer at Harding ESE, Inc. and the Environmental Division Program Planning Chair for SME**. An **article** was **published** in the December 2001 issue of **"Mining Engineering" (16,000 subscribers) about our presentations** at the 2/25/02 convention. As previously noted in "The Catalyst" (April 2002), there were two sessions (10 papers!!) focusing on "Conquering AML Issues with Public-Private Partnerships".

Abstracts were provided **in the conference program** with the **papers on disk** which were given to each of the over 3000 attendees. The papers included

PA Department of Environmental Protection's Growing Greener Program - A Public-Private Partnership
by **David Hogeman,** PG, Director, PA DEP Bureau of Environmental Sustainability

A Public-Private Partnership Success Story: Treating AMD at Jennings Env. Ed Center
by **Will Taylor,** Env. Ed. Program Coordinator & **Dave Johnson,** Center Mgr, Jennings Env. Ed. Center; **Margaret H. Dunn,** PG, SRI.; **Janice Belgraden,** Educational Consultant

Fabricated Soils: An example for Scientific Contributions by a Public-Private Partnership Effort
by **Valentin Kefeli,** PhD, Soil Scientist, BioMost, Inc.

Federal Cooperation to Protect Watersheds Degraded by Coal Mine Drainage from AML
by **Bernie Sarnoski,** Coal Mine Drainage Initiative Coordinator, US EPA

Slippery Rock Watershed Coalition: A Public-Private Partnership for Stream Restoration and Education
by **Fred Brenner,** PhD, Biology Dept., Grove City College

Slippery Rock Watershed Public-Private Partnering: A Means to Restore AML in Western PA
by **Margaret H. Dunn, Tim Danehy, Shaun Busler, & Cliff Denholm,** Stream Restoration Inc.

Effectiveness of PA's Remining Program in Abating AMD: Part I - Water Quality Impacts
by **Michael Smith,** Dist. Mining Mgr., **Keith B. C. Brady,** PG, Bureau of Mining & Rec., PA DEP

Effectiveness of PA's Remining Program in Abating AMD: Part II - Efficacy of BMPs
by **Jay Hawkins,** US Dept. of Interior, OSM; **Ken Miller,** Statistician & **Joan Cuddeback,** Sr. Env. Eng., DynCorp; **Keith B. C. Brady,** PG, PA DEP Bureau of Mining and Rec.

Office of Surface Mining and National Endowment for the Arts Coal Country Initiative
by **T. Allen Comp,** US Dept. of Interior, Office of Surface Mining

The Dark Shade Brownfields Project: Abandoned Coalfields as Brownfields
by **D. C. Ciotti,** AMD & ART, Inc.

Because of these presentations, the AML efforts in Pennsylvania are being acknowledged not only *nationally* but also *internationally*. Next month, sharing the vision of public-private partnering with visitors from Peru!! Thanks to Mike Leon and everyone at SME for giving us this opportunity!!!

The Kids Catalyst

For this month's Kid's Catalyst, take a picture of a stream near you! Label the picture and tell us the stream's name and where it is! Send us your photo and we will send you a Gift Certificate! Or if you would rather draw us an original picture that would work as well!!! A lot of your pictures were on display at the Symposium, and everyone loved them!!!!!! Look for your pictures to be displayed at the Get Together! Great job and keep sharing your talents with us!!!

THE SRWC SYMPOSIUM 2002 Cont.

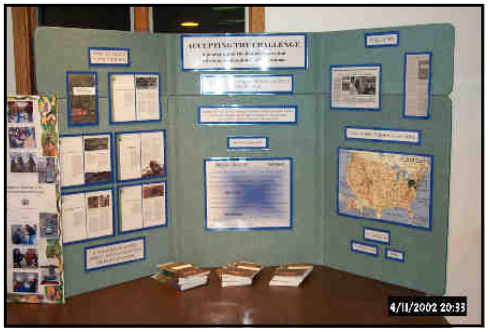
"Building Partnerships for the Future"

On Thursday, April 11, student presenters, their professors, and environmental professionals met at the Wolf Creek School Café for dinner and discussion, a great networking opportunity. Thank you, John Stilley and Amerikohl Mining for sponsoring the dinner and believing in this evening as much as we do!!!

After dinner, we continued to Jennings Environmental Education Center to hear the students excellent presentations. In addition, **Cliff Denholm**, SRI, gave an overview of SRWC activities and **Joan Clippinger**, DCNR, discussed some of PA's great natural resources. **Shaun Busler**, SRI, spoke about his journey from student to professional working with the Coalition. The students who spoke were: **Susan LaRue** and **Jamie Skoloda** from GCC with **Dr. Brenner**; **Michele Gauger** and **Theresa Reustle** from SRU with **Dr. Borsari** and **Dr. Kefeli**; **Joelle Kerr** from SRU with **Dr. DeNicola** (see above); **Todd C. Crouch** from SRU with **Dr. Stapleton**; **Timothy Elder** from SRU with Dr. Borsari; **Spencer Welton** from SRU with Dr. Borsari; as well as **Craig Fisher, Joselyn Hohenwarter, Rachel Orwan** and **Kirk Sander** from SRU with **Dr. Stapleton**. A ***HUGE THANK YOU*** goes out to ALL THE HARDWORKING AND DEDICATED students who have played an essential role in documenting the amazing improvements we have seen in the watershed AND who are helping to develop the technology needed to make it happen!!! A Thank You also needs to go out to their professors!! Without their guidance and knowledge none of this would be possible!!!!! More about the students in the next issue...

Sunday's Community Watershed Tour

On Sunday April 7th, about 50 people assembled at Jennings Environmental Education Center to hear **Will Taylor** speak about the Slippery Rock Creek Watershed. Will covered everything from the time before the dinosaurs to problems we face today. To be able to understand the future we must always look towards the past and Will was able to show those in attendance just how we came to face the problems we do today.



Following the presentation we toured the onsite passive treatment system at Jennings and got to see first hand what mine discharges do to our water. Will continued to educate us as those in attendance asked questions and wanted to learn more.

A poster on *Accepting the Challenge* illustrated where the book has traveled so far (see photo to the right). And everyone was invited to take a copy with them. Thank you to those who came and participated! And thank you Will for being such an excellent guide through our watershed!!!

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., Allegheny Mineral Corporation and PA DEP for their support.
For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. May Distribution: 869 copies

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The low pH, metal-laden discharge shown above is the source of a small unnamed tributary in the headwaters of Seaton Creek.

View of the small unnamed tributary to Seaton Creek that is being treated by the De Sale Phase II passive system.

Construction of the De Sale Phase II Passive Treatment System.

Coal encountered during construction of the De Sale Phase II Passive Treatment System.

Construction of the Vertical Flow Ponds located in parallel at the De Sale Phase II Restoration Area.

Construction of Vertical Flow Pond West of the De Sale Phase II passive treatment system. Note the geotextile liner and placed limestone.

Construction of the underdrain piping system for Vertical Flow Pond East by Amerikohl Mining Inc., employees.

Close up-view of the underdrain piping system for one of the Vertical Flow Ponds located at the De Sale Phase II Passive Treatment System.

Placement of spent mushroom compost on top of the limestone for the De Sale Phase II Vertical Flow Ponds.

Placement of stone during the construction of the Horizontal Flow Limestone Bed at the De Sale Phase II Passive Treatment System.

Construction of the final spillway, which conveys the effluent from the Horizontal Flow Limestone Bed to the unnamed tributary of Seaton Creek.

View of the approximate 3-foot high dam (above) constructed of concrete Jersey barriers in order to back up the stream to allow the intake pipe (below) to convey up to 200 gpm of the unnamed tributary into the passive system for treatment. Under normal flow conditions the entire stream is being treated by the passive system.

View of the De Sale Phase II Forebay looking towards the passive system.

View of De Sale Phase II Vertical Flow Pond West (Center) and Vertical Flow Pond East (Far Left).

The Settling Pond receives the effluent from the Vertical Flow Ponds and is also used as a flush pond.

A partial view of the De Sale Phase II wetland before the volunteer wetland planting.

Bob Beran, Aquascape, explaining to Slippery Rock University professor John Constable's Aquatic Plants class the function of the wetland plants and planting procedures.

Slippery Rock University students assisted in the planting of the De Sale Phase II wetland. Unfortunately due to high water levels, many of the plants did not survive over winter.

Research on the effectiveness of the Vertical Flow Pond flushing mechanism was spearheaded by the Department of Energy's National Energy Technology Lab in Pittsburgh under the direction of George Watzlaf (front center). Other partner participants included members of Stream Restoration, University of Pittsburgh, and West Virginia University.

With so much to do in such little time, everyone was assigned a task. Tim Danehy is taking flow measurements while Candace Kairies takes water samples.

Each pipe discharges from one of eight quadrants within the Vertical Flow Pond. Note the black coloring of the flush water.

View of the water hammer, a physical phenomenon that occurs once the flush valve is closed following a flushing event.

Nick Morgan, a Grove City College student, constructing a small jack dam of limestone donated by Quality Aggregates' Boyers Quarry. Students from Grove City College have been monitoring the site to determine if any change in water quality occurs due to the dam.

Ariel view of the De Sale Restoration Area. The Phase I passive treatment system is on the right while the Phase II passive treatment system is on the left.