Laurel Run Watershed Initiative

HARBISON WALKER RESTORATION AREA
MINE DRAINAGE ABATEMENT

PHASE I

Public Private Partnership Effort

Ohiopyle State Park, Stewart Township, Fayette County, PA

June 2000

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: July 31, 2000

To: Department of Environmental Protection
Bureau of Mining and Reclamation
Division of Environmental Analysis and Support
Rachel Carson State Office Building
P. O. Box 8461
Harrisburg, PA 17105-8461

Attn: Lou DiLissio, Project Officer

Re: Final Report for Project WR11
Watershed Restoration and Partnership Act (WRPA) - ME #359394
Abatement of Mine Discharges - Laurel Run 12 & 13
Ohiopyle State Park, Stewart Twp., Fayette Co., PA
200701/FR-trans

Enclosed is the final report for the above noted project.

This report represents only a portion of the "success stories" made possible by this grant. The public-private partnership effort and the "hands-on" educational opportunities have spurred interest in the restoration of this and other watersheds in the region. We hope that this report will meaningfully acknowledge the importance of this project and the funding received through your office.

Please review and comment. The submission of a good-quality work product is important to all of us.

Your patience and assistance has been very much appreciated. If there are any questions or comments, please do not hesitate to contact any of the participants.

From: Stream Restoration Incorporated

By: Margaret H. Dunn, PG, President

Sent: First Class Mail

Copy: JONES, D. Scott; HORANSKY, Ron; GREENE, C.R.; and BRAHOSKY, James, PA DEP, Greensburg DMO
OLIVER, John, Secretary, PA DCNR
DOLENCE, Robert, Deputy Secretary, PA DEP
THOMAS, Al; JASKOLKA, John; and SMITH, Stephen, PA DCNR
BIELO, Mike, PE, PA DCNR
CAVAZZA, Eric; KLEMAN, Mark; and BAKER, Dean, PA DEP, BAMR
HILTON, Tiff, Mining Engineer, WOPEC
HEDIN, Robert, Hedin Environmental
HELLIER, William, Technology Transfer Coordinator, PA DEP, Bureau of Mining and Rec.
HOEHN, Doug, Park Manager, PA DCNR, Ohiopyle State Park
FIRST, Josh, Conservation Fund
SPARKS, Steven, Staff Development Specialist, Pressley Ridge School
STILLEY, John and JOHNSON, Fred, Amerikohl Mining, Inc.
COLEMAN, Rita, Watershed Coordinator, Southwest Region
MALLISON, Betsy, Community Relations Coordinator, PA DEP
WATZLAF, George, Env. Eng., US Dept. of Energy
DANEHY, Tim, EPI, BioMost, Inc.

LAUREL RUN WATERSHED INITIATIVE

FINAL REPORT

HARBISON WALKER RESTORATION AREA
MINE DRAINAGE ABATEMENT

PHASE I

DISCHARGES 12, 13, 14
OHIOPYLE STATE PARK, STEWART TOWNSHIP, FAYETTE COUNTY, PA

submitted to

Pennsylvania Department of Environmental Protection
Bureau of Mining and Reclamation

Brief Description of Project Work Conducted through Grant

Designed passive system with estimated treatment life of at least 25 years using the following parameters: 27 gpm flow for combined discharges 12 and 13 having a 4 pH, 2 mg/L alkalinity, 350 mg/L acidity, 200 mg/L dissolved iron, 26 mg/L manganese, and <1 mg/L aluminum. Installed the following components in series: Anoxic Collection System, Anoxic Limestone Drain, Settling Pond #1, Vertical Flow Pond, Settling Pond #2, Aerobic Wetlands, and Horizontal Flow Limestone Bed. Vertical Flow Pond and second Settling Pond added without increasing total contract amount in order to have a final system discharge with sufficient excess alkalinity to treat discharge 14. Monitored water quality of each component, discharge 14, tributary C, and Laurel Run to determine measurable impact of passive treatment system. Planted Aerobic Wetlands using volunteers from the Pressley Ridge School and other participants in the public-private partnership effort. Kept photographic and video log. Submitted electronic updates, quarterly status reports, the final report with "As-Builts" and selected photos, and administered the contract.

Contract Amount: **$261,294**

Grant Program: **Watershed Restoration and Partnership Act**
"Reclaim PA" Initiative

In-Kind Contributors:

PA Department of Conservation and Natural Resources
PA Department of Environmental Protection -
    Bureau of District Mining Operations, Greensburg Office;
    Bureau of Mining and Reclamation
    Bureau of Abandoned Mine Reclamation
Volunteers including Pressley Ridge School and others
Amerikohl Mining, Inc.
BioMost, Inc.
Stream Restoration Inc. [non-profit]

July 2000

cover photos: A student from Pressley Ridge Wilderness School working with an employee from Amerikohl Mining, Inc. gathering cattails to be planted in the treatment wetland.

PUBLIC-PRIVATE PARTNERSHIP

Water Quality Monitoring, Project Review, and Aerial Pictures of Completed System
PA DEP, District Mining Operations, RR2, Box 603-C, Greensburg, PA 15601-8739
HORANSKY, Ron, MCI; GREENE, C.R., Insp. Supervisor; JONES, D. Scott, Acting Permit Chief; ROBERTS, J. Scott, Director BMR (former Permit Chief); BRAHOSKY, James, Dist. Mining Mgr. (724) 925-5500

System Maintenance
PA DCNR, Ohiopyle State Park, PO Box 105, Ohiopyle, PA 15470
HOEHN, Doug, Park Mgr.; WALLACE, Frank, Maintenance; (724) 329-8591

Construction Services
Amerikohl Mining, Inc., 202 Sunset Dr., Butler, PA 16001
STILLEY, John, President, and JOHNSON, Fred, Reclamation Mgr. (724) 282-2339

Aerial Topography
PA DEP, Bureau of Abandoned Mine Reclamation, PO Box 149, Ebensburg, PA 15931
CAVAZZA, Eric, PE, KLEMAN, Mark, PE, BAKER, Dean, PE, (814) 472-1846

Conceptual Design of Passive Treatment Systems
Hedin Environmental,195 Castle Shannon Blvd., Pittsburgh, PA 15228
HEDIN, Robert, PhD, Ecologist (412) 571-2204
PA DEP, Bureau of Mining and Reclamation, PO Box 209, Hawk Run, PA 16840
HELLIER, William, PE, Tech. Transfer Coordinator, (814) 342-8200

Engineering Design of Passive Treatment Systems
BioMost, Inc., 3016 Unionville Rd., Cranberry Twp., PA 16066
DANEHY, Timothy, EPI; DUNN, Margaret, PG (724) 776-0161

Baffle Design and Installation
WOPEC, Rt. 2, Box 294B, Lewisburg, WV 24901
Hilton, Tiff, Mining Engineer, (304) 645-7633

Volunteer Wetland Planting Effort
PA DEP, Southwest Regional Office, 400 Waterfront Dr., Pittsburgh, PA 15222-4745
COLEMAN, Rita, Watershed Coordinator (412) 442-4149
MALLISON, Betsy, Community Relations Coordinator (412) 442-4182
PA DCNR, Ohiopyle State Park, PO Box 105, Ohiopyle, PA 15470
WALLACE, Barbara, Environmental Education
Amerikohl Mining, Inc., 202 Sunset Dr., Butler, PA 16001
JOHNSON, Fred, Reclamation Manager (724) 282-2339
Pressley Ridge School at Ohiopyle, 305 Pressley Ridge Road, Ohiopyle, PA 15470
SPARKS, Stephen, Staff Development Specialist, students and faculty (724) 329-8300
Stream Restoration Incorporated, 3016 Unionville Rd., Cranberry Twp., PA 16066
DUNN, Margaret, PG; BUSLER, Shaun, Biologist (724) 776-0161

Grant Administration and Public-Private Partnership Initiative
Stream Restoration Inc. [non-profit]**,** 3016 Unionville Rd., Cranberry Twp., PA 16066
DANEHY, Timothy, EPI; DUNN, Margaret, PG; PEART, Darcy, Public Relations; BUSLER, Shaun, Biologist; TAYLOR, Will, Environmental Education (724) 776-0161

LAUREL RUN WATERSHED INITIATIVE

FINAL REPORT

HARBISON WALKER RESTORATION AREA MINE DRAINAGE ABATEMENT

PHASE I: DISCHARGES 12, 13, 14

OHIOPYLE STATE PARK, STEWART TOWNSHIP, FAYETTE COUNTY, PA

submitted to

Pennsylvania Department of Environmental Protection
Bureau of Mining and Reclamation

EXECUTIVE SUMMARY

A public-private partnership was created to address the pollution problems from an old, 120-acre, surface clay and coal mine on lands now within one of the premier recreational facilities within the Commonwealth, Ohiopyle State Park. Both untreated and conventionally treated discharges were impacting a high-quality cold water fishery. The cost to passively abate all discharges was estimated to be $1 ½ million.

Through funding from the PA Department of Environmental Protection, Bureau of Mining and Reclamation, under the Watershed Restoration and Partnership Act, the first phase of the comprehensive abatement plan has been completed which includes support from the PA Department of Conservation and Natural Resources in the continued operation and maintenance of the systems.

Because of the committed effort from all participants, the construction of the Phase I passive treatment system was successfully completed within five weeks, six months ahead of the contract deadline. By pooling resources, the project was also completed within budget, even with the addition of two passive components.

With a design life of 25+ years, the seven-component passive system neutralizes an estimated 31,000 lbs/year or over 15 tons annually of acidity in three discharges and the unnamed receiving stream. In addition, about 9,000 lbs/year or over 4 tons annually of metals are captured in the settling ponds and 1/4-acre aerobic wetlands.

Utilizing plants removed from settling ponds associated with the former active treatment plant on the Phase II area, volunteers from Pressley Ridge School successfully vegetated the Phase I constructed wetland. The enthusiasm of the students in the "hands-on" educational experience was reported in a local newspaper. Due to this positive response, faculty participants have asked that the students be included in the future Phase II wetland planting.

Due to the overwhelming success of the public-private partnership effort, Phase II restoration has been recently funded through the Commonwealth's Growing Greener Initiative. Upon Phase II completion, all known perennial discharges at this site will have been abated with measurable improvement in the high-quality cold water fishery.

SELECTED HIGHLIGHTS

Background

- There are seven pollutive discharges that issue on property now within Ohiopyle State Park that degrade Laurel Run, a high-quality cold water fishery. This property was formerly surface mined for clay and coal. (Within Ohiopyle State Park boundaries, Laurel Run flows about ½-mile into Meadow Run which flows about 1 ½ miles into the Youghiogheny River. All are high-quality cold water fisheries.)

- As part of the comprehensive restoration plan for the site developed through a public-private partnership initiative, the project was divided into two phases. Phase I included abatement of discharges 12, 13 and construction of a collection system for 14. Phase II included abatement of discharges A/C, B1, B3, tributary C, and 14.

- Phase I discharges 12 and 13 were flowing untreated to Laurel Run.

- Phase II discharges B1 and A/C were being treated conventionally. Discharges B3, 14, and tributary C were not being treated.

- Acidic discharges 12 and 13 with high iron content had the following characteristics: 10 gpm, 4.2 pH, no alkalinity, 348 mg/L acidity, 186 mg/L iron, 26 mg/L manganese, 1 mg/L aluminum.

- Acidic discharge 14 with moderate iron content had the following characteristics: 12 gpm, 3.0 pH, no alkalinity, 227 mg/L acidity, 42 mg/L iron, 18 mg/L manganese, 2 mg/L aluminum.

- On 7/22/99, the partnership effort submitted a proposal to the Commonwealth under the Watershed Rehabilitation Partnership Act to install a five-component passive system to treat discharges 12 and 13 and to install an anoxic collection system for discharge 14 at a cost of $261,294.

- On 9/15/99, the Pennsylvania Department of Environmental Protection, Bureau of Mining and Reclamation approved the proposal.

Phase I Passive Treatment System Construction for Discharges 12 and 13

- By 10/11/99, 3 ½ weeks after proposal approval, site preparation began.

- By 10/13/99, the Anoxic Collection System to combine the diffuse flow was completed.

- Construction was delayed one week, from 10/13/99 to 10/20/99, in order to sample and to evaluate the characteristics of the drainage intercepted by the Anoxic Collection System for final design considerations.

- The passive system consisted of the seven components in series:
  - Anoxic Collection System,
  - Anoxic Limestone Drain (670 tons limestone),
  - Settling Pond #1 with baffles,
  - Vertical Flow Pond (600 tons limestone overlain by compost/limestone mixture),
  - Settling Pond #2,
  - Aerobic Wetlands (planted by volunteers 7 months later),
  - Horizontal Flow Limestone Bed (500 tons).

- The regraded area (about 3 acres), much of which was predominantly barren due to the impacts of the acidic, iron-bearing, drainage, was covered with excess soil material from the excavation associated with the passive treatment system installation and revegetated using a grass mixture, recommended by the PA Department of Conservation and Natural Resources. The site was also limed, fertilized, and mulched. (The total affected area was less than 5 acres.)

- By 11/17/99, within 5 weeks of equipment mobilization, construction of the seven-component passive treatment system and land reclamation were complete.

Project Expansion

- Based on a consensus by the participants involved in the system design, two treatment components (Vertical Flow Pond and Settling Pond #2) were added in order to provide a significantly net alkaline final effluent with a low iron content that was capable of successfully treating discharge 14.

- The dye testing program, funded though a separate grant through the Commonwealth's "Reclaim PA" initiative, was expanded to include this passive treatment system. This was accomplished by the generosity of the participants without increasing the original budget or extending the deadline of either grant. Based on the dye testing, baffles were recently added to Sediment Pond #1 in order to decrease the iron solids in the influent to the Vertical Flow Pond.

- The monitoring program was expanded to include field testing of alkalinity. Comparison of the field and laboratory alkalinity measurements of Anoxic Limestone Drain effluent samples clearly depicts the effects of exposing anoxic water containing alkalinity and a high content of dissolved ferrous iron to oxygen.

- A database was created to efficiently manage water quality analyses. The database allows individuals to easily view, add, and update table data by using forms; find and retrieve specific monitoring points by using queries; and analyze or print data in a specific layout by using reports. The database is capable of several calculations, including mean values and loadings of all of the interested parameters.

Public Outreach/Environmental Education

- On 5/24/00, about 7 months after construction, the Aerobic Wetland was planted by about 25 volunteers. Most of the volunteers were from the Pressley Ridge School from Ohiopyle. Being well-received by the students, faculty participants from the Pressley Ridge School have asked the students be included in the future planting of the Phase II wetlands.

- Articles about the Phase I restoration project have been published in The Daily Courier (local newspaper), PA DEP "Update", and the PA DCNR "Resource".

Measurable Environmental Benefits

- Discharges 12 and 13 successfully passively treated within a limited area.

	Raw	Treated	Loading Decrease(est.)
• pH	4	7	
• alkalinity	2	145 mg/L	
• acidity	350	0 mg/L	15,300 lbs/yr
• total iron	186	3 mg/L	8,000 lbs/yr
• manganese	26	10 mg/L	700 lbs/yr

- Discharge 14 is successfully treated by combining with the net alkaline final effluent from the passive system installed for discharges 12 and 13.

	Before	After	Loading Decrease(est.)
• pH	3	7	
• alkalinity	0	85 mg/L	
• acidity	227	0 mg/L	11,900 lbs/yr
• total iron	42	2 mg/L	2,100 lbs/yr
• manganese	18	12 mg/L	300 lbs/yr

- Tributary C, which is the intermittent receiving stream for the discharges, is improved after the confluence with the combined discharge 12, 13, and 14 flow.

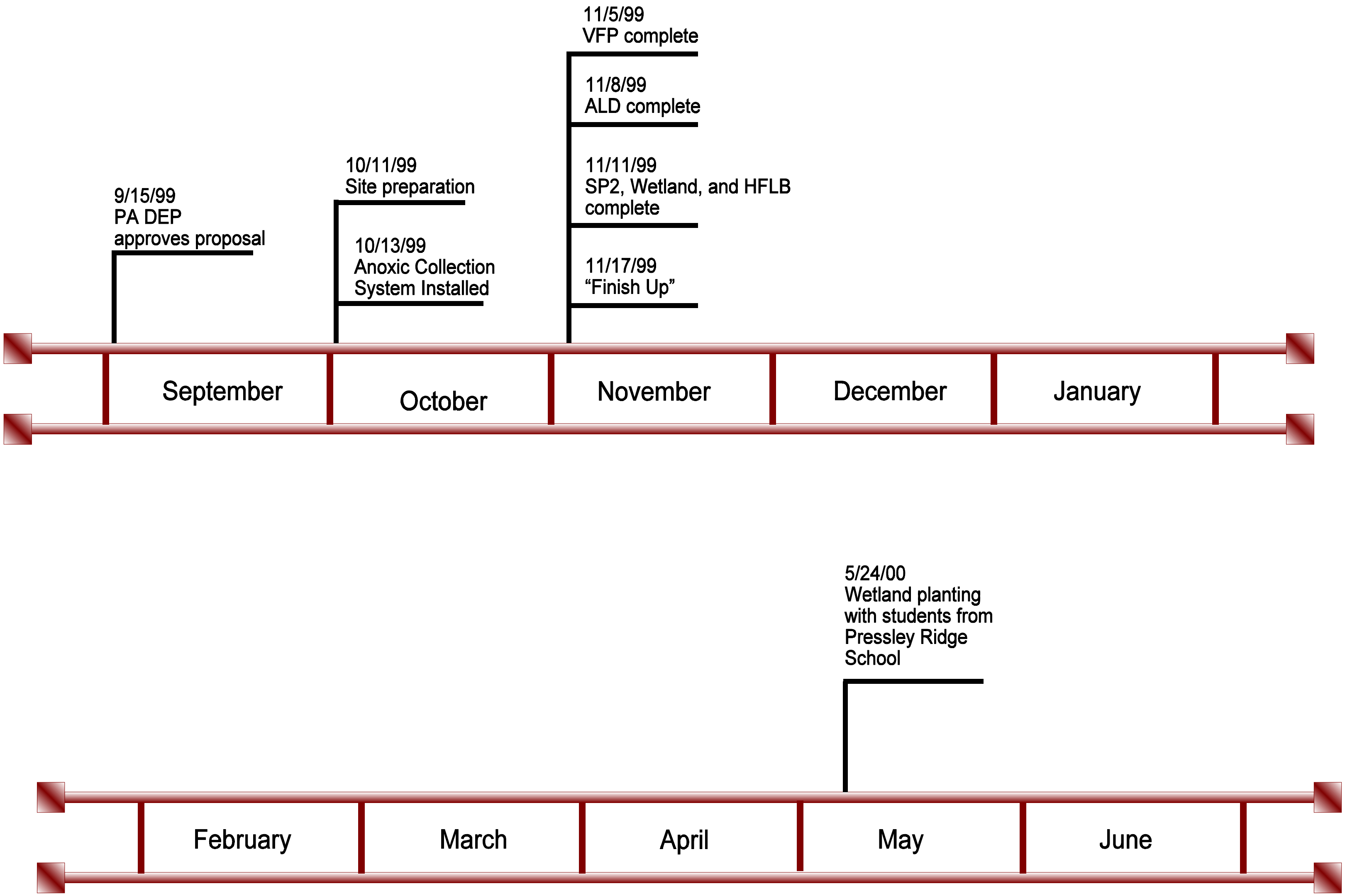
	Before	After	Loading Decrease(est.)
• pH	5	6	
• alkalinity	0	5 mg/L	
• acidity	23	13 mg/L	4,000 lbs/yr

- The total decrease in loading is an estimated 31,000 lbs/yr (>15 tons/yr) of acidity and 11,000 lbs/yr (>5 tons/yr) of metals.

- 1/4-acre of Aerobic Wetlands has been successfully constructed and vegetated.

- About 3 acres of formerly barren land has been successfully reclaimed.

Timeline for Harbison Walker Phase I



Timeline

Date	Description
04/14/99	< Proposal submitted
09/15/99	< Project approved
09/17/99	< Review and revise proposal
10/01/99	< E&S control plan completed
10/11/99	< E&S control facilities installed
10/11/99	< Begin clearing/grubbing
10/12/99	< PNDI
10/13/99	< Anoxic collection system finished
10/15/99	< Water samples and installation of raw water monitoring port
10/20/99	< Raw water sampling port
10/20/99	< Field meeting
10/26/99	< Update
10/28/99	< Field investigation and photos
10/29/99	< Construct ALD and stone delivery
11/01/99	< Contract executed
11/02/99	< Update
11/05/99	< Construction of VFP and materials installation
11/08/99	< Cover ALD and turn water in
11/09/99	< Field meeting
11/10/99	< Water Discharging from ALD
11/11/99	< Construction of SP2, Wetland, HFLB
11/15/99	< Update
11/17/99	< Finish up and stabilize site
11/19/99	< As-built survey work completed
11/30/99	< Update
12/10/99	< Water is flowing through the entire system
12/14/99	< Update
12/15/99	< Update
12/17/99	< Water samples and photos
12/22/99	< Update
01/14/00	< Quarterly Report
01/17/00	< Field meeting to review phase I and II site
01/25/00	< Field meeting with DEP and DCNR to review phase I and II site
03/30/00	< Water samples and photos
04/25/00	< Update
04/28/00	< Water samples
05/18/00	< Update
05/24/00	< Wetland planting
05/25/00	< Update
06/08/00	< Dye test
06/26/00	< Site inspection

Laurel Run Watershed Initiative
Final Report: Watershed Project

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INTRODUCTION

Laurel Run, a High-Quality Cold Water Fishery, is being impacted by previous clay/coal surface mining operations. Laurel Run flows into Meadow Run which is tributary to the Youghiogheny River. These are popular fishing and recreational streams which have also been classified as High-Quality Cold Water Fisheries. Because of the degradation to the stream by the previous mining activities, the Commonwealth of Pennsylvania has assigned Laurel Run a high restoration priority. [Ref: 1998 303(d) list] The current target area for restoration of Laurel Run and the downstream segments of Meadow Run and the Youghiogheny River all lie within one of the premier state recreational facilities of Commonwealth, Ohiopyle State Park. The Pennsylvania Department of Conservation and Natural Resources assumed the responsibility for perpetual treatment of two (A/C and B1) of the seven (A/C, B1, B3, 12, 13, 14, trib. "C") known pollutional discharges on land now within Ohiopyle State Park shown in Figure 1. Both the untreated and treated discharges were responsible for degradation of Laurel Run. This report addresses the passive treatment of untreated discharges 12, 13, and 14, which is Phase I of the comprehensive restoration plan for the site. Phase II is the installation of passive treatment systems to abatement the remaining treated and untreated discharges. Phase II has recently been funded through the Commonwealth's Growing Greener initiative and is currently under construction.

Site Location

Both Phase I and II restoration areas are within Ohiopyle State Park in Stewart Township, Fayette County, PA. The site is east of Laurel Run on the northerly and westerly side of T-415 (Grover Road) about ½-mile from the intersection with SR-2011. This intersection is about 1 mile south of the park office. (See Location Map on "As-Built" drawing.) The site is located on the 7 ½' USGS Ohiopyle topographic map (PI 1977) at about 39^0 50' 37' latitude and 79^0 29' 34" longitude.

PRE-EXISTING CONDITIONS PHASE I AND II

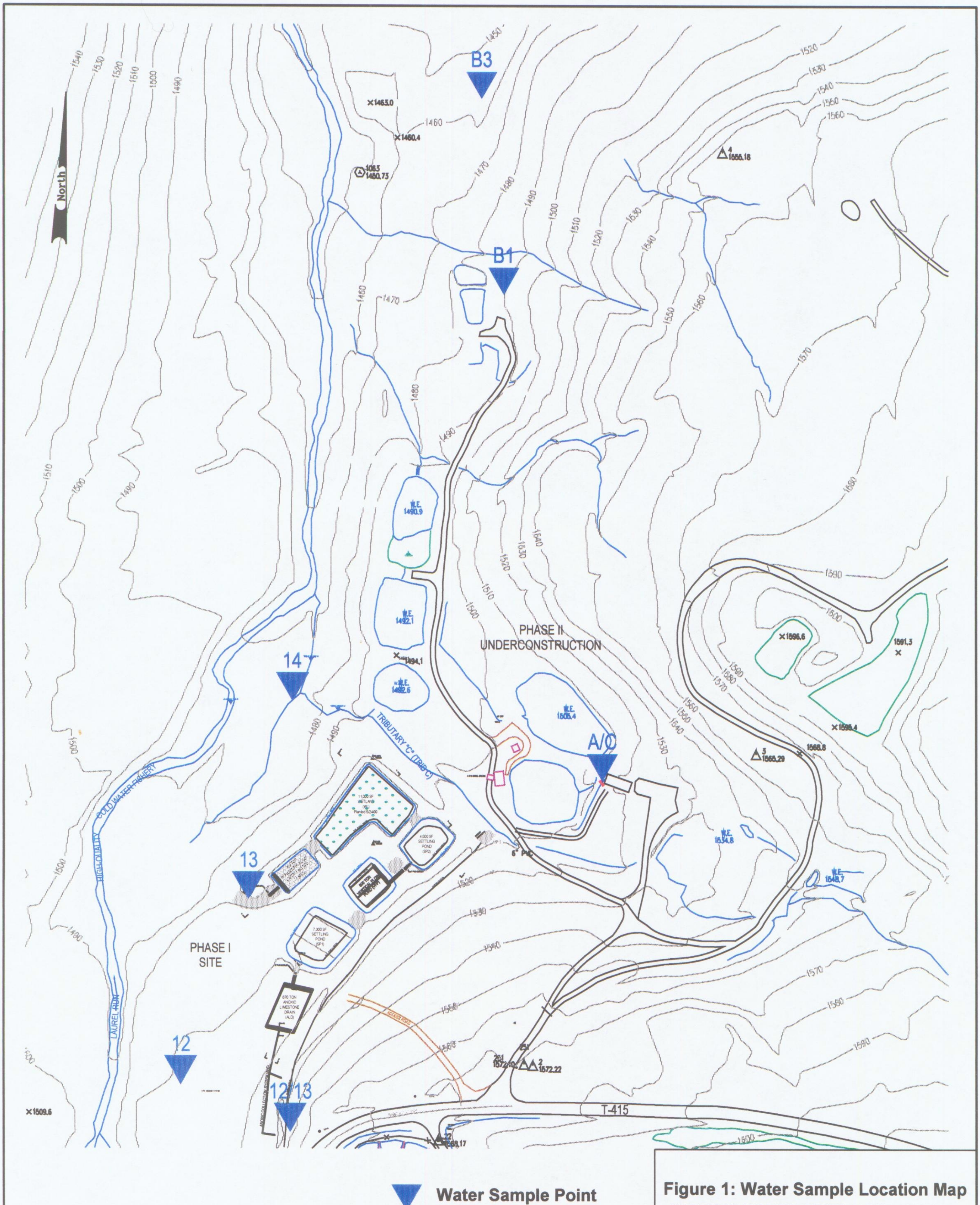
Minesite Description

The previous surface clay mining operation was conducted by Harbison Walker Refractories under permit number 269BSM24. With a disturbed area of about 120 acres, the Lower Kittanning claystone (Kittanning Fm.; Allegheny Gp.) and immediately overlying Lower Kittanning coalbed were mined and/or spoiled at the site. The site has been backfilled and portions have been revegetated with either grasses and legumes or evergreens. Older, essentially barren, steep outslopes are also present on the site. The permit effluent limits were 6 to 9 pH, alkalinity to exceed acidity, and 7 mg/L total iron. There were no manganese or aluminum effluent limits.

A conventional lime treatment facility and a soda ash briquette hopper were being used to treat discharge A/C and B1, respectively.

Pre-Existing Water Treatment [to be replaced with passive systems in Phase II]

The lime plant was operated by the PADCNR to treat the discharge with the largest flow



Water Sample Point

Figure 1: Water Sample Location Map

HARBISON WALKER RESTORATION EFFORT - PHASE I

Ohiopyle State Park

Stewart Township, Fayette County, PA

103502/WSPT Location/Layout1

(100 gpm). Based on available information, this discharge identified as A/C is the combined flow from pipes that extend into the backfill area of the former clay mine. With a pH of 3.5, this discharge is characterized by high dissolved aluminum (60 mg/L) and low dissolved iron (1 mg/L). The treated flow entered a series of four to six settling ponds that required periodic cleaning. The large volume of lime sludge generated was pumped to two intermediate upgradient ponds in the old mining area and then pumped into boreholes. From a brief inspection of the ponds on 3/1/99, undissolved lime appeared to significantly contribute to sludge volume. Reportedly, many of the existing boreholes were filled to capacity and sludge had been observed oozing from the ground downslope. From the analysis of a sample collected 6/17/97 by the PADEP Greensburg District Mining Office, the final treated A/C effluent, prior to entering Laurel Run, had a 6.4 pH with acidity (74 mg/L) exceeding alkalinity (28 mg/L) and 1.3 mg/L total aluminum. Note that in this instance, even with an acceptable pH, the discharge quality is not in compliance with the effluent limit as acidity exceeds the alkalinity due to the metals content of the drainage.

Soda ash briquettes were used to treat the 30-gpm B1 discharge which has a high dissolved iron (155 mg/L), low dissolved aluminum (3 mg/L), and low pH of 3.5. Two small settling ponds were in use. On 6/17/97, a grab sample collected of the treated effluent had the following quality: 5.8 pH, 20 mg/L alkalinity, 212 mg/L acidity, 78 mg/L total iron, and 1.3 mg/L total aluminum. Again note that in this instance, the effluent exceeds the permit limits.

Pre-Existing Untreated Water [Phase I(12, 13, 14) passive systems installed; Phase II (B3, trib. C) passive systems to be installed]

Discharges B3, 12, 13, 14, and trib. C were not being treated. The 15-gpm B3 discharge has a 4 pH with 1 mg/L total iron and 7 mg/L total aluminum based on review of analyses furnished by William Hellier, PhD, PADEP, Bureau of Mining and Reclamation, Hawk Run Office. The 12, 13, 14 seeps with an aggregate flow of about 45 gpm are characterized as high dissolved iron (60 mg/L or more) and low dissolved aluminum (3 mg/L or less). In addition, sample analyses of unnamed tributary C, provided by the PADEP, Greensburg District Mining Office, and by recent sampling during site reconnaissance, indicate that this stream has been impacted, with a pH of 4.3 to 4.6, alkalinity around 6 mg/L, acidity around 20 mg/L, and 2 to 3 mg/L dissolved aluminum. Other small-flow, degraded discharges have also been observed at the site.

Impact of Pre-Existing Treated and Untreated Drainage on Receiving Stream

As previously noted, the receiving steam is Laurel Run, a High-Quality Cold Water Fishery (PA Title 25, Chap. 93). Analyses of samples collected by the PA DEP, Greensburg District Mining Office on 6/26/98 document that the water quality standards (PA Title 25, Chap. 93) were exceeded due to drainage from this site, even during active treatment. On this date, the total iron concentration in Laurel Run increased from less than 1 to 3 mg/L and total aluminum increased from less than 0.5 to 1.4 mg/L. In addition, sulfate was increased from 48 to 109 mg/L and pH was decreased from 6.6 to 6.2. The buffering capacity was also decreased with 30 mg/L alkalinity above the site and 26 mg/L below. (PADEP analyses for LR-3 and LR-4.) About 1400 feet downstream of the site, Laurel Run confluences with Meadow Run which is tributary to the Youghiogheny River.

PHASE I - SITE PREPARATION

Pre-Construction Site Description

The majority of the site could be characterized as a "dead area" where the diffuse flow of the acidic mine drainage from discharges 12 and 13 killed the vegetation. Iron precipitates, dark- to light-orange and red in color, coated the gently-sloping ground surface. (See photo section of before conditions, p. 2 and 3.) At the southernmost end of the "dead area" was a wetland and the remaining area was tree covered. The total area of the passive system installation was about 4 acres.

Notifications, Permits, Waivers

Necessary road bonds were handled by Amerikohl Mining, Inc. As the site was less than five acres, review by the county conservation district of the Erosion and Sediment Pollution Control Plan was not required; however, a plan was completed 10/1/99 and kept at the jobsite. A PA Natural Diversity Index search, submitted 9/21/99, indicated that there was a potential for species of special concern in the Phase I and II areas. However, after a field review by PADCNR staff, no species were found. As the site was less than ten acres, notification of the PA Historic and Museum Commission was not required. In addition, waivers/permits relating to wetlands/streams, public roads, etc. were not required, as these features were outside of the proposed affected area.

Access Road and Staging Area

On 10/11/99, in order to avoid impacting the wetlands to the south of the project area, an access road was constructed from the existing stabilized entrance from T-415 used in the operation and maintenance of the active treatment facilities by Ohiopyle State Park personnel. A staging area to temporarily store supplies and equipment was also developed upgradient of the site at the existing park entrance. (See photo section showing harvested trees and compost stockpile, p. 4.) The access road was stabilized with aggregate.

Site Preparation

Beginning 10/11/99, the Erosion and Sediment Pollution Controls were installed, which primarily consisted of filter fabric fence placement (See photo section of ALD installation with filter fence in background, p. 6.) and a diversion ditch (See photo section of ditch and energy dissipater, p. 18.) construction below and above the site, respectively. The site was then cleared and grubbed. Selected trees were harvested and stacked in the staging area for use by Ohiopyle State Park. (See photo section of harvested trees, p. 4.) Brush and small trees were placed in windrows upgradient of the site. (See photo section of limestone aggregate delivery with windrow in background, p. 4.) [Even though useful as wildlife habitat, windrows are not in keeping with the park management plan and are to be avoided in future Phase II work at the site.]

PHASE I: PASSIVE SYSTEM INSTALLATION AND LAND RESTORATION

The construction of the seven-component system and the land reclamation was completed within five weeks or over six months ahead of schedule.

The passive treatment system consists of the following components constructed in series **(See “As-Builts” for details.)**:

1. **Anoxic Collection System** - consisting of 154 tons of AASHTO #57 sandstone with 4-inch, perforated SDR 35 piping totaling 200 feet in length;

2. **Anoxic Limestone Drain** - containing 670 tons of 90% $CaCO_3$, AASHTO #1, limestone aggregate with influent and effluent manifolds;

3. **Settling Pond #1** - 7,300 SF in size at design water level with baffles;

4. **Vertical Flow Pond** - containing an underdrain system; 600 tons of 90% $CaCO_3$, AASHTO #1, limestone aggregate overlain by a mixture of 36 tons of spent mushroom compost with 69 tons of 48% $CaCO_3$, AASHTO #10 and 71 tons of 48% $CaCO_3$, AASHTO #57, limestone aggregate;

5. **Settling Pond #2** - 4,500 SF in size at design water level;

6. **Aerobic Wetlands** - 11,000 SF in size at design water level with a ½-foot substrate containing a mixture of about 30 tons of spent mushroom compost and 23 tons of 48% $CaCO_3$, AASHTO #57, limestone aggregate planted with cattails;

7. **Horizontal Flow Limestone Bed** - containing 500 tons of 90% $CaCO_3$, AASHTO #1, limestone aggregate and an oulet manifold into a rip-rap lined spillway.

An additional 140 tons of 48% $CaCO_3$, R-4, limestone rip-rap was used in spillways.

Discharges 12 and 13 were collected and directed through the passive treatment system. Discharge 14 was treated to a net alkaline discharge upon combining with the final effluent from the system.

The flow and water quality used for the system design is the following: 27 gpm, 350 mg/L acidity, 219 mg/L ferrous iron, and 26 mg/L manganese. The design life is more than 25 years.

Anoxic Collection System

On 10/13/99, the Anoxic Collection System, 200 feet in length with two laterals, was completed. (See photo section showing installation of a lateral and bedding stone, p. 5.) The permanent outlet from the Anoxic Collection System consisted of a 10-foot section of 4-inch, solid, Schedule 40, PVC pipe with an anti-seep collar. (See photo section of the ALD inlet pipe, p. 7.) This pipe was directly plumbed onto the perforated collection pipe. Collection of the drainage was an imperative “first-step” as the flows of 12 and 13 were diffuse. The collection system allowed for water sampling and flow measurement representative of the drainage to be treated, which was needed to finalize the design of the system. Upon installation of the collection system, the construction activities were stopped for one week while the designers of the system arrived at a consensus regarding the size and type of components to be built. (See photo section of co-sampling collection system outlet with Ron Horansky, MCI, Greensburg DMO, p. 6.)

Anoxic Limestone Drain and Settling Pond #1

The Anoxic Limestone Drain and Settling Pond #1 were under construction from 10/25/99 through 11/8/99. The inlet was plumbed directly onto the Anoxic Collection System outlet. The inlet includes 4-inch, solid, SDR 35, PVC piping with a 90^{o} elbow to direct the flow to a “T” near the base of the Anoxic Limestone Drain which is part of a 4-inch, perforated, SDR 35, PVC manifold that extends about 45 feet across the inlet end of the system. A 6-inch, perforated, Sch. 40, PVC pipe extends about 45 feet across the outlet end of the system. 6-inch, solid, Sch. 40, PVC piping is then plumbed into the perforated manifold. The outlet is completed with an upturned, 90^{o} elbow to inhibit oxygen from entering the drain. Geotextile was placed in the excavation prior to installation of the piping and aggregate. (See photo section showing aggregate placement, p. 7.) The water from the Anoxic Collection System was directed into the Anoxic Limestone Drain on 11/8/99. Within two days, water was discharging from the Anoxic Limestone Drain. By 11/19/99, the flow into Sediment Pond #1, which has a water depth of about six feet, was nearing the elevation of the spillway. Due to iron solids passing from Sediment Pond #1 through the spillway and into the Vertical Flow Pond, on 6/14/00 sediment curtains were installed in this pond. (See “As-Built” drawings and photo section, p.10.)

Vertical Flow Pond

Prior to directing the flow from the collection system to the Anoxic Limestone Drain, the Vertical Flow Pond was constructed from 11/1/99 through 11/5/99. Geotextile was first placed on the bottom and along the sides of the excavation to the approximate height of the stone. The effluent from Setting Pond #1 enters the Vertical Flow Pond via a spillway lined with R-4 rip-rap. Three laterals, placed in the center and near the pond sides of 4-inch, perforated, SDR 35, piping, extend about 52 feet from the inlet end of the pond to the outlet end. These laterals “T” into a 6-inch, perforated, Sch. 40, PVC main that extends about 40 feet along the pond bottom at the outlet end. Near the easterly end of the main, the outlet system consists of 6-inch, solid, Sch. 40, PVC piping that extends through the breastwork. In addition, a 4" Sch. 40 riser approximately 4' high was plumbed into the 6" bottom pipe. Outlet pipes were installed at the midpoint and top of this riser and each extend to the outlet spillway. An upturned, 90^{o} elbow is plumbed on the uppermost pipe. The outlet at the lowest elevation is for flushing the pond and is currently capped. The mid-elevation outlet is also currently capped and is to be used if the permeability of the treatment media is decreased and additional head is needed. The uppermost pipe currently conveys the effluent. (See photo section showing each of the three outlet pipes, p. 13 and 14.) An emergency spillway, which outlets into Settling Pond #2, was also constructed and lined with R-4 rip-rap. (See photo section of Settling Pond #2 showing emergency spillway and area stabilized with rip-rap for the outlet pipes, p. 14.)

Settling Pond #2 and Aerobic Wetland

Settling Pond #2 and the Aerobic Wetland were constructed from 11/8/99 through 11/11/99 at the same time that the Anoxic Limestone Drain was filling with water. The water depth is about 3 ½ feet in Settling Pond #2 and about ½ foot in the Aerobic Wetland. (See photo section of Settling Pond #2 with wetland in background, p. 14.) The rock-lined spillways were installed to convey the flow from these components. On 5/24/00, about 6 months after construction, the Aerobic Wetland was planted by about 25 volunteers using primarily cattails from the nearby sludge ponds that were in the process of being removed as part of the Phase II restoration project. To plant the wetland, the substrate was parted with a shovel and the cattail plant with rhizome was placed into the substrate with the material around the plant compacted by hand. Plant spacing was about 3 feet. (See photo section showing wetland planting, p. 21.)

Horizontal Flow Limestone Bed

The Horizontal Flow Limestone Bed was constructed at the same time as Settling Pond #2 and the Aerobic Wetland. The inlet to the Horizontal Flow Limestone Bed is the rock-lined spillway from the wetland. The outlet, constructed at the opposite end of the component from the inlet, consists of a 6-inch, perforated, Sch. 40, PVC pipe that extends about 37 feet along the base of the component. Using a “T” fitting plumbed onto the perforated pipe, a 6-inch, solid, Sch. 40, PVC riser with a 90^{o} elbow and piping extending into the rock-lined spillway, was installed to convey the final effluent from the passive treatment system. [Although functioning, the elevation of the elbow may be lowered or aggregate added in the near future in order to further encourage flow through the aggregate.] About 4' of limestone aggregate was placed into the approximately 35' x 65' excavation. (See photo section showing limestone aggregate in completed system, p. 15.) The system was discharging by 12/10/99.

Diversion Ditch

A permanent, V-shaped, upland diversion ditch about 600 feet in length was constructed in order to convey surface and shallow subsurface water away from the passive system. An energy dissipator was constructed at the outlet and the ditch was stabilized by vegetation. (See photo section showing mulched ditch and rock-filled energy dissipater, p. 18.)

Site Vegetation

In order to provide a suitable growth medium, excess soil-type material encountered during excavation of the passive treatment system was spread over the barren area.

The embankments, regraded area overlying the Anoxic Collection System and Anoxic Limestone Drain, and land reclamation area were vegetated by 11/17/99 with the following mixture, as recommended by Ohiopyle State Park personnel:

	Rate
Hard Fescue Mixture	13.0 lbs/1000 SY
Creeping Red Fescue	8.5 lbs/1000 SY
Annual Ryegrass	2.5 lbs/1000 SY
	24.0 lbs/1000 SY TOTAL
Hay/Straw Mulch	1.5 tons/acre
Fertilizer (10-20-20)	680 lbs/acre

Major Equipment List
330 Caterpillar track excavator
D6H LGP Caterpillar dozer
963 LGP Caterpillar track loader

(See photo section, p.4, 6, 7, and 15.)

PHASE I: SYSTEM PERFORMANCE

The degree of success of the individual components of the passive treatment system and the land reclamation is briefly addressed below. **(See attached analyses and graphs, Figures 2-7.)**

Anoxic Collection System
The collection system has successfully collected drainage associated with discharges 12 and 13 and has prevented the oxidation of the metals prior to entering the Anoxic Limestone Drain. Needless to say, any drainage which issued from strata below the elevation of the base of the collection system was not encountered which may account for the few downgradient damp spots. There is no noticeable flow in these areas. A raw water sampling port, which was not included in the original proposal, was installed into the collection system; however, representative water samples have been difficult to obtain. Re-installation of the port is planned.

Anoxic Limestone Drain
On 10/16/99, Robert Hedin, PhD, collected six limestone incubation samples from the Anoxic Collection System prior to installation of the Anoxic Limestone Drain. After seven hours of incubation, the measured alkalinities were the following: 184 mg/L, 193 mg/L, 183 mg/L, 211 mg/L, 188 mg/L, and 207 mg/L. The field alkalinity performed on effluent samples from the Anoxic Limestone Drain collected 3/30/00 and 4/28/00 were 199 mg/L and 188 mg/L, respectively, which demonstrates that the system is performing as predicted. Please note that the alkalinity measured in the laboratory for the same sampling events was 14 mg/L and 77 mg/L, respectively. This is due to the high dissolved ferrous iron content (150$\pm$ mg/L) in the effluent from the Anoxic Limestone Drain and the fast chemical reaction that forms ferric iron solids in the bottle prior to being received and analyzed by the laboratory (Figure 2).

Settling Pond #1
The design of Settling Pond #1 assumed that the iron removal rate would be 10 g m^{-2} day^{-1} or about ½ of the iron content. The pond was enlarged during construction, however, in order to provide more retention. The available water monitoring demonstrates that between 21% to 57% of the iron content was being removed from the drainage in Settling Pond #1. Comparing the total and dissolved iron contents of the effluent on 1/17/00, 3/30/00, and 4/28/00, indicated that 94%, 94%, and 96% of the iron remained dissolved in the flow upon entering the Vertical Flow Pond. This also indicates that 4 to 6% of the total iron content entering the Vertical Flow Pond were solids. As the reddish solids were collecting at the water-compost interface, after a dye test (See photo section of dye test, p. 9 and 16.) was performed to determine preferential flow through the pond, curtains were installed in Setting Pond #1 to decrease the percentage of solids entering the Vertical Flow Pond. At the time of writing this report, although a decrease in solids can be directly observed, sample analyses are not available for comparison. (The dye testing and the curtains were not part of the original project but were included in the project through the partnership effort without requesting additional funds through the granting agency.) Also, as predicted, alkalinity was depleted as the iron solids were formed. This is readily

demonstrated by comparing the field alkalinity of the Settling Pond #1 influent which averaged 190 mg/L with the effluent which averaged 11 mg/L (Figure 3).

Vertical Flow Pond

A Vertical Flow Pond was installed to receive the effluent from Settling Pond #1 in order to provide a net alkaline final discharge from the passive treatment system. The laboratory alkalinity of the Vertical Flow Pond effluent has averaged 120 mg/L. Field testing indicates that the alkalinity may be up to about 20 mg/L higher. Based on available analyses, the average total iron content of the Vertical Flow Pond influent is 87 mg/L compared to 15 mg/L in the effluent. This indicates that an average of 83% of the total iron entering the Vertical Flow Pond is currently being retained within the Vertical Flow Pond. This iron is probably retained in the system as iron precipitates at the water-compost interface, iron sulfides within the compost, and/or by an affinity to the organic material. The baffles recently installed in Settling Pond #1 are expected to decrease the influent iron content which would decrease the amount of iron being retained in the system. Additional monitoring is planned through the partnership effort. The average manganese content is also noted to decrease 4 mg/L from an influent flow of 20 mg/L to an effluent flow of 16 mg/L. This has been observed in other systems to be a temporary phenomenon.

Settling Pond #2

Settling Pond #2 allows for additional oxidation of metals and the settling of particulates. Comparison of the field measurements of the influent and effluent alkalinity, measured 3/30/00 and 4/28/00, indicates a decrease from 108 to 98 mg/L and 121 to 101 mg/L, respectively (Figure 3). On 3/30/00, dissolved iron decreased from 5 mg/L in the influent to 0.3 mg/L in the effluent, which would explain the decrease in the alkalinity. Total iron on the same date decreased from 7 to 4 mg/L (Figure 6). On 12/10/99, the total iron was higher in the effluent than in the influent. Sampling events since indicate that particulate iron decreases about 4 mg/L through the system. Note on 1/17/00, the total and dissolved iron concentrations in the influent were 23 and 15 mg/L, respectively, while the total and dissolved iron concentrations in the effluent were 19 mg/L and 4 mg/L (Figure 6). This indicates that the pond is successfully providing an oxidizing environment.

Wetlands

The wetlands were only recently planted and the analyses available at the time of the writing this report were from samples collected prior to the planting. The functioning of the wetlands, therefore, should only improve with the increased filtering of particulates by the plants. The total iron measured in the effluent ranged from 0.8 to 14 mg/L. At the time of highest total iron concentration (1/17/00), the dissolved fraction was 1.6 mg/L, however. On 3/30/00, the dissolved iron in the effluent was 0.1 mg/L. At times, a decrease in manganese was noted through the system of up to 5 mg/L. (See 4/28/00 influent and effluent sample analyses and Figure 7.) This may be due to an affinity of the manganese to the organic matter in the substrate, bacterial reactions, and/or to oxidation and precipitation of the manganese after oxidation of the dissolved iron from the discharge. Additional monitoring is planned by the public-private initiative to characterize the change in water quality.

Horizontal Flow Limestone Bed

This type of passive treatment facility is in the experimental stage. This component is intended to assist in the removal of manganese from the discharge flow and to impart alkalinity. As predicted the iron concentration is characteristically low entering the Horizontal Flow Bed and armoring does not appear to be a problem. The dissolved iron entering this component is 0.1 to 1.6 mg/L and leaving this component measures from <0.1 to 0.6 mg/L. The total manganese, which in the various components appears to be primarily dissolved, is currently decreased by about 2 mg/L (Figure 7). Dye testing (See photo section of dye testing, p. 16.) indicates that the water is, however, currently short-circuiting and steps to correct this will be taken by the public-private partnership initiative during construction of Phase II. The average quality of the final effluent is 7.3 pH, 145 mg/L alkalinity, no acidity, 3 mg/L total iron, and 10 mg/L total manganese while the average raw water quality is 4 pH, 2 mg/L alkalinity, 348 mg/L acidity, 186 mg/L total iron, and 26 mg/L total manganese.

Land Reclamation

The area formerly barren is now well vegetated with nearly 100% cover. (See photo section depicting vegetation, p. 19, 20, 21, and 23.) This includes the area underlain by the Anoxic Collection System and the Anoxic Limestone Drain. There are a few very small areas on pond embankments which need additional plant coverage. If not vegetated by natural processes, these areas will be further addressed. The diversion ditch is very well stabilized with vegetative growth. The cattails in the recently planted wetland have vigorous growth and generally two additional cattails appear to be sprouting from each rhizome. (See cattails in photo section, p. 23).

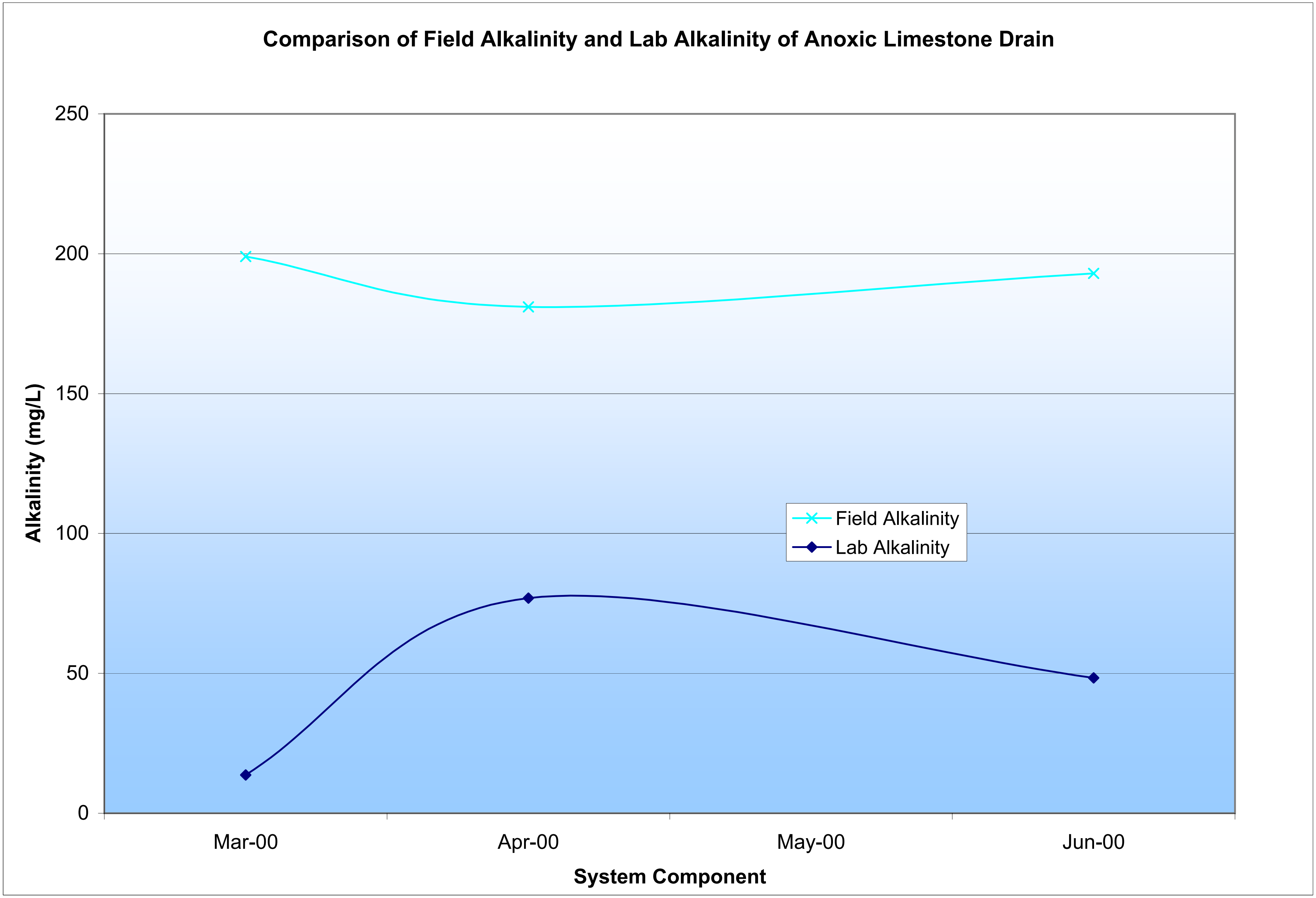

Comparison of Field Alkalinity and Lab Alkalinity of Anoxic Limestone Drain
250
200
150
100
50
0
Alkalinity (mg/L)
Field Alkalinity
Lab Alkalinity
Mar-00
Apr-00
May-00
Jun-00
System Component

Figure 2

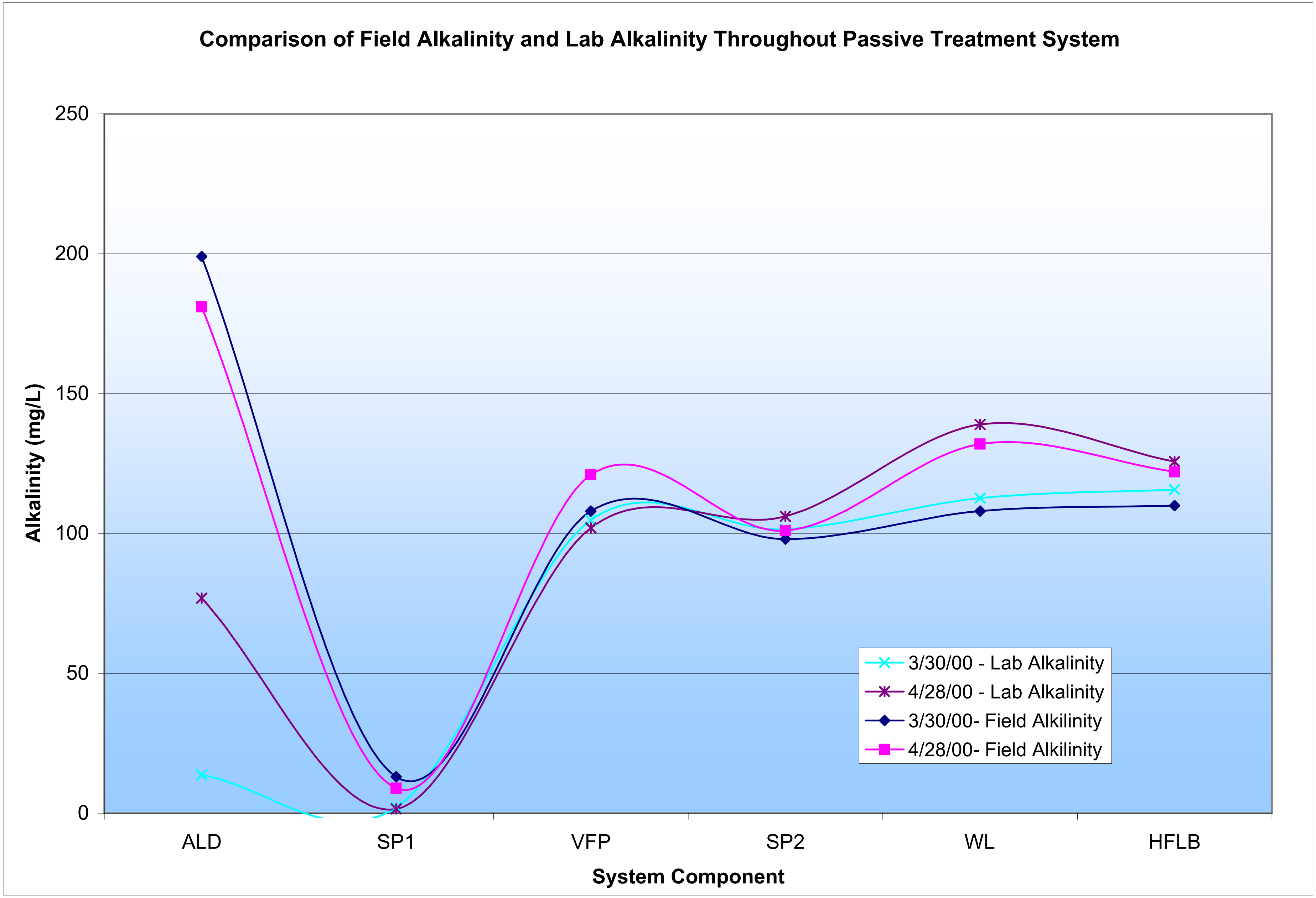

Comparison of Field Alkalinity and Lab Alkalinity Throughout Passive Treatment System
250
200
150
100
50
0
Alkalinity (mg/L)
ALD
SP1
VFP
SP2
WL
HFLB
System Component
3/30/00 - Lab Alkalinity
4/28/00 - Lab Alkalinity
3/30/00- Field Alkilinity
4/28/00- Field Alkilinity

Figure 3

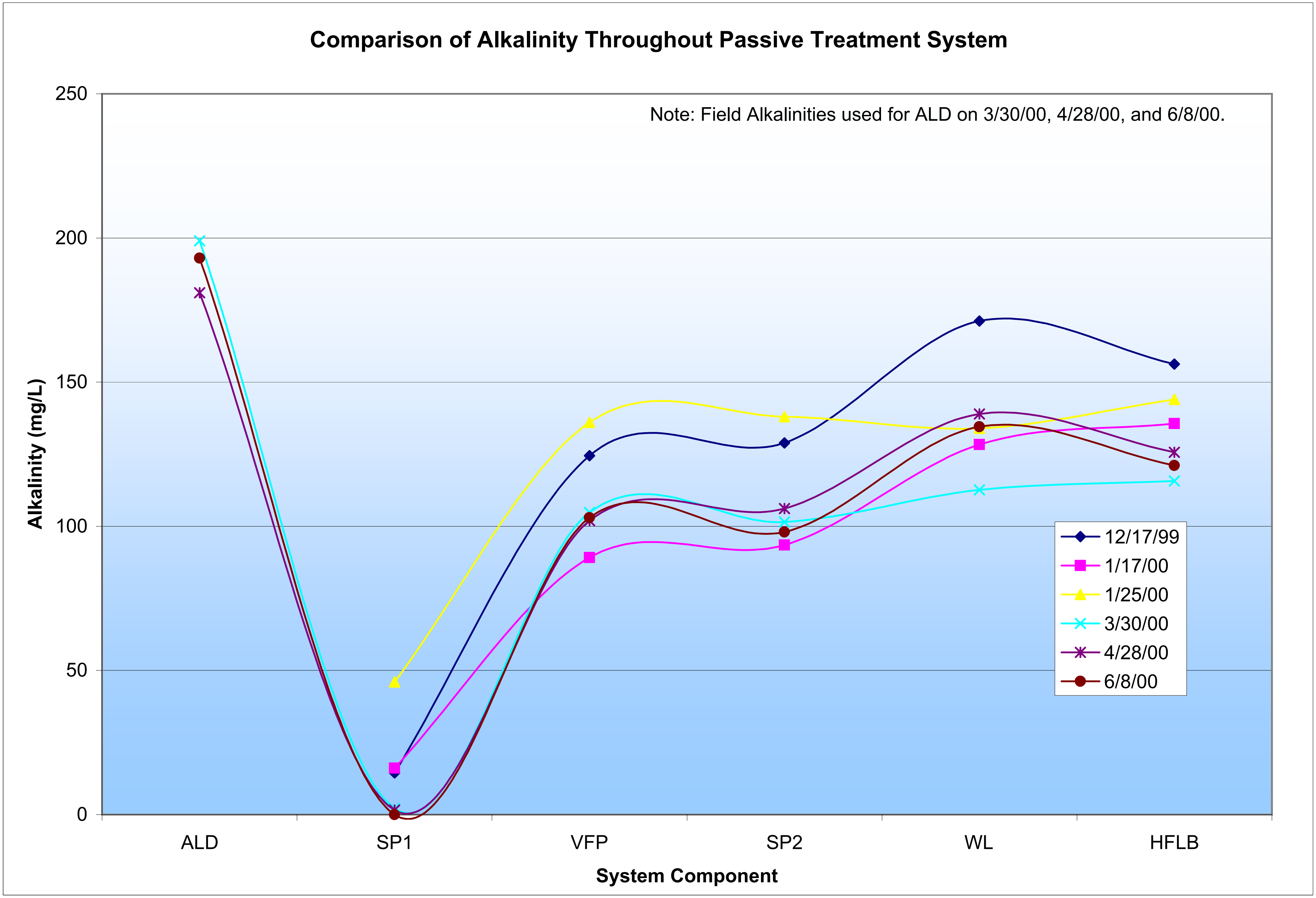

Comparison of Alkalinity Throughout Passive Treatment System
Note: Field Alkalinities used for ALD on 3/30/00, 4/28/00, and 6/8/00.
Alkalinity (mg/L)
250
200
150
100
50
0
ALD
SP1
VFP
SP2
WL
HFLB
System Component
12/17/99
1/17/00
1/25/00
3/30/00
4/28/00
6/8/00

Figure 4

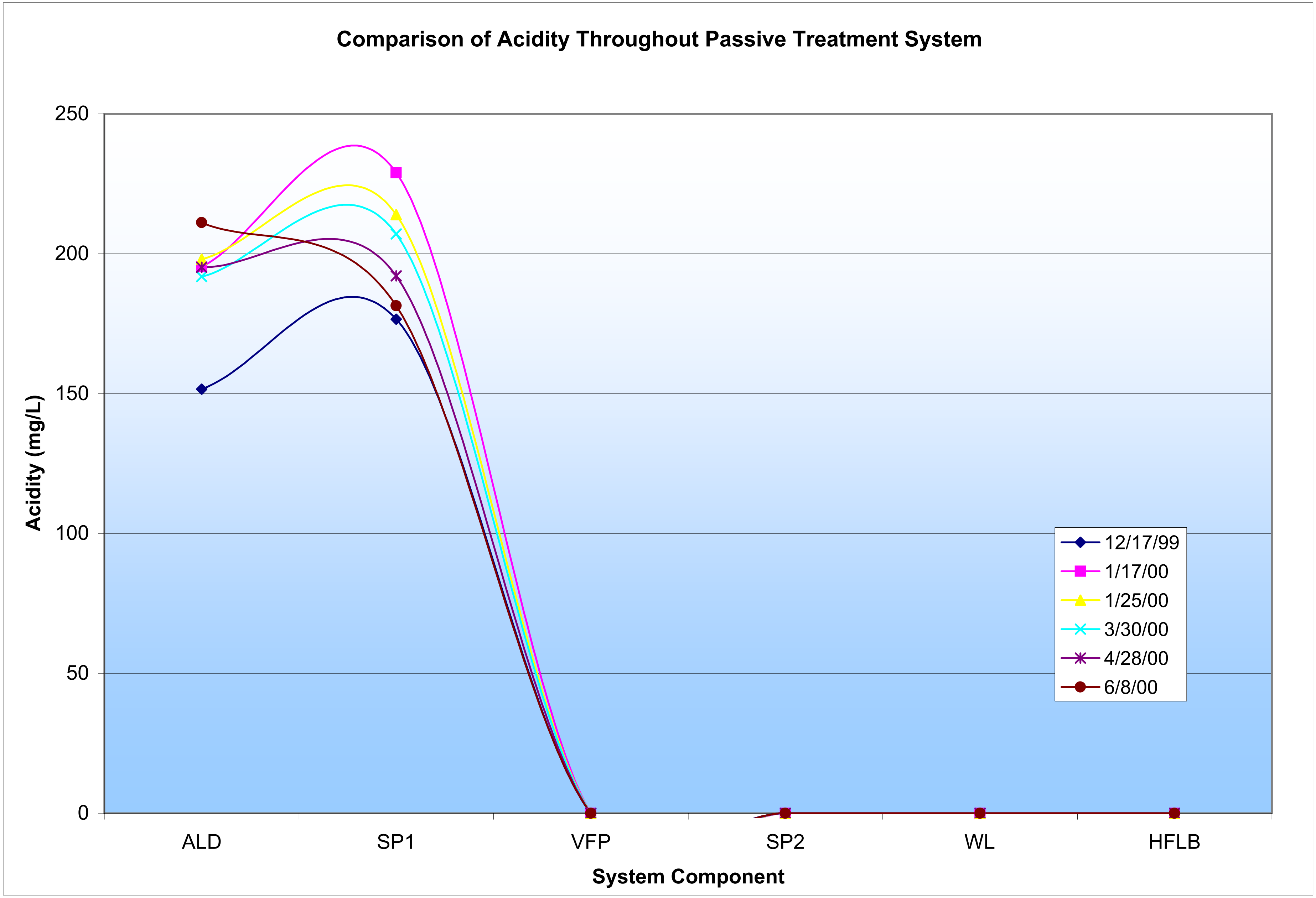

Comparison of Acidity Throughout Passive Treatment System
Acidity (mg/L)
250
200
150
100
50
0
ALD
SP1
VFP
SP2
WL
HFLB
System Component
12/17/99
1/17/00
1/25/00
3/30/00
4/28/00
6/8/00

Figure 5

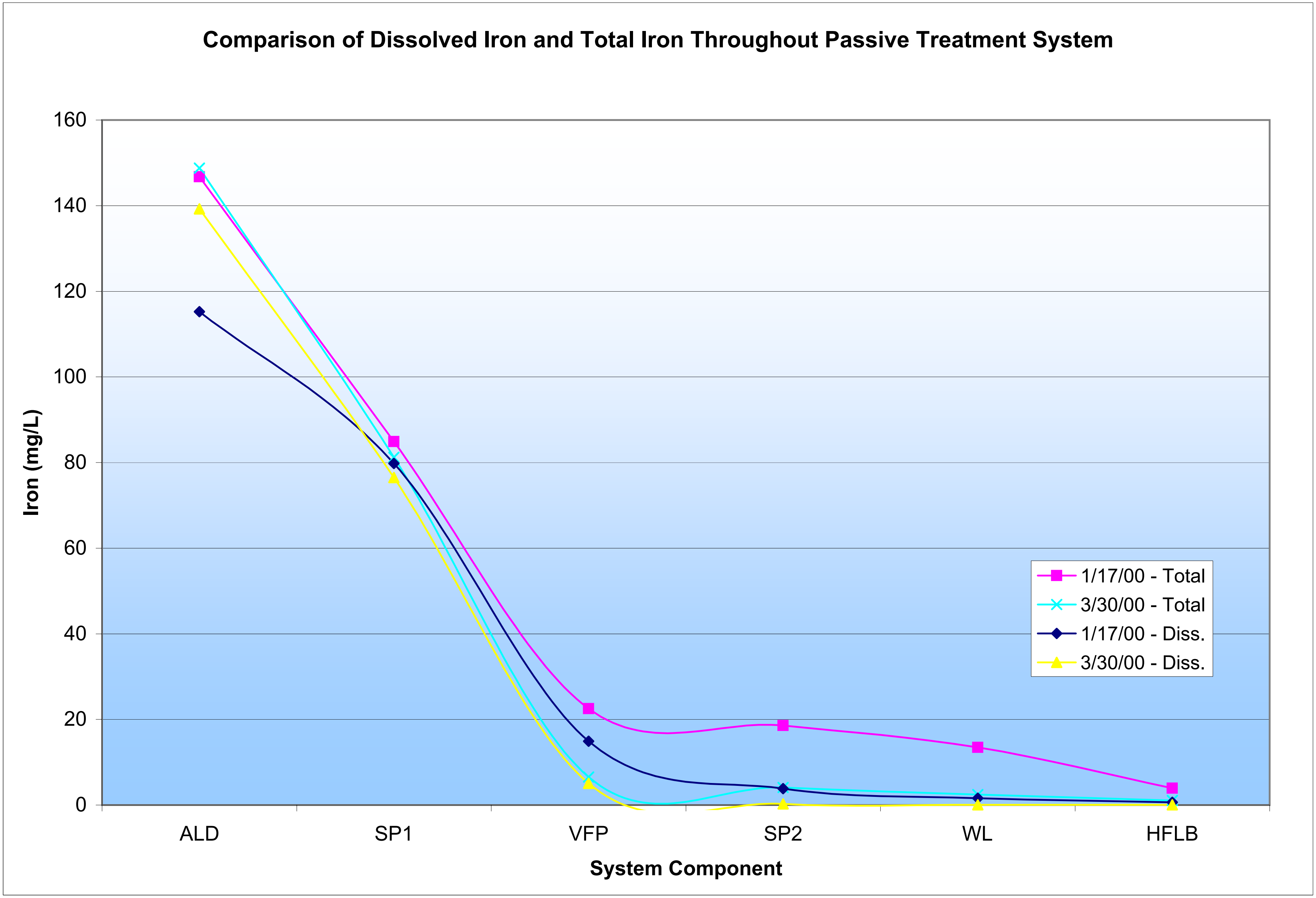

Comparison of Dissolved Iron and Total Iron Throughout Passive Treatment System
160
140
120
100
80
60
40
20
0
Iron (mg/L)
ALD
SP1
VFP
SP2
WL
HFLB
System Component
1/17/00 - Total
3/30/00 - Total
1/17/00 - Diss.
3/30/00 - Diss.

Figure 6

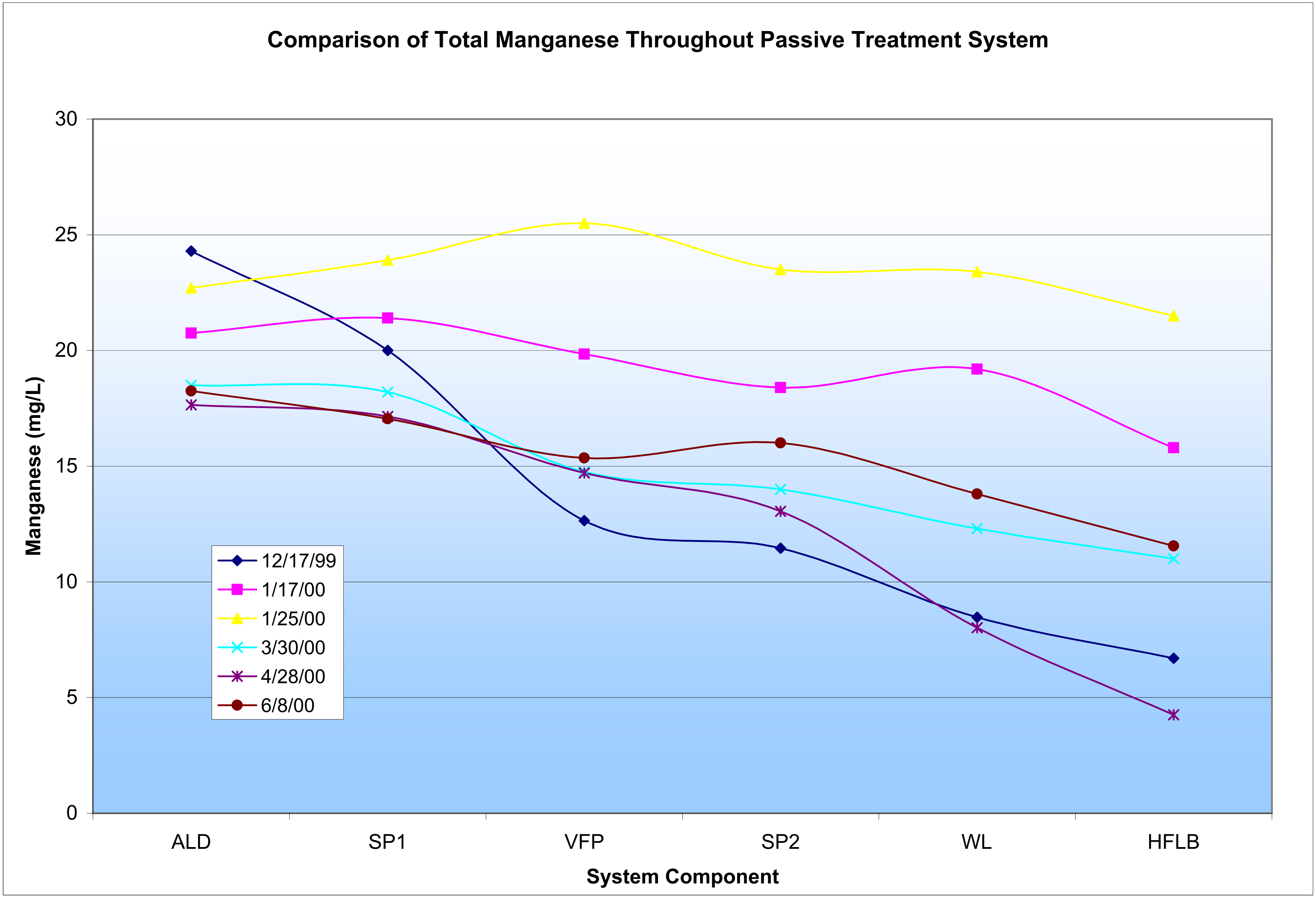

Comparison of Total Manganese Throughout Passive Treatment System
Manganese (mg/L)
30
25
20
15
10
5
0
ALD
SP1
VFP
SP2
WL
HFLB
System Component
12/17/99
1/17/00
1/25/00
3/30/00
4/28/00
6/8/00

Figure 7

MEASURABLE ENVIRONMENTAL IMPROVEMENT

The system has been successfully treating the collected flows of discharges 12 and 13 for 7 months from December 1999 through July 2000. The effluent from the system also successfully treats discharge 14 and significantly improves tributary C.

DISCHARGES 12 AND 13

A direct comparison of the raw and final effluent quality from the passive treatment system is noted below.

Comparison of Raw and Final Effluent Quality

point	pH	alkalinity	acidity	iron (T/D)	manganese (T/D)
raw	4.2	2	348	186	26
effluent	7.3	145	0	3/<1	10/10

alkalinity, acidity, and metals expressed in mg/L; average values (pH not averaged from H^+ conc.); n = 6; sampling dates for raw and effluent not always coincident; total(T), dissolved(D);

Maintaining an average flow of 10 gpm, within a year over 15,000 lbs (more than 7 tons) of acidity and about 9,000 lbs (over 4 tons) of metals will be removed from the combined 12 and 13 discharges by the passive treatment system (Figure 1 and 2).

DISCHARGE 14

A direct comparison of the "before and after" characteristics of discharge 14 in response to the construction of the passive treatment system is noted below. (Water data from weir previously installed by PA DEP.)

Comparison of Quality Before and After

point	flow	pH	alkalinity	acidity	iron	manganese
before	12	3.0	0	227	42	18
after	23	7.3	85	0	2	12

flow in gpm; alkalinity, acidity, and metals expressed in mg/L; average values (pH not averaged from H^+ conc.); n(flow before & after; pH and concentrations after) = 4, n(pH and concentrations before) = 6;

Due to the excess alkalinity in the flow from the passive system, the final effluent substantially improves the quality of discharge 14 (Figure 3, 4, and 5). Once iron-bearing and acidic, discharge 14 is now net alkaline with low iron concentration. At an average flow of 12 gpm for discharge 14, annually about 12,000 lbs (6 tons/year) of acidity are being neutralized and over 2000 lbs (1 ton/year) of metals are prevented from degrading Laurel Run.

STREAM IMPACT

A direct comparison of the upstream and downstream quality of the receiving stream, tributary C, after installation of the passive treatment system for discharges 12 and 13 is noted below.

Comparison of Upstream and Downstream Quality After

point	pH	alkalinity	acidity	iron	manganese
above	4.7	0	23	<1	2
below	5.6	5	13	1	3

alkalinity, acidity, and metals expressed in mg/L; average values (pH not averaged from H^+ conc.); n = 3;

Due to the much larger flow of Laurel Run and the negative impact of the degraded tributary C, Laurel Run does not show improvement in direct response to the installation of the passive systems for discharges 12 and 13. Tributary C, however, was measurably improved. Above the confluence with the passively treated water, tributary C was measured to be about 90 gpm when the flow at the discharge 14 weir was measured to be 15 and 26 gpm. (See attached water monitoring data.) Even though the stream had a flow at least 3 ½ times greater than the combined 12,13, and 14 discharge, the passively treated water was able to decrease the net acidity from 23 to 8 mg/L and increase the pH about 1 unit or 10-fold in the stream; therefore, considering that the stream is intermittent, an estimated <u>4,000 lbs annually (2 tons/year) of acidity are no longer contributing to the degredation of Laurel Run</u> (Figure 6). In addition, tributary C has been included in the Phase II restoration effort.

Wetlands and Land Reclamation

About a 1/4 acre of wetlands has been established at the site and about three acres of land have been successfully revegetated. (Compare before and after photos.)

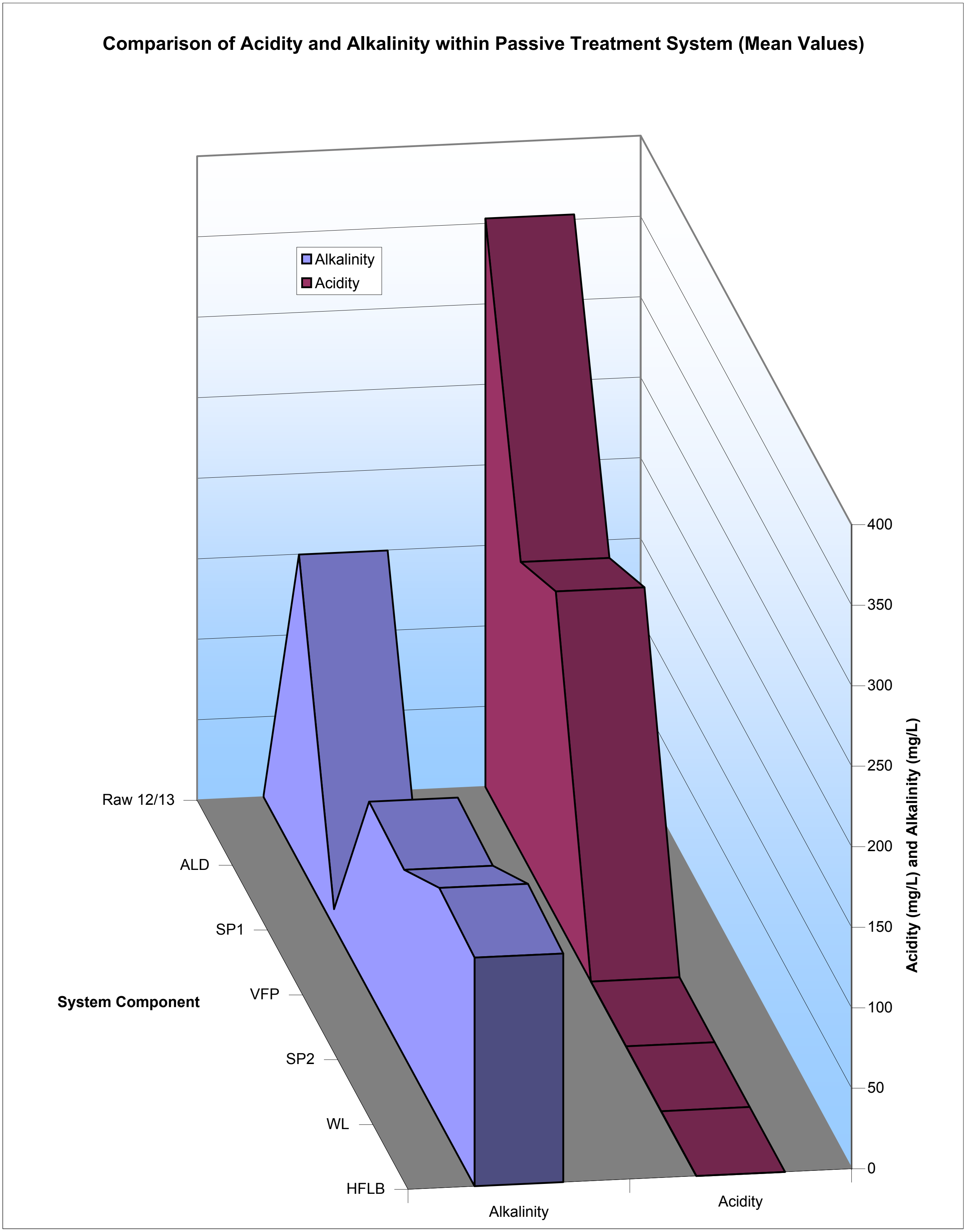

Comparison of Acidity and Alkalinity within Passive Treatment System (Mean Values)
Alkalinity
Acidity
Raw 12/13
ALD
SP1
VFP
SP2
WL
HFLB
System Component
Alkalinity
Acidity
0
50
100
150
200
250
300
350
400
Acidity (mg/L) and Alkalinity (mg/L)

Figure 1

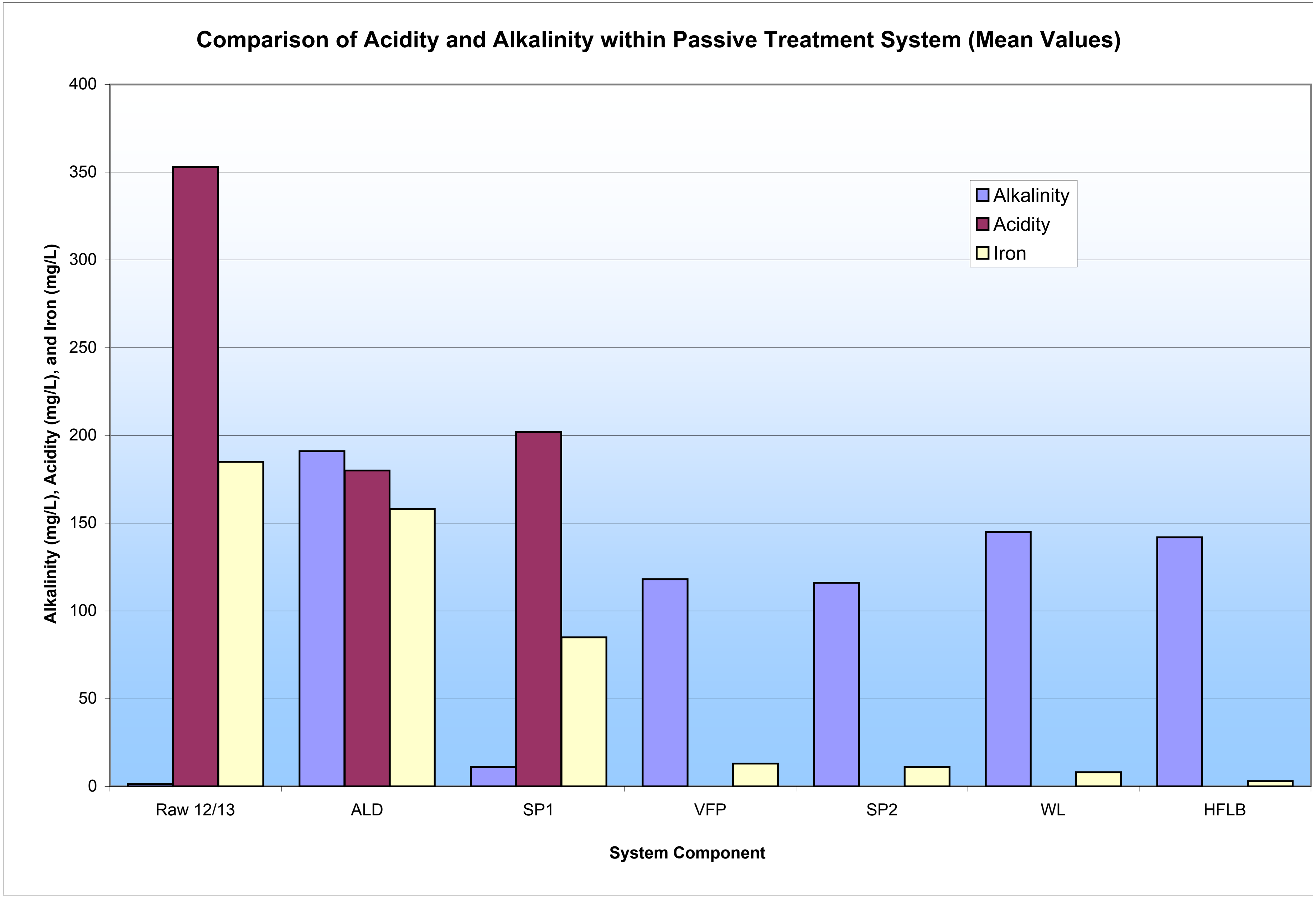

Comparison of Acidity and Alkalinity within Passive Treatment System (Mean Values)
Alkalinity (mg/L), Acidity (mg/L), and Iron (mg/L)
400
350
300
250
200
150
100
50
0
Alkalinity
Acidity
Iron
Raw 12/13
ALD
SP1
VFP
SP2
WL
HFLB
System Component

Figure 2

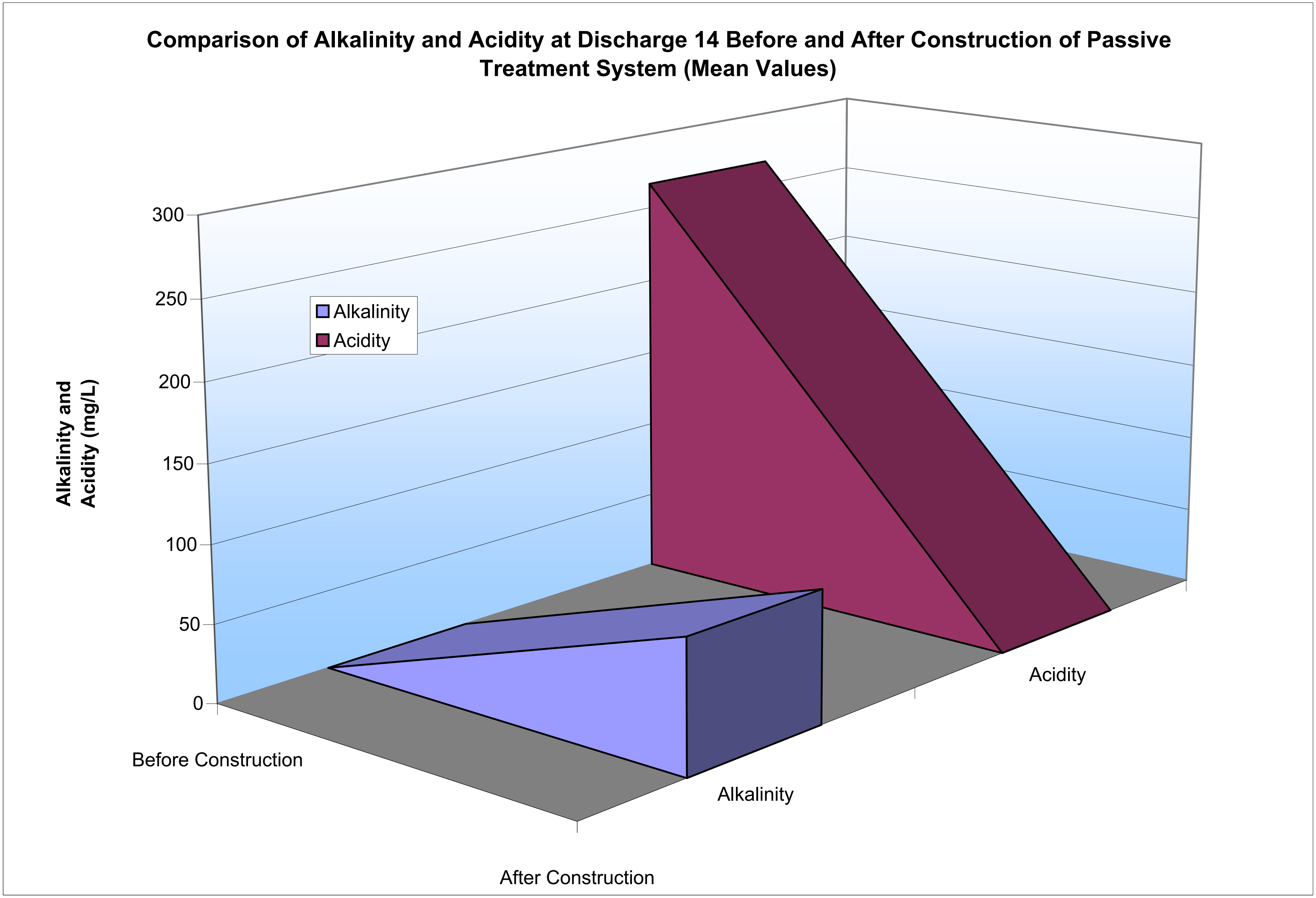

Comparison of Alkalinity and Acidity at Discharge 14 Before and After Construction of Passive Treatment System (Mean Values)
Alkalinity and Acidity (mg/L)
300
250
200
150
100
50
0
Alkalinity
Acidity
Before Construction
After Construction
Alkalinity
Acidity

Figure 3

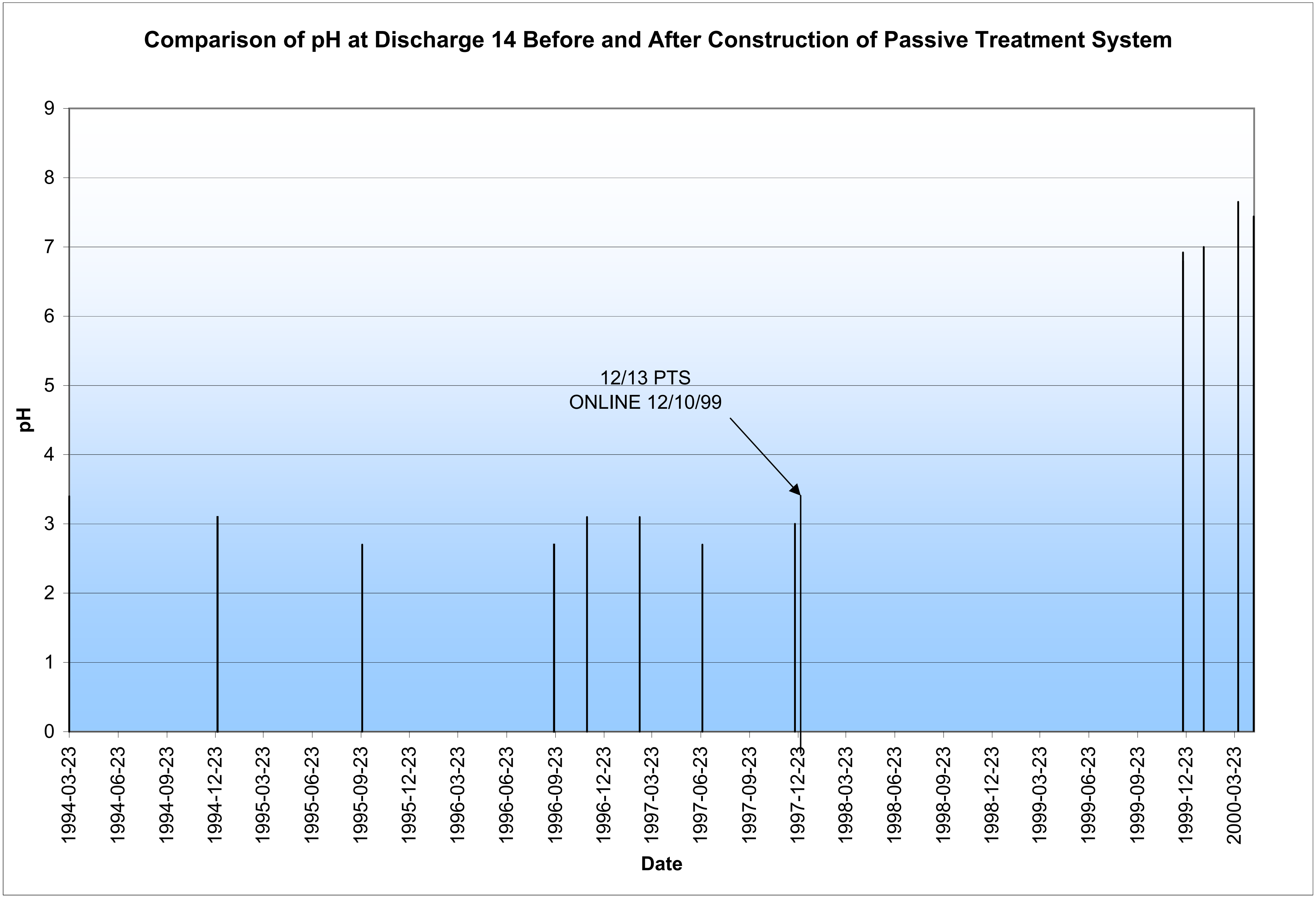
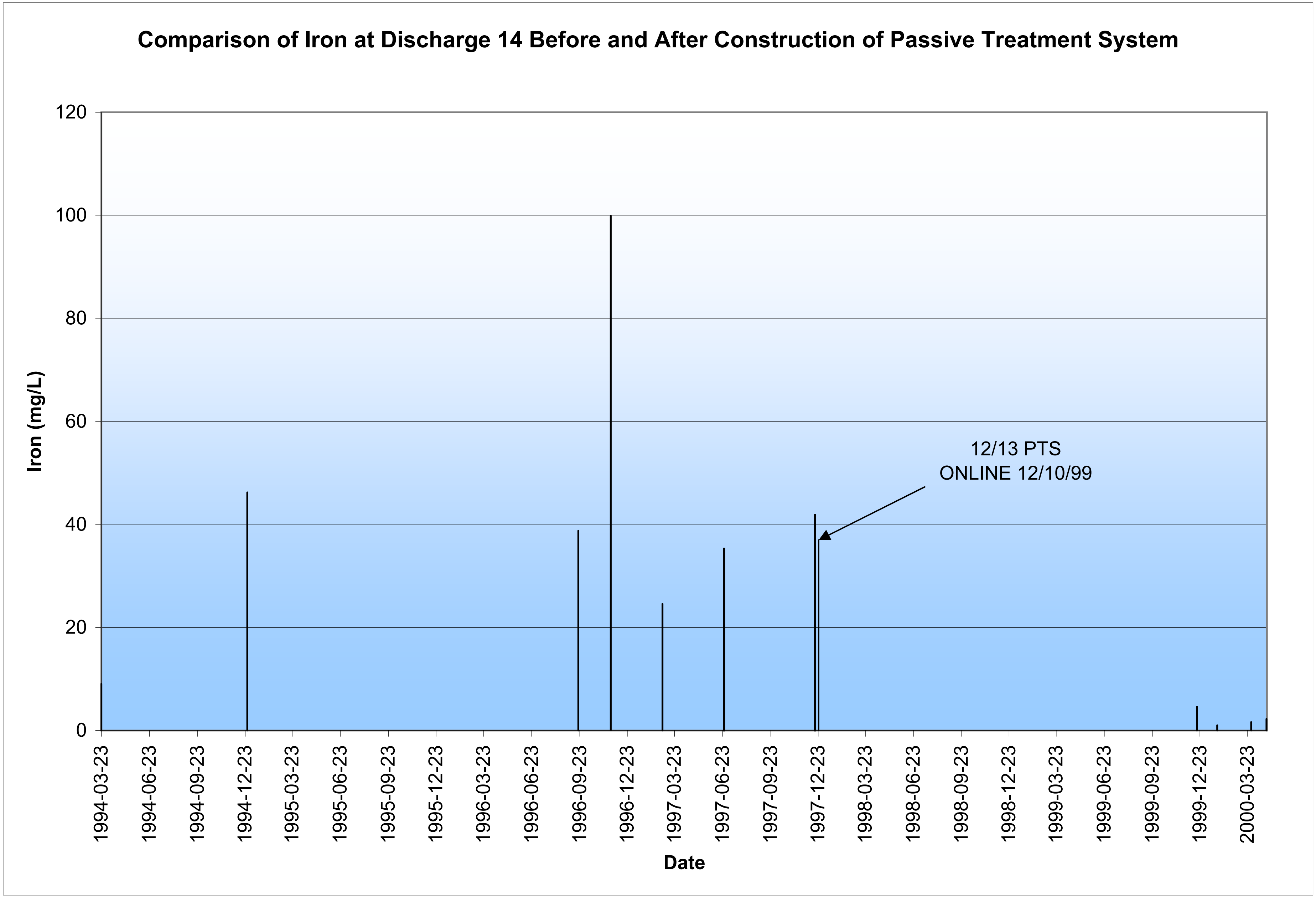

Comparison of pH at Discharge 14 Before and After Construction of Passive Treatment System
pH
0
1
2
3
4
5
6
7
8
9
12/13 PTS
ONLINE 12/10/99
1994-03-23
1994-06-23
1994-09-23
1994-12-23
1995-03-23
1995-06-23
1995-09-23
1995-12-23
1996-03-23
1996-06-23
1996-09-23
1996-12-23
1997-03-23
1997-06-23
1997-09-23
1997-12-23
1998-03-23
1998-06-23
1998-09-23
1998-12-23
1999-03-23
1999-06-23
1999-09-23
1999-12-23
2000-03-23
Date

Figure 4


Comparison of Iron at Discharge 14 Before and After Construction of Passive Treatment System
Iron (mg/L)
120
100
80
60
40
20
0
12/13 PTS
ONLINE 12/10/99
1994-03-23
1994-06-23
1994-09-23
1994-12-23
1995-03-23
1995-06-23
1995-09-23
1995-12-23
1996-03-23
1996-06-23
1996-09-23
1996-12-23
1997-03-23
1997-06-23
1997-09-23
1997-12-23
1998-03-23
1998-06-23
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1998-12-23
1999-03-23
1999-06-23
1999-09-23
1999-12-23
2000-03-23
Date

Figure 5

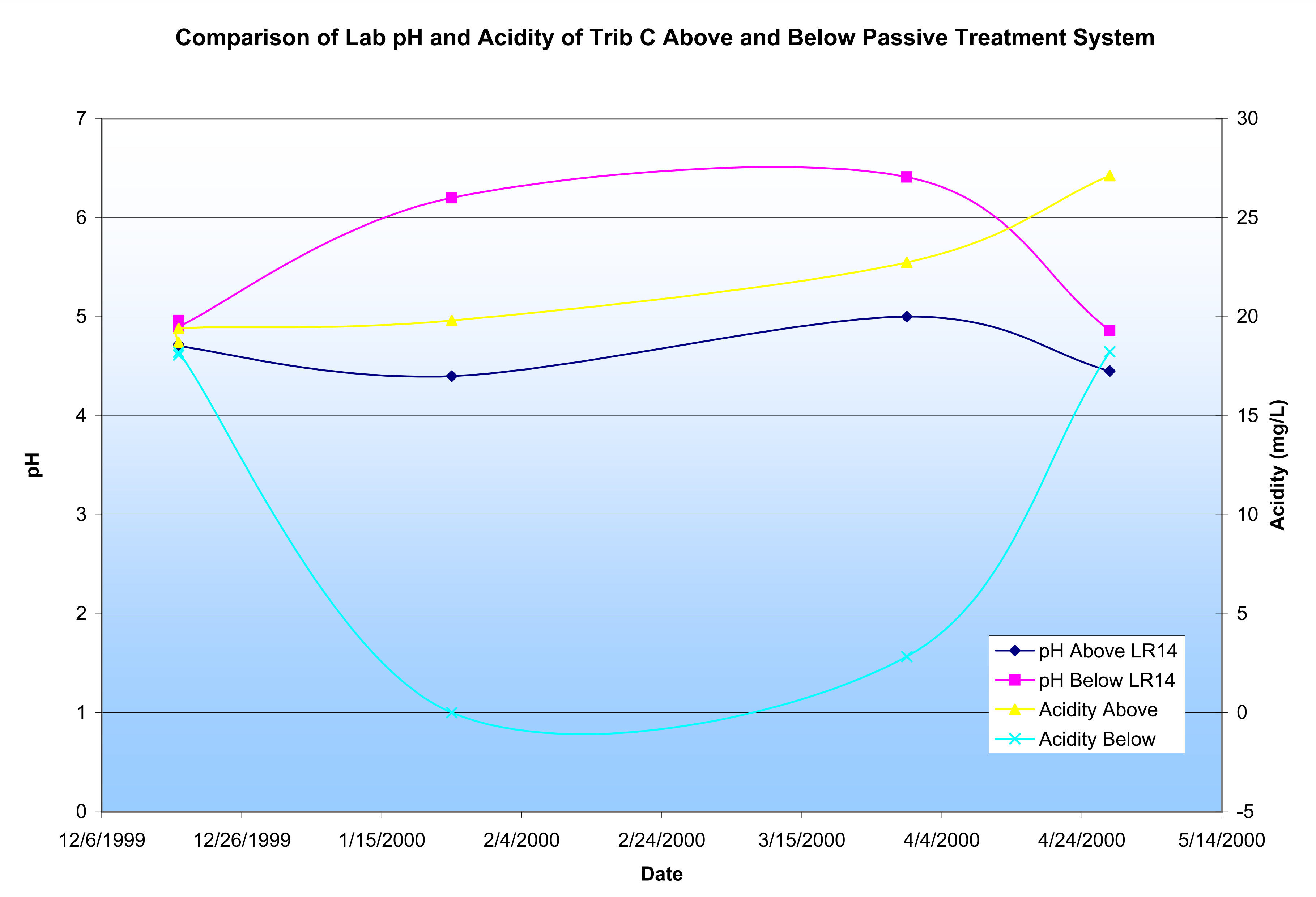
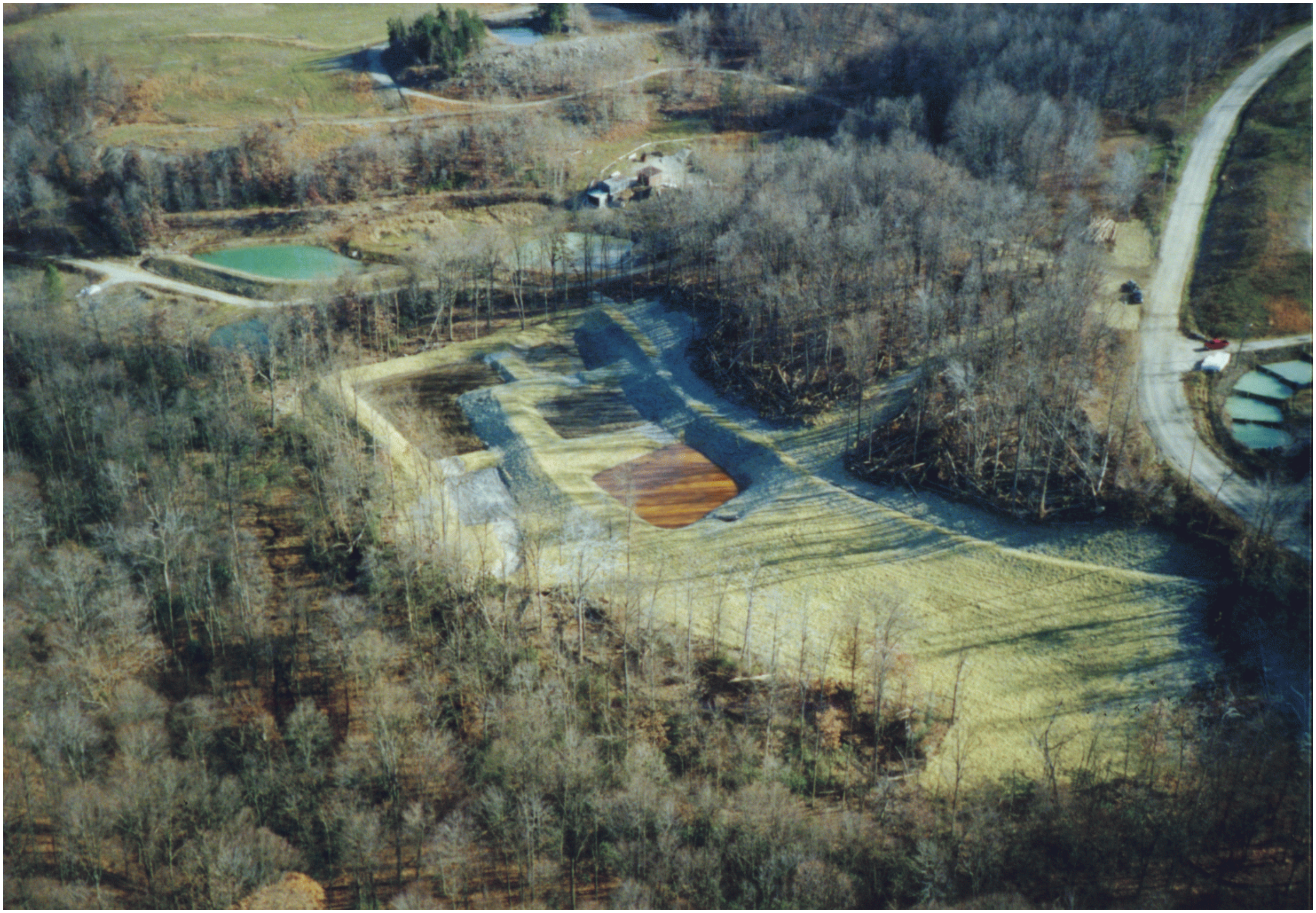

Comparison of Lab pH and Acidity of Trib C Above and Below Passive Treatment System
pH
Acidity (mg/L)
Date
12/6/1999
12/26/1999
1/15/2000
2/4/2000
2/24/2000
3/15/2000
4/4/2000
4/24/2000
5/14/2000
pH Above LR14
pH Below LR14
Acidity Above
Acidity Below

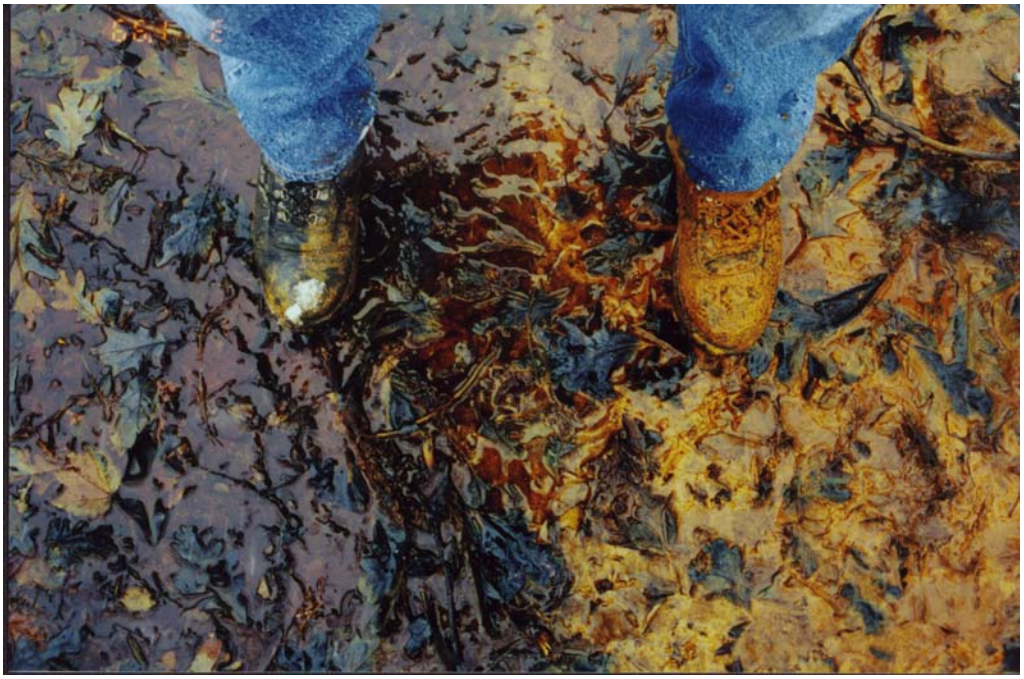
Figure 6



Aerial view of passive treatment system for Phase I constructed in 5 weeks 10/11/99 through 11/17/99 taken one day after construction. (Photo take 11/18/99 by Ron Horansky, MCI, PA DEP, Greensburg, DMO)


9 17'99

Effects of abandoned mine drainage at Harbison Walker Restoration Area, Ohiopyle State Park, Stewart To
Fayette County, PA. (SRI 9/17/99)



Iron precipitates at discharges 12 and 13 prior to passive treatment system installation. (3/1/99)

Sampling diffuse flow of discharges 12 and 13 prior to passive treatment system installation. (3/1/99)

Spent mushroom compost and harvested trees from the Phase I passive treatment system construction area (11/3/99).

AASHTO #1 limestone used in the construction of the ALD and VFP. (10/29/99)

4 inch, perforated SDR 35 pipe in collection system. One of two laterals shown. (10/11/99)

Placing of sandstone aggregate in collection ditch. (10/11/99)

Ron Horansky, MCI, PA DEP, Greensburg District Mining Office, and Tim Danehy, EPI, BioMost, Inc., preparing to disconnect piping to sample flow from anoxic collection system. (10/20/99)

Sandstone aggregate being placed to bed pipe for outlet manifold in Anoxic Limestone Drain. (10/1999)

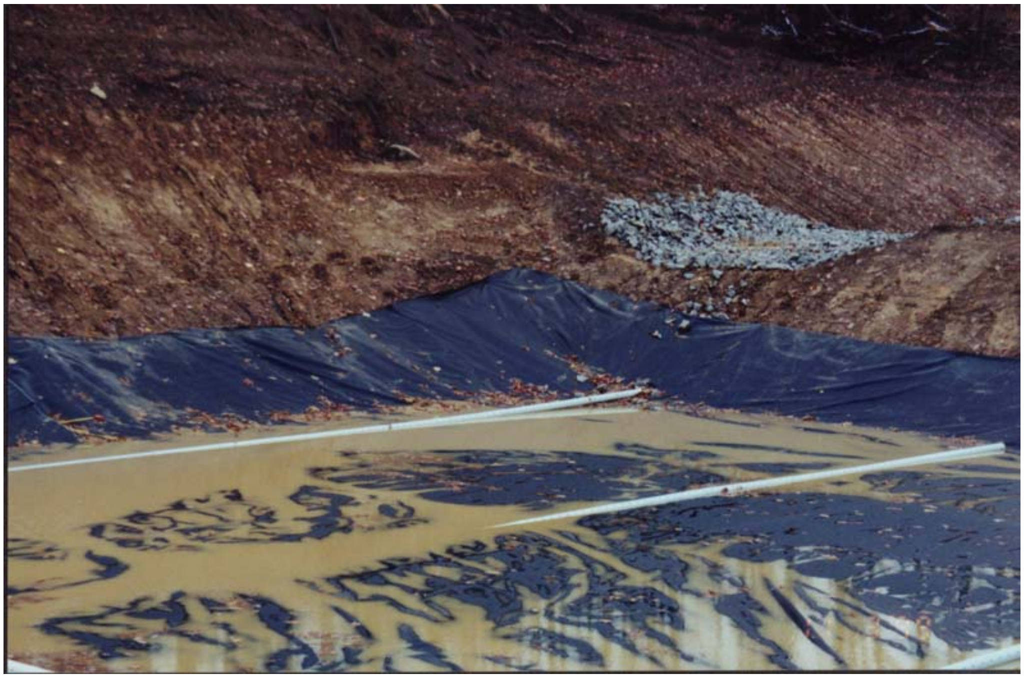
Influent pipe from Anoxic Collection System to Anoxic Limestone Drain. (10/28/99)

Construction of Anoxic Limestone Drain (670 tons), part of the Phase I passive treatment system. (10/28/99)

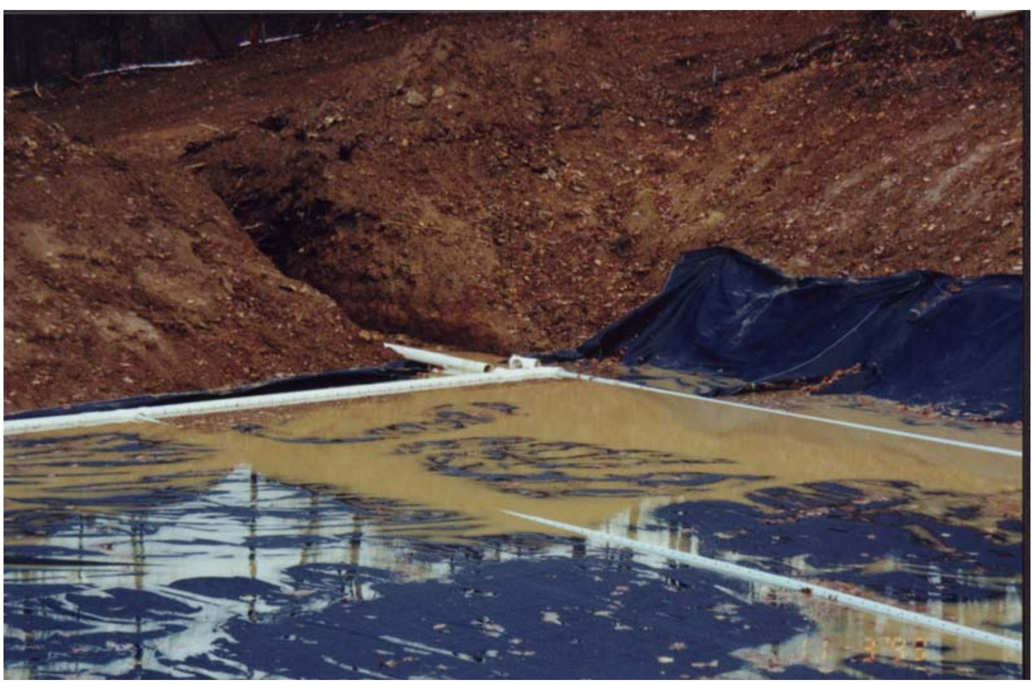
Left: Effluent from Anoxic Limestone Drain. (11/19/99)

Below: Iron accumulation within Settling Pond #1 and surveying of passive treatment system. (11/19/99)

Beginning of dye test of Settling Pond #1 examining water distribution patterns.



Underdrain of Vertical Flow Pond before addition of limestone and compost. (11/3/99)



Effluent pipe of Vertical Flow Pond leading to Settling Pond #2. (11/2/99)

Spent mushroom compost and limestone aggregate mixture overlying 600 tons of limestone in Vertical Flow Pond. (11/19/99)

Completed Vertical Flow Pond with 600 tons of AASHTO#1 overlain by mixture containing 36 tons of spent mushroom compost, 71 tons of AASHTO #57, 69 tons of AASHTO #10 aggregate. (11/19/99)

6" Bottom flush pipe for Vertical Flow Pond. (11/19/99)

4" Alternate discharge pipe for Vertical Flow Pond. (11/19/99)

Tim Danehy, EPI, BioMost, Inc., sampling water from effluent pipe of Vertical Flow Pond. (12/17/99)

Settling Pond #2 before water began flowing through the passive treatment system. (11/19/99)

Construction of 500 ton Horizontal Flow Limestone Bed. (11/9/99)

Spillway from 11,000 SF Wetland to Horizontal Flow Limestone Bed containing 500 ton of AASHTO #1 aggregate. Rodman surveying for "As-Builts." (11/19/99)

Darcy Peart, Stream Restoration, Inc., looking over dye quickly moving through the HFLB.

Final survey of passive treatment system. (11/19/99)

Revegetation: seed, fertilizer, lime, and mulch in former iron precipitate coated dead area. (11/19/99)

Above: Diversion ditch (looking northerly) preventing surface water runoff from entering the passive treatment system. (11/19/99)

Left: Energy dissipator/level spreader at end of upland diversion ditch. (11/19/99)

Successful revegetation above Anoxic Limestone Drain six months after seeding.

Iron solids in settling pond #1.

Successful revegetation after 6 months looking towards wetland before planting.

Wetland after 6 months prior to planting.

Volunteers planting wetlands.

Volunteers planting wetlands.

Volunteers from Pressley Ridge School that planted wetlands.

Volunteers from Pressley Ridge School that planted wetlands.

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GETTING DOWN AND DIRTY

Pressley Ridge students help plant wetlands constructed to clean up the environment

LIZ ZEMBA
Courier Staff Writer

OHIOPYLE — In mud up to their ankles and murky water reaching nearly to their knees, a group of Pressley Ridge School students got down and dirty at Ohiopyle State Park on Wednesday.

"This is pretty cool," said 14-year-old Joe Scott of Pittsburgh as he emerged from an 11,000-square-foot pond, smiling as thin rivulets of muddy water oozed from his elbows to his fingers and onto the grass-covered bank. "It's fun, helping out the environment, playing in the mud."

Scott and a half-dozen of his classmates were at the park's Laurel Run watershed as volunteers Wednesday morning, helping plant wetlands constructed to clean up waters poisoned with acid mine drainage in the area of the old Harbison Walker clay mine. Their duties entailed transplanting cattail plants taken from an untreated area within the watershed to the wetlands.

Sporting calf-high rubber boots, jeans and T-shirts, three of the teenage boys slipped and slid through mud more than a half-foot deep in some spots to uproot the cattail plants.

From there, they ferried the plants in buckets and wheelbarrows across a rock-strewn stream and through a patch of woods to four manmade ponds that comprise the wetlands.

Shovels in hand, others in the group grabbed the cattails and waded into the third in the series of the four treatment ponds. They worked in

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JOHN F. BROTHERS/Daily Courier
Kenny Moore, a Presley Ridge Wilderness School student transplants cattails into restored wetlands near Ohiopyle.

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Wetlands, from Page A1

> *"It's nice to know we're doing something that will have a long-term, positive effect on the area."*
> **— Mike Timmers**

JOHN F. BROTHERS/Daily Courier

Josh Moore, a Pressley Ridge Wilderness School student, carries buckets full of cattails that will be transplanted.

teams of two and three, with one boy plunging the spade into the foot-deep water and underlying compost bed while the others held a cattail plant or pushed its roots firmly into the freshly dug hole.

Another of the students, 17-year-old Mike Timmers of Cleveland, Ohio, found the replanting refreshing.

"It's nice to know we're doing something that will have a long-term, positive effect on the area," said Timmers, adding neither the mud nor a foul odor emanating from the ponds bothered him. "We're doing something positive by getting dirty and messy."

Overseeing the operation were two Pressley Ridge supervisors and several others from various organizations involved with the state-funded project, including Margaret Dunn, a geologist with the Cranberry Township-based Stream Restoration Inc.

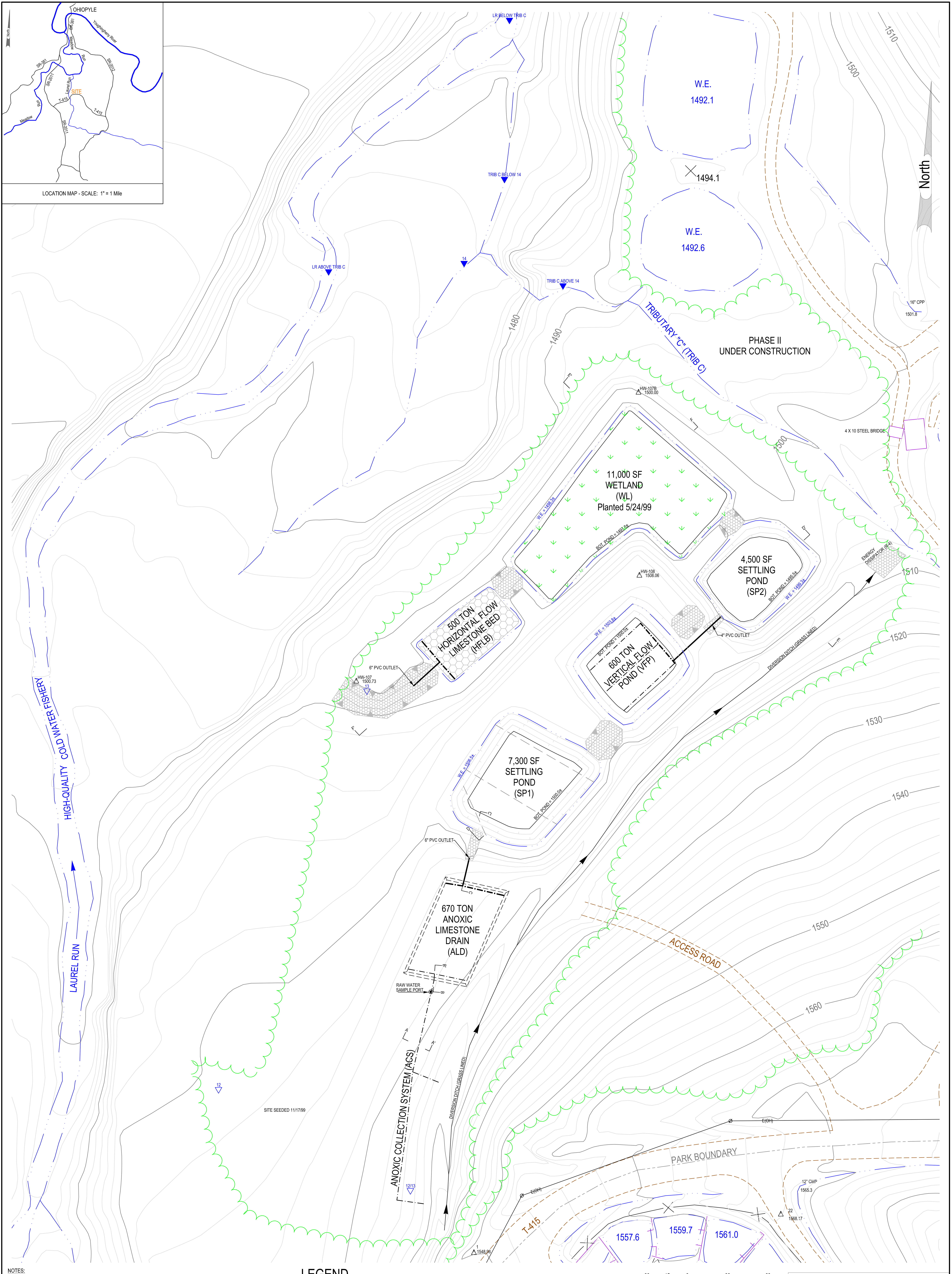
Dunn said cattails were selected for placement in the third pond because of their ability to naturally filter out metals suspended in the contaminated water. Such metals include iron and manganese, both of which kill vegetation, fish and other aquatic life.

The plants will remove any metals not eliminated as they flow through limestone and compost filters in the two ponds located above the third one. A fourth pond, situated horizontally to the third one, removes any manganese not filtered out in the first three ponds.

Dunn says the entire wetlands system, funded by a $261,294 state grant, works passively, meaning the water flows naturally from one pond to another during the filtration process.

She estimates the system will remove four tons of iron from the water annually and will remain active for at least 25 years, with little or no maintenance required.

Zemba's e-mail address is lzemba@tribweb.com.



NOTES:

Base map provided by PA DEP BAMR from aerial photographs taken 19981215.
As Built EDM survey by Earthtech, Inc., Johnstown, PA with additional information provided by Amerikohl Mining, Inc. and BioMost, Inc.
Settling pond and wetland surface areas determined at water surface elevation.
Water sampling point locations are approximate.
Elevations of As Built survey adjusted to correspond with BAMR survey point BL-1 (1).
Water surface areas and elevations subject to change based on passive component permeability and/or spillway outlet conditions.
Wetland planting completed by students and staff from Pressley Ridge School and other volunteers.
Baffle curtains installed 6/14/00.
Baffle curtain locations taken from as built drawings by WOPEC, Lewisburg, WV.
Raw water sample port inlet bedded in anoxic collection system with 1/2" PE tubing extending to surface protected by a vertical 4" pipe; the tubing is terminated with a capped, standard hose nipple (male).

LEGEND

- CONTOUR - INDEX
- CONTOUR - INTERMEDIATE
- WATER
- PROPERTY LINE
- TREELINE
- E(OH) ELECTRIC LINE
- Ø UTILITY POLE
- UNIMPROVED ROAD
- TRAILS
- OUT BUILDING OR OTHER STRUCT.
- WATER SAMPLING POINT (PRE CONSTRUCTION)
- WATER SAMPLING POINT (PRE and/or POST CONSTRUCTION)
- BAFFLE CURTAIN
- 4" PVC SDR 35 PIPE (SOLID)
- 4" PVC SDR 35 PIPE (PERFORATED)
- 6" PVC SCH 40 PIPE (SOLID)
- 6" PVC SCH 40 PIPE (PERFORATED)
- RIP RAP (R-4) SPILLWAY/CHANNEL
- 1548.96 MARKED SURVEY POINT WITH SURFACE ELEV.
- A A' AS BUILT CROSS SECTION

30 15 0 30 60

SHEET 1 OF 2

PREPARED BY	REVIEWED BY

AS BUILT PLAN
HARBISON WALKER
RESTORATION EFFORT - PHASE I
DISCHARGES 12, 13, 14
Laurel Run Watershed Initiative
STREAM RESTORATION INCORPORATED
situate in
Ohiopyle State Park
Stewart Township, Fayette County, PA
Scale: 1" = 30' Date: 6/2000
BioMost, Inc., Cranberry Twp., PA

103502/103502ab/AsBuilt1


MATERIAL USED (ACS):
154 TONS AASHTO #57
SANDSTONE AGGREGATE
ANOXIC COLLECTION SYSTEM (ACS)
4" PVC SDR 35 PERFORATED
EL. 1517.5±
EL. 1514.5±
SECTION A - A'
SCALE: 1" = 10' HORIZONTAL
SCALE: 1" = 3' VERTICAL
MATERIAL USED (ALD):
670 TONS AASHTO #1 LIMESTONE (90% CaCO3)
ACS
4" PVC SDR 35 SOLID
INV. EL. 1514.2
PLASTIC LINER
EL. 1514±
ANOXIC LIMESTONE DRAIN (ALD)
INV. EL. 1511.9
EL. 1510±
4" PVC SDR 35 PERFORATED
SECTION B - B'
SCALE: 1" = 5' HORIZONTAL
SCALE: 1" = 3' VERTICAL
PLASTIC LINER
6" PVC SCH 40 SOLID
TOP EL. 1514.7
TOP EL. 1513.6
6" ELBOW
ALD
EL. 1514±
INV. EL. 1511.6
EL. 1510±
6" PVC SCH 40 PERF.
1506.5±
SETTLING POND (SP1)
EL. 1500.0±
SECTION C - C'
SCALE: 1" = 5' HORIZONTAL
SCALE: 1" = 3' VERTICAL
1506.5±
SETTLING POND (SP1)
EL. 1500.0±
SPILLWAY
EL. 1508.0±
MATERIAL USED (VFP):
600 TONS AASHTO #1 LIMESTONE (90% CaCO3)
36 TONS SPENT MUSHROOM COMPOST MIXED WITH
71 TONS AASHTO #57 AGGREGATE (48% CaCO3) AND
69 TONS AASHTO #10 AGGREGATE (48% CaCO3)
EL. 1503.5 (AVG.)
EL. 1503.0±
1503.8±
VERTICAL FLOW POND (VFP)
EL. 1500.0 (AVG.)
4" PVC SDR 35 PERFORATED
INV. EL. 1503.7±
EMERGENCY SPILLWAY
EL. 1508.0±
4" PVC SCH 40 SOLID
4" ELBOW
TOP EL. 1503.4
4" PVC SCH 40 SOLID
4" PLUG
INV. EL. 1502.0
6x6x4 TEE
6" PVC SCH 40 SOLID
6" PLUG
INV. EL. 1499.9
1499.3±
SETTLING POND (SP2)
EL. 1495.5
SECTION D - D'
SCALE: 1" = 10' HORIZONTAL
SCALE: 1" = 4' VERTICAL
DIVERSION DITCH
1499.3±
SETTLING POND (SP2)
EL. 1495.5
SPILLWAY
EL. 1500.9±
EL. 1497.5 (AVG.)
EL. 1497.0 (AVG.)
MATERIAL USED (WL):
30 TONS SPENT MUSHROOM COMPOST MIXED WITH
23 TONS AASHTO #57 AGGREGATE (48% CaCO3)
PLANTED WITH TYPHA sp.
1498.3±
WETLAND (WL)
EL. 1500.0±
SECTION E - E'
SCALE: 1" = 20' HORIZONTAL
SCALE: 1" = 5' VERTICAL
EL. 1500.0±
EL. 1497.5 (AVG.)
EL. 1497.0 (AVG.)
1498.3±
WETLAND (WL)
EL. 1500.0±
SPILLWAY
EL. 1497.8 (AVG.)
1497.9±
MATERIAL USED (HFLB):
500 TONS AASHTO #1 LIMESTONE (90% CaCO3)
HORIZONTAL FLOW LIMESTONE BED (HFLB)
TOP EL. 1498.1
EL. 1493.8 (AVG.)
EL. 1500.0±
EL. 1499.0
EM. SPILLWAY
INV. EL. 1497.6±
OUTLET CHANNEL TO EX. SWALE
6" PVC SCH 40 SOLID
6" PVC SCH 40 PERF.
SECTION F - F'
SCALE: 1" = 20' HORIZONTAL
SCALE: 1" = 5' VERTICAL
NOTE:
ALL SPILLWAYS LINED WITH R-4 RIP RAP (48% CaCO3)
LEGEND
GROUND SURFACE
WATER
PIPE
GEOTEXTILE
BAFFLE CURTAIN
LIMESTONE (AASHTO #1)
RIP RAP (R-4)
SANDSTONE (AASHTO #57)
SPENT MUSHROOM COMPOST/AGGREGATE MIXTURE
1 | 8/22/00 | WL and VFP Materials used
REV. | DATE | DESCRIPTION
PREPARED BY
REVIEWED BY
SHEET 2 OF 2
AS BUILT CROSS SECTIONS
HARBISON WALKER
RESTORATION EFFORT - PHASE I
DISCHARGES 12, 13, 14
Laurel Run Watershed Initiative
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