Harbison Walker Restoration Area - Phase II
Operation and Maintenance Plan
ME # 3591054
Ohiopyle State Park
Stewart Township, Fayette County, Pennsylvania

OPERATION AND MAINTENANCE PLAN

This is the operation and maintenance plan for the Harbison Walker Restoration Area - Phase II site in Ohiopyle State Park, Stewart Township, Fayette County, Pennsylvania. This project is located along Laurel Run, a High Quality Cold Water Fishery (HQ-CWF). Laurel Run flows into Meadow Run (HQ-CWF), which is tributary to the Youghiogheny River (HQ-CWF). This passive treatment system consists of three collection systems, two limestone-only Vertical Flow Ponds (VFP), one compost and limestone Vertical Flow Pond, one Slag-Only Vertical Flow Pond, a Horizontal Flow Limestone Bed (HFLB), a Diversion Well, three flush ponds, five settling ponds, five aerobic wetlands, and numerous piping systems and hydraulic structures to control the flow.

The partners are responsible for the maintenance of all structures in order for the passive treatment system to continue to function properly. This AMD treatment system was designed, based on the best available knowledge and technology at the time and implemented through a public-private partnership effort coordinated by Stream Restoration Incorporated (SRI), a non-profit. It must be recognized that the technology of passively treating AMD is relatively new. All structures were designed focusing on minimal operation and maintenance compared to conventional treatment systems. In order, however, for these facilities to effectively treat the mine drainage, periodic inspections and maintenance are required.

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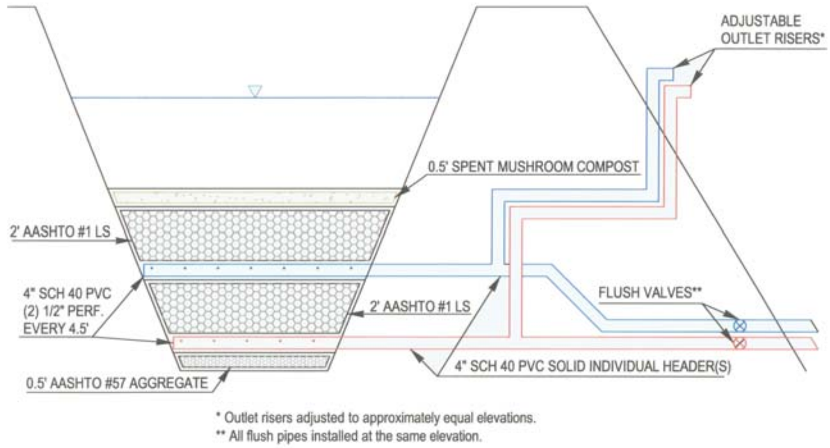
PASSIVE TREATMENT COMPONENT OVERVIEW

Passive systems use no electricity, require limited maintenance, and use environmentally-friendly materials for treatment, such as limestone aggregate and spent mushroom compost, which provide a cost-effective alternative to the harsh dangerous chemicals typically used for the conventional treatment of mine drainage. These passive systems neutralize the acidity and add alkalinity while providing an environment suitable for beneficial chemical reactions and biological activity to take place. Adding alkalinity encourages the metals dissolved in the mine drainage to form particulates which are then retained in the settling ponds and constructed naturally-functioning wetlands.

There are several main types of passive treatment components that can be used, often in series, to treat degraded mine drainage. These components are chosen based upon the drainage characteristics (quality and flow rate) and the chemical or biological reaction preferred.

Open Limestone Channels (OLC) are often the cheapest and easiest passive treatment system to install. It is essentially an open drainage ditch lined with limestone aggregate. The water reacts with the limestone producing alkalinity and neutralizing acidity. In an open channel, however, iron solids tend to precipitate and coat or armor the limestone, decreasing effective neutralization. Periodically, debris and accumulated sediment will need to be removed from the channels. There are two OLC-type components, B3A and B3, on the Harbison Walker Phase II site. These ditches are located in the upland area and are over 800 feet and 600 feet in length, respectively.

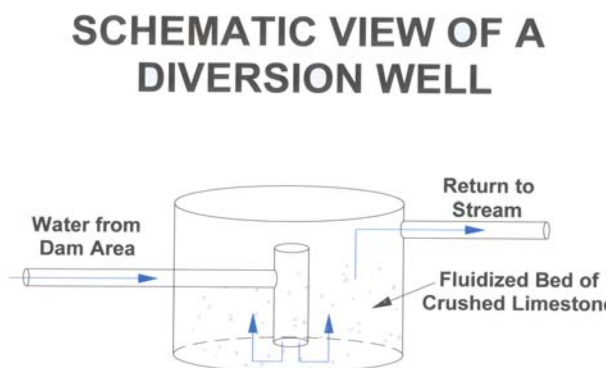
Anoxic Limestone Drains (ALD) are basically buried beds of limestone that are often wrapped in a geotextile material. By burying the limestone aggregate, aeration and associated oxidation can be essentially eliminated; thus, substantially preventing coating of the limestone by iron precipitates, that can be problematic for the Open Limestone Channels. In addition, alkalinity production is much more significant in an Anoxic Limestone Drain due to the increase in dissolved carbon dioxide concentrations within the water. Once discharged from the ALD, the water becomes oxygenated which allows the iron to form solids and precipitate out of solution within a settling pond or wetland. Although the ALD can be a valuable component for the treatment of acidic mine drainage, it is generally not suitable for waters with concentrations of dissolved aluminum greater than 1 mg/L or where there is significant ferric iron, as solids form and can be retained in the ALD and create plugging problems. Although not a part of Phase II, an ALD was installed as part of the Harbison Walker Phase I system. Eventually the limestone will need to be replaced.



Vertical Flow Ponds (VFP) are able to treat a wide variety of mine waters. Although varying in design, the basic concept is a pond filled with limestone aggregate which may be overlain by a layer of compost. The water travels generally vertically through the treatment media to be collected by a piping system. The compost may create a reducing environment to convert ferric iron to ferrous iron as well as generate alkalinity through microbial sulfate reduction. The acidic water dissolves the limestone and generates alkalinity and neutralizes acidity; thereby, encouraging the precipitation of metals upon discharge and aeration from the VFP. VFPs at the Harbison Walker site possess underdrain systems to allow flushing of accumulated metal solids to discourage plugging. Eventually the treatment media will need to be replaced. In Phase I and II, there is a combined total of five VFPs, three of which can also function as Hybrid Flow Ponds. During operation as a Hybrid Flow Pond, there is little or no water cap (standing water) and the effluent is discharged through the risers attached to the flush pipes.

Horizontal Flow Limestone Only Beds (HFLB) are similar to Anoxic Limestone Drains in that they are beds of limestone aggregate; however, HFLBs are not buried and no attempt is made to prevent or eliminate oxygen from entering the system. Typically, HFLBs are placed as the last component to provide an alkalinity boost. In addition, after several months online, these components remove manganese without inoculation of microorganisms. Whether this phenomenon is due to biological activity and/or an autocatalytic process is not completely understood at this time. There is one HFLB in Phase II and one in Phase I.

Settling Ponds and Wetlands are typically used in passive treatment systems to allow for the oxidation, precipitation, and accumulation of metal solids that occur when alkaline drainage issues from a minesite or after acidic drainage has passed through an alkalinity-generating treatment component. Although many treatment wetlands are angular-shaped, shallow ponds supporting predominantly cattails, they can be designed, built, and planted to look and function as a natural wetland with high species diversity that provides not only treatment but also exceptional wildlife habitat. There are four Settling Ponds (Phase II has three.) and seven Wetlands (Phase II has six.) at the Harbison Walker Restoration Area. Two of the wetlands in Phase II are called Bioswales, which are vegetated ditches (swales) with a very gentle gradient that convey and help to treat the mine drainage.



Diversion Wells are manholes with inlet and outlet pipes that are periodically charged with small limestone chips. The water flows from a forebay (located at least 8 feet in elevation above the Diversion Well) under pressure (natural head) into the Diversion Well through the intake pipe. The force of the water “churns” the limestone breaking it into smaller pieces which adds alkalinity and increases pH. As the limestone is being pulverized, the effect of iron armoring is essentially eliminated. Small-sized limestone aggregate is stockpiled near the Diversion Well. The limestone aggregate must be periodically placed by hand (shoveled) or by machine (loaded) into the Diversion Well. As the stockpile is depleted, additional aggregate with a recommended Calcium Carbonate Equivalent of 90% must be ordered and delivered. There is a Diversion Well on the Phase II site to treat the intermittent stream, known as tributary “C”.

SITE SPECIFIC INSTRUCTIONS

All partners who will be involved in the operation of the site should have an understanding of, and the ability to perform, basic routine duties, such as site inspections that include evaluating channels, spillways and passive treatment components as well as water sampling, measuring flows, and flushing.

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

To maintain the integrity of the passive treatment facility, the site should be inspected at regular intervals and after major precipitation events or other natural/manmade occurrences that may affect the performance or integrity of the structure. Regular site inspections should be conducted on a monthly basis. A qualified person should perform the inspection and complete the appropriate report(s). (See attached inspection report forms.) The inspector should keep the paper copy of the report in permanent files in chronological order at the main office of Ohiopyle State Park. Report data should also be submitted online via the website www.datashed.org, as soon as practicable.

The report should include the inspection date, the inspector's name, the organization with which the inspector is affiliated, and the start and end time of the actual inspection. The following sections correspond with the attached Passive Treatment System O&M Inspection Report.

A. Revegetated Spoil Areas (Uplands and Associated Slopes)

Vegetation (i.e. groundcover) is extremely important to provide wildlife habitat and to prevent erosion. Erosion can carry sediment into streams resulting in turbidity and siltation. Sediment entering the passive treatment components can cause plugging or loss of capacity. During the inspection, overall condition of the site vegetation **(section A)** should be observed and numerically rated from 0 to 5. If significant areas are barren, describe the action needed as well as the location. Normal husbandry practices (such as fertilizing, removing unwanted species, etc.) should be implemented, as necessary, to maintain a stable non-erosive ground cover and viable wildlife habitat on the site.

Rating	Description	Recommended Action
0	Site barren	Revegetate as soon as practicable; temporary seeding, installation of staked straw/haybales, filter fabric, etc. may be necessary until stabilization with permanent DCNR-approved seed mix
1	Site mostly barren. Only small isolated areas of vegetation present	(Same as for "0" rating)
2	Large area(s) barren	Outline approximate area(s) on Site Schematic; revegetate as described for "0" rating
3	Revegetation spotty; erosion gullies present	Outline approximate area(s) on Site Schematic; on poorly vegetated areas, seed, mulch, apply soil amendments, as necessary; install staked straw/haybales, rip-rap, etc. in gullies to control erosion
4	Successful vegetation >70% groundcover; few, isolated, minor erosion features or areas with <70% groundcover	Identify potential problem areas; note changes on future Inspection Reports
5	Successful vegetation >70% groundcover	No remedial action required

B. Diversion Ditches, Collection Channels, Spillways

All diversion ditches, collection channels, and spillways should be inspected and maintained to minimize erosion and insure proper water handling. The channels should be kept free of obstructions/debris that would restrict water flow. Any debris/obstructions should be removed. If disturbed or eroded areas are present, then these areas should be stabilized as soon as possible with rip-rap or plant species accepted by the DCNR. Channels or ditches that carry mine drainage should be cleaned out when precipitate reduces the capacity by one half. Particular attention should be paid to the stability of rock-lined channels and spillways to assure that the rock lining is intact.

On the inspection sheet **(section B),** for each identified channel or spillway note:

- <u>Significant erosion present (Yes or No):</u> Is the rip-rap or vegetative lining impaired or absent? Has the berm been overtopped and/or breached? Is there significant sedimentation?
- <u>Significant debris present (Yes or No):</u> Are there tree limbs, leaves, trash, etc. that would "dam" the water in the diversion ditches and collection channels? Is there vegetation and/or debris in the rip-rap lined spillways that would cause the water level to rise in the passive components?
- <u>Maintenance performed (Yes or No):</u> Have the plants been removed from the rip-rap lined spillways? (Removal of plants from rip-rap lined spillways on a regular basis as part of "general housekeeping" prevents overtopping of berms and loss of function of the facility.) Have tree limbs, leaves, trash, etc. been removed? Has the erosion been addressed (rocks placed in erosion features; sediment cleaned from ditches, dirt placed and compacted on berms of ditches and channels, etc.)?
- <u>Maintenance remaining:</u> Describe additional maintenance needed. Indicate areas for additional maintenance on the Site Schematic.

C. Passive Treatment System Components

All Vertical Flow Ponds, settling ponds, flush ponds, wetlands, collection systems that intercept and convey water need to be inspected for erosion, berm (slope) stability, vegetation, siltation, leaks, etc. Any problem should be noted and corrected as soon as practicable.

Water inlet areas for all structures should be observed during each site inspection and kept free from sediment, leaves, and any other foreign objects. This is very important for the efficient operation of the system. Any debris present in the water inlet areas should be removed.

All flow control structures including pipes should be maintained to assure that they are free flowing and not restricted.

All valves should be monitored and maintained so that the free flow of water continues during normal operation as well as flushing events. Valves also need to be monitored to insure full operation (are able to be completely opened & closed) and that no leakage is occurring.

During inspections, the condition of the vegetation and the presence of any disturbed or eroded areas should be noted. Disturbed or eroded areas will need to be stabilized as soon as possible with staked straw/haybales, rip-rap, plantings with accepted species, etc., whichever is appropriate.

On the inspection sheet **(section C)**, for each identified passive treatment component note:

- Significant erosion present (Yes or No): Are there erosion gullies on the inside and outside berms?
- Features relating to berm instability present (Yes or No): Is there any slumping noted? Are there tension cracks on top of the berms?
- Successful vegetation (Yes or No): Are there significant areas on the inside and outside berms that need to be revegetated? Overall does the vegetation appear healthy?
- Significant siltation/sedimentation present (Yes or No): Is there significant sediment from erosion of berms or upland areas accumulating in the passive component?
- Significant change in water level (Yes or No): Is the water level rising or lowering in the passive component? Is there a discharge from the emergency spillway? Is the water level appropriate (not too high or too low) for the plants in the wetlands?
- Valves operable (Yes or No): Are all valves able to be opened and closed by hand? Are the valve boxes in good condition? (All valves should be fully operated during each inspection in order to maintain proper functionality.)
- Maintenance required: Do portions of the berms need to be stabilized with rip-rap and/or reconstructed? Does supplemental reseeding and mulching need to be completed? Do any passive components need to be cleaned of sediment? Is the water level rising in the Vertical Flow Ponds, indicating a need for flushing and/or additional investigation? Do valves need to be replaced? Is there any vandalism to the valves or valve boxes?

D. Diversion Well

The Diversion Well should be regularly inspected and maintained to ensure treatment of intermittent tributary C. This includes the occasional recharging of the component by the addition of limestone aggregate. The frequency of recharging the component is dependent upon the flow rate and duration of flow in tributary C. (During high flow periods, more aggregate will be consumed than in low flow periods.) The inspector will need to make sure that the diversion well is flowing and that it remains free of debris and sediment. Periodically, the inlet area of the pond and piping into and out of the Diversion Well may need to be cleaned. Particularly, the vertical pipe that is located in the center of the well itself may need to be cleaned. This may be accomplished by shutting the inlet valve, removing the screw-in plug at the top of the riser, gently dislodging any accumulated debris at the bottom of the vertical pipe (using the ½" rod device or similar instrument), and replacing the plug and opening the inlet valve. The inlet valve may be opened during the cleaning process in order to assist in flushing out the debris.

On the inspection sheet **(section D)**:

- Diversion Well discharging (Yes or No): Is water issuing from the Diversion Well? If the Diversion Well is not flowing, describe the reason (such as, tributary C is dry, inlet piping plugged, etc.) and any maintenance needed. If discharging, take the pH of the water in and out of the Diversion Well. Record readings on the inspection report in Section I.
- Sufficient limestone in Diversion Well (Yes or No): Check level of limestone aggregate. Lower the marked rod into the Diversion Well. If the mark on the rod is at the level of the grate then there is sufficient stone in the well. If the mark on the rod is below the level of the grate, then shovel aggregate into the well. Record if the Diversion well was recharged.

- Sufficient limestone aggregate in stockpile (Yes or No): Order more aggregate when the stockpile is nearing depletion.
- Maintenance required: Has the Diversion Well been vandalized? Is the inlet valve working properly? Is the grate intact?

E. Culverts

The road culverts should be maintained and kept free of any obstructions. The culverts should be inspected to make sure that no damage has occurred to the pipe and that they have not become plugged. If plugged or if the capacity is substantially decreased, the debris and sediment should be removed and any damage repaired.

On the inspection sheet **(section E)**:

- Culvert functioning (Yes or No): Is there evidence of flows over or around the culvert?
- Culvert in need of maintenance (Yes or No): Has the culvert been crushed or damaged? Is the culvert significantly blocked with debris?
- Maintenance required: Should culvert be replaced? Is machinery needed for cleaning?

F. Access Roads

Stabilized, access roads are needed for the maintenance, monitoring, and educational/outreach programs. The entrance gate should be kept locked to control unauthorized vehicular traffic.

On the inspection sheet **(section F)**:

- Access roads passable (Yes or No): Are there fallen trees or debris blocking access? Are there significant erosion gullies present?
- Maintenance required: Do portions need to be stabilized with aggregate? If so, identify area on Site Schematic. Is machinery required to remove debris?

G. Wildlife Utilization

One of the functions of the constructed wetlands is to provide wildlife habitat for desired species. If, however, during inspections, signs of damage are noted, such as from muskrats in wetlands, appropriate steps should be taken to continue the function of the passive system and general site restoration. Significant damage needs to be corrected by repairing berms, removing invasive species, replanting, and trapping (contact PA Game Commission).

On the inspection sheet **(section G)**:

- Animals observed: Although not an inventory, please record whether there were tracks or visual observations of wildlife utilizing the site. Describe any damage observed.
- Invasive plants observed: If invasive or undesirable plants (as determined by the DCNR) are observed, please note and remove as soon as practicable.

H. Flow Measurements at Vertical Flow Ponds:

When collecting samples and/or conducting site inspections, the effluent flow rate from each discharging pipe should be measured [ACVFPN(pipe#), ACVFPS(pipe#), B1VFP(pipe#), B1B3VFP(pipe#)] using the bucket and stopwatch method or other acceptable method. The bucket and stopwatch method consists of timing (in seconds) the filling of a bucket of known volume (preferably calibrated in gallons). The flow rate in gallons per minute can then be calculated utilizing the following formula:

$$\textbf{Flow (gal/min)} = \left(\frac{\textbf{Gallons}}{\textbf{Seconds}} \right) \times 60$$

On the inspection sheet **(section H)**:

- Pipe discharge: Flows and pH measurements (field kit or meter) should be taken at each pipe. Where pH is 4.5 or greater, a field alkalinity test should also be performed. If a pipe is not flowing, a “0” should be placed in the “Gallons Measured” column.
- Maintenance required: If any pipes are broken, plugged or leaking, the pipe number and the condition of the pipe should be documented.

I. Field Water Monitoring and Sample Collection

In order to assess the efficiency and performance of this system, water quality monitoring of each component of the system should be completed according to the schedule below. If possible, water samples should be taken and analyzed by the PA State Lab or other approved laboratory using standard chemical testing procedures for the following water quality parameters.

Laboratory Water Quality Parameters

pH	**Total Iron**	**Total Aluminum**
Alkalinity	**Dissolved Iron**	**Dissolved Aluminum**
Acidity	**Total Manganese**	**Sulfates**
Specific Conductance	**Dissolved Manganese**	**Total Suspended Solids**

Total calcium and dissolved oxygen are also valuable. In addition to the laboratory analyses, field tests should be completed including flow (as feasible), pH, temperature, and alkalinity. If water samples cannot be taken for laboratory analysis then, at a minimum, the following field tests should be completed: pH, temperature, alkalinity, and dissolved iron.

Water sampling and field testing at the following locations will enable evaluation of the degree of success of the passive components, individually and combined, in treating the mine drainage:

1. ACRAW
2. ACVFPN
3. ACVFPS
4. ACFP
5. ACSPWL
6. ACWL
7. B1RAW
8. B1VFP
9. B1SP
10. B1WL3
11. B3SP
12. B1B3VFP
13. B1B3SPWL
14. B1B3HFLB
15. DWRAW
16. DW out
17. TRIB C below DW
18. LR BELOW TRIB C
19. LR BELOWB3

The monitoring program should include points other than the Vertical Flow Pond discharges in order to provide a complete description of the water quality through the passive treatment complex at the time of sampling. For instance, the untreated raw mine discharge (as close to the source as possible), each component (at the effluent), and the stream (above and below the system) should be monitored. These monitoring point locations are identified on the O&M Inspection Sheet, site schematic, and "As-Built" plans.

In order to conduct laboratory analyzes for pH, alkalinity, acidity, sulfates, conductivity, and total suspended solids, a 500-ml (or other specified volume), unfiltered, sample should be collected, stored in a cooler, and transported to the laboratory. In order to differentiate between dissolved and total iron, manganese, and aluminum concentrations, the laboratory requires two, 125-ml (or other specified volume) samples that are preserved with trace metal-grade nitric acid to ensure that the pH is <2. The sample for total metals is not filtered. The sample for dissolved metals is filtered using a 0.45-μm filter in the field prior to placing the sample in the bottle. The filtering device should be rinsed with distilled or de-ionized water between each sample. Each bottle should be labeled with its own unique number.

A record of every sample taken should be made directly on the inspection sheet. Information such as sampler's name, sample location, sample date, flow rate, field tests, and sample bottle identification will be written on the inspection sheet. Pertinent information is then transferred from the inspection sheets to the laboratory's Record of Sample form or Chain of Custody form.

For laboratory analysis, a composite sample may be taken for ACVFPN, ACVFPS, B1VFP, and B1B3VFP. A composite sample is collected by holding a container under each of the outlet pipes that are discharging for an equal amount of time. The container should be large enough to fill the sample bottles with sufficient additional volume to run a field pH and temperature.

On the inspection sheet **(section I)** for each Sampling Point:

- Monitoring point field measurements recorded:

Parameter	**Method**
Flow	Bucket & Stopwatch (where pipe discharge)
pH	HACH pH kit, pH meter, etc.
Temperature	Field thermometer, pH meter, etc.
Alkalinity	HACH Digital Titrator, etc.
Iron	HACH iron
dissolved oxygen (optional)	HACH DO kit, DO meter, etc.

  Record readings to nearest whole number, except pH (record to nearest tenth). If the discharge is not piped at the monitoring point, no flow is measured. If flow measurement is desired, a weir or flume may be installed. Although seeps are encountered, the flow from the ACWL may be approximated by assuming the measured flow from the ACFP or the ACRAW.
- Sample bottle data: If water samples are collected, assign and record bottle numbers on the inspection sheet. You will need to transfer this information to the laboratory's Record of Sample or Chain of Custody form.
- Comments: Observations such as color of the sample or other information may be recorded in the "Comments" column.

ANNUAL SLUDGE ACCUMULATION ASSESSMENT REPORT

In addition to the periodic O&M Inspection Reports, it is recommended that an Annual Sludge Accumulation Inspection Report be completed once a year. The primary purpose of this inspection is to assess the type and amount of sludge that is accumulating within the passive treatment components. This can give an indication as to how the system is functioning and when action is needed to remove the sludge from the component.

On the Annual Sludge Accumulation Assessment Report, for each component listed provide:

- Sludge description: Note the color and depth (estimated) of the sludge. Typically, white, red, and black colors indicate precipitate rich in aluminum, iron, and black, respectively. Has the sludge filled the component to within 1 foot of the emergency spillway?
- Comments: For example: Is there significant organic debris in the sludge? Is there evidence of wildlife utilizing the component? Depth of water?

ANNUAL WETLAND PLANT DIVERSITY REPORT

It is also recommended that an Annual Wetland Plant Diversity Report be completed once a year. The primary purpose of this report is to assess the diversity of plant species within the constructed treatment wetlands in order to determine if species diversity is increasing or decreasing. Species diversity is believed to increase the health, productivity, and treatment capability of the wetland. In addition, increased plant species diversity should result in an increase in wildlife diversity. A secondary purpose is to identify if unwanted invasive plants have become established. These plants should be removed from the wetlands.

Complete a separate Annual Wetland Plant Diversity Report for each wetland. On the report provide the common name and/or scientific name for each plant, the plot number, the location of the plot, and the population within that plot.

FLUSHING INSPECTION REPORT

Flushing:

Maintenance of the four alkalinity-producing VFPs includes flushing quarterly or more frequently as needed. Periodically, the flushing schedule will be evaluated and adjusted to reflect water quality and quantity changes and system performance. Prior to flushing, the water elevation in the Flush Pond should be checked to assure sufficient storage capacity. [The Flush Pond, downgradient of each VFP, has piping (barrel & riser) with a valve for dewatering, as needed.] Care should be taken to avoid suspended solids (sediment) discharging from the Flush Pond. In the ACVFPN, ACVFPS, and B1B3VFP, there are eight underdrain cells. B1VFP has four underdrain cells. Each cell can be flushed individually. To clean the piping and a limited area in the treatment media, open valves and flush for about 15 minutes, or until the flush water clears. To remove additional precipitates from the VFP, raise the water level in the VFP (water level should not be raised to discharge through the emergency spillway) and/or backflush by attaching a small pump to the individual risers that are used when operating as a Vertical Flow Pond. (Risers operational during hybrid flow conditions should not be used for backfushing.) Do not exceed 15 psi. (If desired, VFPs can be flushed and drained to within ~½ -foot of the bottom.) Valves should be monitored and maintained to allow for free flow of water during flushing. Valves should also be monitored to assure complete closure with no leakage. Use the Flushing Inspection Report to record the start and end time of the flushing event for each pipe as well as to note the bottle numbers for any samples taken for laboratory analysis. The following flushing sequence should be followed. This sequence is also on the Flushing Inspection Report.

FLUSHING PROCEDURE

Step #	Description
1	Remove valve box cover. Select valves will be open if ACVFPN, ACVFPS, and/or B1VFP are operating as Hybrid Flow Ponds. Be sure that all valves are closed. For limited flushing to remove metal solids from pipes, proceed to step 2. For flushing to also remove solids from a portion of the media, allow water level to rise in pond to within ~1-foot of the emergency spillway and proceed to step 2. For more aggressive flushing, raise water level as described and then attach pump or compressor (do not exceed 15 psi) to individual risers used during operation as a VFP. (Do not use risers for operation as a Hybrid Flow Pond.)
2	Remove end caps (screw-type) form each flush pipe. (Use wrench, as necessary.)
3	Open valve(s) of pipe(s) to be flushed. Record start time for each pipe flushed. If desired, collect water samples and perform field measurements.
4	Slowly close valve of each pipe flushed. Record end time for each pipe flushed.
5	Replace end caps. (Use wrench as necessary.)
6	Open valves for pipes designated to be discharging.
7	Replace valve box cover.

MISCELLANEOUS MAINTENANCE CONSIDERATIONS

All materials used in repairs should be of equal or better quality and have the same capacity and function as shown on the "As-Built" plans.

Removal and disposal of accumulated precipitate or sediment
Precipitates from chemical reactions and other solids will be retained within flush ponds, settling/wetlands ponds, Vertical Flow Ponds, etc. This sludge should be removed when the volume of the component is reduced by one half. Inlet and outlets should be kept clear of debris and obstructions. Sludge removal is planned for every fifteen years or as desired. Opportunities may be available to utilize the sludge for metal recovery or the sludge may be allowed to drain/dewater for burial within the old surface mine site. (An Erosion and Sediment Pollution Control Plan should be completed for the placement area.)

Miscellaneous Piping
This passive treatment system complex contains miles of buried piping that are critical to the proper functioning of the system. To insure the continuous treatment of the mine drainage, inlet and outlet structures should be regularly inspected and any problems noted and corrected as soon as possible.

In addition to the underdrain piping, there are cross-pipes and other pipes and culverts at the site that may need to be cleaned when the capacity is reduced by 25 percent. Cleaning pipes can be carried out by using pipe clean-out rods, industrial snake clean-out tools, backflushing, or other reasonable methods.

REPLACEMENT

This passive treatment complex is unique. The designs are innovative with many "firsts" relating to passive technology. The treatment media quantities and sludge storage capacity for a projected design life of 25 years were based upon PA DEP background monitoring data and published references. Higher flow rates and poorer water quality can substantially affect the design life. When spent, the media will need to be replaced or recharged. The spent media may be removed and placed/buried within the old minesite. (Contact the PA DEP prior to placement. An Erosion and Sediment Pollution Control Plan should be developed.) Prior to recharging, advances in technology and changes in raw drainage quality and quantity should be considered to determine if revisions to the size and/or design of the system would be advantageous. Replacement considerations include:

- Estimating Best Management Practice (BMP) design life;
- Determining replacement responsibility, including a successor, as necessary;
- Determining approximate costs for the following possible needs:
    - removing accumulated sediments;
    - replacing defective valves, water control structures, etc.;
    - re-sizing the system to accommodate changed water quality or quantity;
    - recharging organic matter in wetlands;
    - recharging limestone aggregate.

Rev 11/2004

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

Inspection Date:	____________	Project Name:	**Harbison Walker Restoration Effort – Phase II**
Inspected by:	____________	Municipality:	**Stewart Township**
Organization:	____________	County:	**Fayette** State: **PA**
Time Start: ______	End: ______	Project Coordinates:	**39° 50' 39"** Lat **79° 29' 30"** Long
Receiving Stream:	**Laurel Run**	Subwatershed:	**Meadow Run** Watershed: **Youghigheny River**

Weather (circle one): Snow Heavy Rain Rain Light Rain Overcast Fair/Sunny **Temp(°F):** #32 33-40 41-50 51-60 60+

Is maintenance required? Yes/No If yes, provide explanation:

INSPECTION SUMMARY

A. Revegetated Spoil Areas (Uplands and Associated Slopes)

Overall condition of vegetation on site: 0 1 2 3 4 5 (0=poor, 5=excellent, circle one) (See instructions.)

Is any reseeding required? Yes/No If yes, describe area size and identify location on Site Schematic:

B. Ditches, Channels, Spillways

Channel Identification	Erosion Rills (Y/N)	Debris Present (Y/N)	Maintenance Performed (Y/N)	Maintenance Performed and Remaining (Indicate ditch by number i.e. 2c = B3A Collection Channel)
1. Diversion Ditch				
2. Collection Channels				
a. B1 (above B1RAW)				
b. B3				
c. B3A				
3. Rock-Lined Spillways				
a. ACVFP (below ACVFPN)				
b. ACSPWL				
c. ACWL to Laurel Run				
d. B1VFP				
e. B1FP				
f. B1SP				
g. B1WL1				
h. B1WL2				
i. B1WL3				
j. B1B3VFP				
k. B1B3SPWL				
l. B1B3 HFLB to Laurel Run				
4. Emergency Spillways				
a. ACVFPS to ACVFPN				
b. ACFP to Trib C				
c. B1FP to ACWL				
d. B1B3FP to Laurel Run				
e. B3ASP				
f. B3SP				
5. Flushing/Primary Spillways				
a. ACVFPN				
b. ACFFPS				
c. B1VFP				

C. Passive Treatment System Components

Component	Erosion Rills (Y/N)	Berms Stable (Y/N)	Vegetation Successful (Y/N)	Siltation Significant (Y/N)	Water Level Change (Y/N)	Valves Operable (Y/N)	**Maintenance Performed and Remaining** Indicate which component i.e. ACWL
ACVFPN							
ACVFPS							
ACFP							
B1VFP							
ACSPWL							
ACWL							
B1FP							
B1SP							
B1WL1							
B1WL2							
B1WL3							
B1B3VFP							
B1B3FP							
B1B3SPWL							
B1B3HFLB							
B3ASP							
B3SP							

D. Diversion Well (DW)

Is the Diversion Well influent pipe clear of debris? Yes/No? If no, did you clear debris? Yes/No?
Is the Diversion Well effluent pipe flowing? Yes/No? If no, describe why and maintenance required.

(Enter pH, flow, and other data in Section I for DW RAW and DW out.)
Is there limestone in the Diversion Well? Yes/No? If no, was it recharged during this inspection? Yes/No?
(Determine level of stone in the Diversion Well with the marked rod. Lower rod into well. If mark on the rod is below the grate, add stone.)

Does AASHTO #67 limestone aggregate need to be ordered? Yes/No?

Describe maintenance performed and remaining: ______________________________

E. Culverts

	Functioning (Y/N)	Maintenance Required (Y/N)	Describe Condition
Culvert 1:	________	____________	______________________________
Culvert 2:	________	____________	______________________________
Culvert 3:	________	____________	______________________________

Describe maintenance performed and remaining:

F. Access Roads

Are the access roads passable for operation and monitoring? Yes/No?
Do the access roads need maintenance? Yes/No?
Describe maintenance performed and remaining (Identify location on Site Schematic.):

G. Wildlife Utilization

Animal sighted or tracks observed ______________________________
Invasive plants observed ______________________________

Describe any damage caused to treatment system by wildlife (especially muskrats) and required maintenance:

H. Flow Measurements for VFP – Use Bucket and Stopwatch method (Indicate no flow by entering "0" in Gallons Measured)
[A maximum of 8 pipes will be discharging for ACVFPN, ACVFPS, and B1B3VFP. A maximum of 4 pipes will be discharging for B1VFP.]

ACVFPN

Pipe #	pH	Alk.	Flow	
			gals.	sec.
1V				
1H				
1F				
2V				
2H				
2F				
3V				
3H				
3F				
4V				
4H				
4F				
5V				
5H				
5F				
6V				
6H				
6F				
7V				
7H				
7F				
8V				
8H				
8F				

ACVPS

Pipe #	pH	Alk.	Flow	
			gals.	sec.
9V				
9H				
9F				
10V				
10H				
10F				
11V				
11H				
11F				
12V				
12H				
12F				
13V				
13H				
13F				
14V				
14H				
14F				
15V				
15H				
15F				
16V				
16F				
16H				

B1VFP

Pipe #	pH	Alk.	Flow	
			gals.	sec.
17V				
17H				
17F				
18V				
18H				
18F				
19V				
19H				
19F				
20V				
20H				
20F				

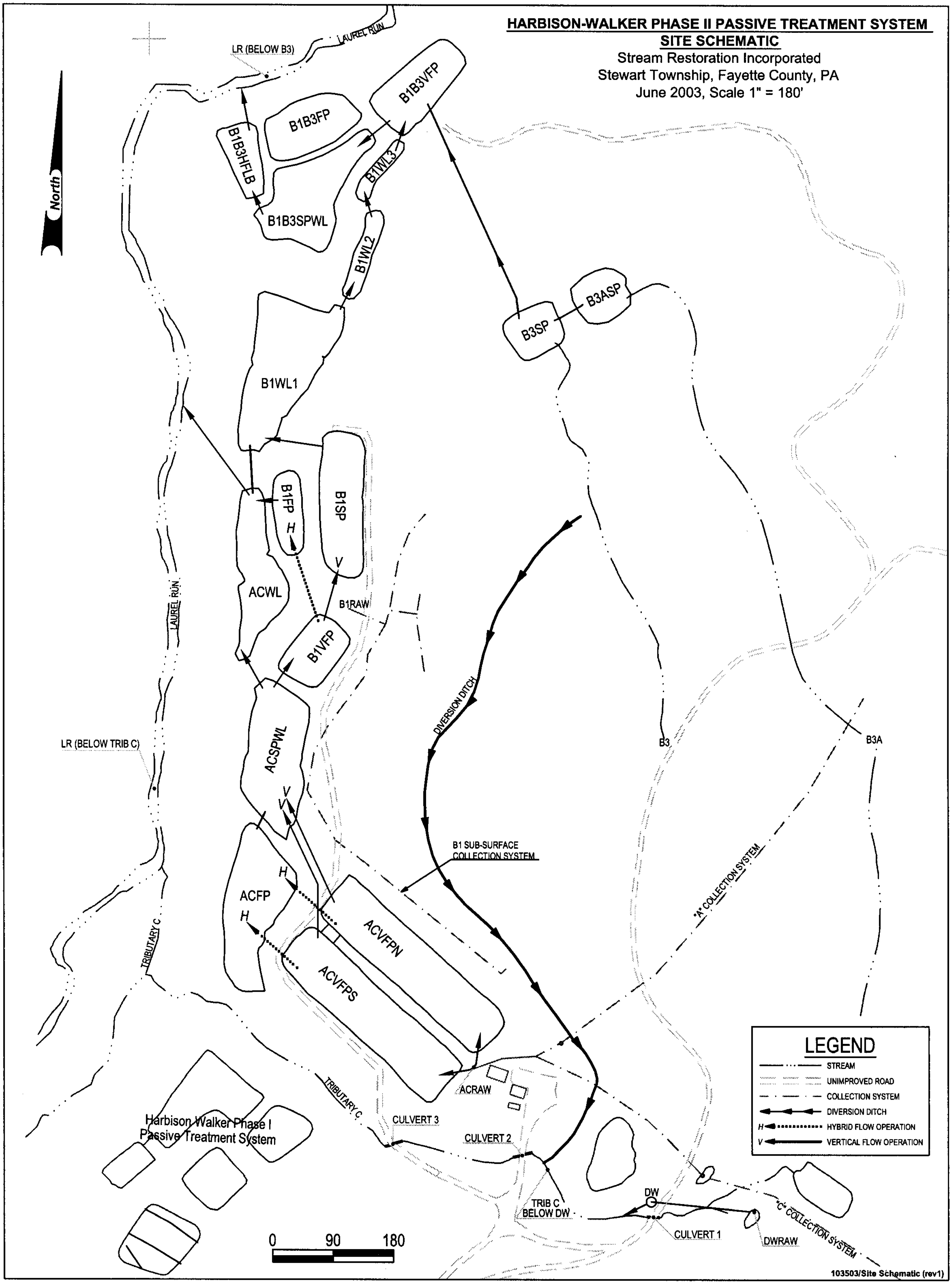
Identify by number any broken, plugged, or leaking pipes.

B1B3VFP

Pipe #	pH	Alk.	Flow	
			gals.	sec.
21V				
21F				
22V				
22F				
23V				
23F				
24V				
24F				
25V				
25F				
26V				
26F				
27V				
27F				
28V				
28F				

I. Field Water Monitoring and Sample Collection - Raw water sample locations as marked on plan. For passive components sample effluent.
- Not monitored

Sampling Point	Flow		pH	Temp (°C)	Alkalinity (mg/L)	DO (mg/L)	Iron (mg/L)	Comments	Bottle #	Bottle # (total metals)	Bottle # (diss. metals)
	gals	sec.									
ACRAW											
ACVFPN(composite)											
ACVFPS(composite)											
ACFP											
ACSPWL											
ACWL (near stream)											
B1RAW											
B1VFP(composite)											
B1FP											
B1SP											
B1WL3											
B3ASP											
B3SP											
B1B3VFP(composite)											
B1B3SPWL											
B1B3HFLB											
DW RAW											
DW out											
LR BELOW TRIB C											
LR BELOW B3											
Trib. C (below DW)											


HARBISON-WALKER PHASE II PASSIVE TREATMENT SYSTEM
SITE SCHEMATIC
Stream Restoration Incorporated
Stewart Township, Fayette County, PA
June 2003, Scale 1" = 180'
North
LAUREL RUN
LR (BELOW B3)
B1B3VFP
B1B3FP
B1B3HFLB
B1WL3
B1B3SPWL
B1WL2
B3SP
B3ASP
B1WL1
B1FP
B1SP
ACWL
B1RAW
B1VFP
DIVERSION DITCH
LR (BELOW TRIB C)
ACSPWL
B3
B3A
B1 SUB-SURFACE
COLLECTION SYSTEM
"A" COLLECTION SYSTEM
ACFP
ACVFPN
ACVFPS
TRIBUTARY C
ACRAW
Harbison Walker Phase I
Passive Treatment System
CULVERT 3
CULVERT 2
TRIB C
BELOW DW
DW
CULVERT 1
DWRAW
"C" COLLECTION SYSTEM
0 90 180
LEGEND
STREAM
UNIMPROVED ROAD
COLLECTION SYSTEM
DIVERSION DITCH
HYBRID FLOW OPERATION
VERTICAL FLOW OPERATION
103503/Site Schematic (rev1)

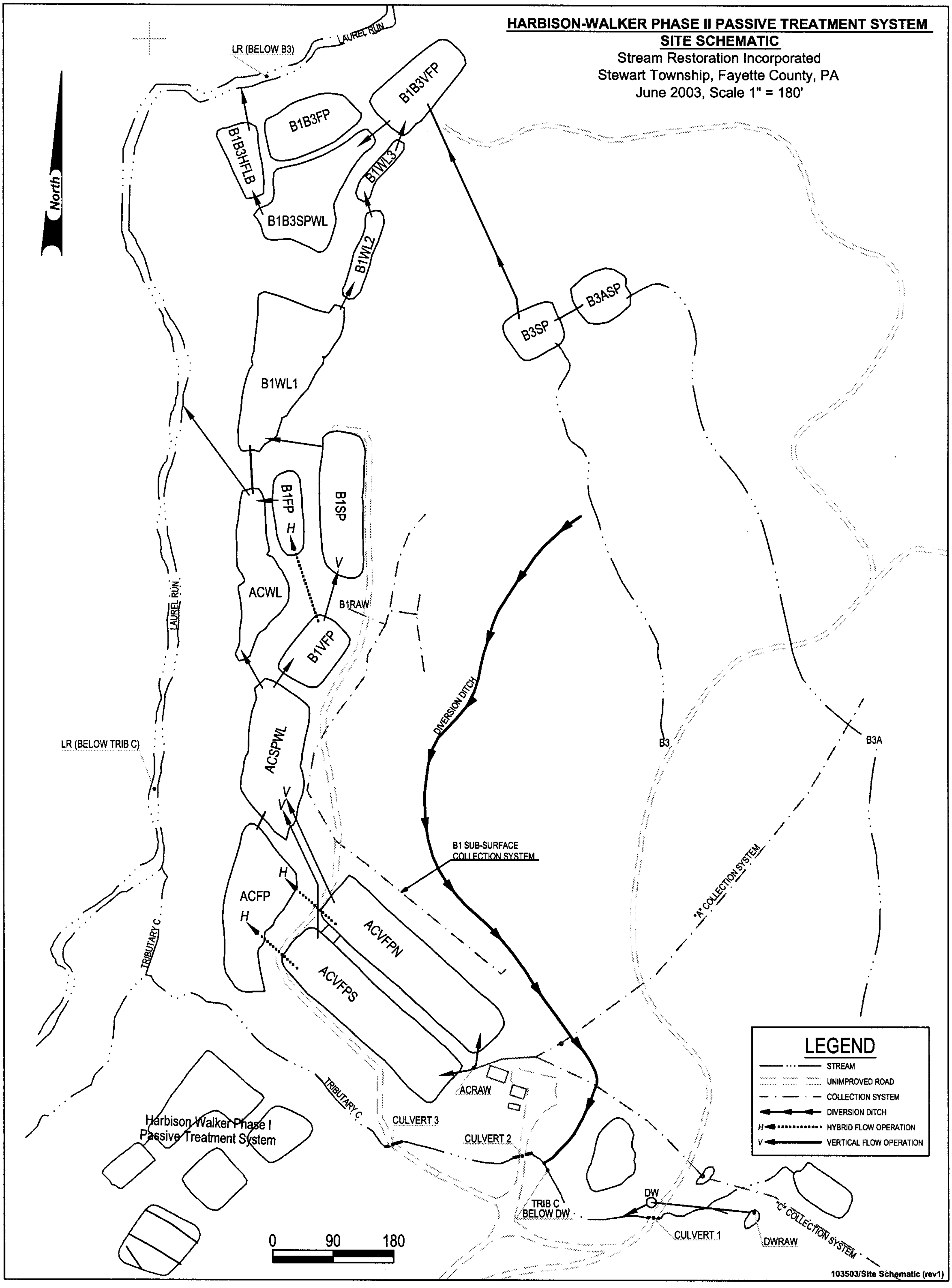
ANNUAL SLUDGE ACCUMULATION ASSESSMENT REPORT

Inspection Date:	________________	Project Name:	**Harbison Walker Restoration Effort – Phase II**		
Inspected by:	________________	Municipality:	**Stewart Township**		
Organization:	________________	County:	**Fayette**	State:	**PA**
Time Start: ________	End: ________	Project Coordinates:	**39° 50' 39''** Lat		**79° 29' 30''** Long
Receiving Stream:	**Laurel Run**	Subwatershed:	**Meadow Run**	Watershed:	**Youghigheny River**

Weather (circle one): Snow Heavy Rain Rain Light Rain Overcast Fair/Sunny **Temp(°F):** #32 33-40 41-50 51-60 60+

Provide sludge assessment for each component including sludge description.

Component	Color	Estimated Depth	Comments
ACVFPN			
ACVFPS			
ACFP			
ACSPWL			
ACWL			
B1VFP			
B1SP			
B1WL1			
B1WL2			
B1WL3			
B3SP			
B3ASP			
B1B3VFP			
B1B3SP/WL			


HARBISON-WALKER PHASE II PASSIVE TREATMENT SYSTEM
SITE SCHEMATIC
Stream Restoration Incorporated
Stewart Township, Fayette County, PA
June 2003, Scale 1" = 180'
North
LAUREL RUN
LR (BELOW B3)
B1B3VFP
B1B3FP
B1B3HFLB
B1WL3
B1B3SPWL
B1WL2
B3SP
B3ASP
B1WL1
B1FP
H
B1SP
V
ACWL
B1RAW
B1VFP
LAUREL RUN
LR (BELOW TRIB C)
ACSPWL
DIVERSION DITCH
B3
B3A
V
V
B1 SUB-SURFACE
COLLECTION SYSTEM
"A" COLLECTION SYSTEM
H
ACFP
H
ACVFPN
ACVFPS
TRIBUTARY C
ACRAW
TRIBUTARY C
Harbison Walker Phase I
Passive Treatment System
CULVERT 3
CULVERT 2
TRIB C
BELOW DW
DW
CULVERT 1
DWRAW
"C" COLLECTION SYSTEM
0
90
180
LEGEND
STREAM
UNIMPROVED ROAD
COLLECTION SYSTEM
DIVERSION DITCH
H
HYBRID FLOW OPERATION
V
VERTICAL FLOW OPERATION
103503/Site Schematic (rev1)

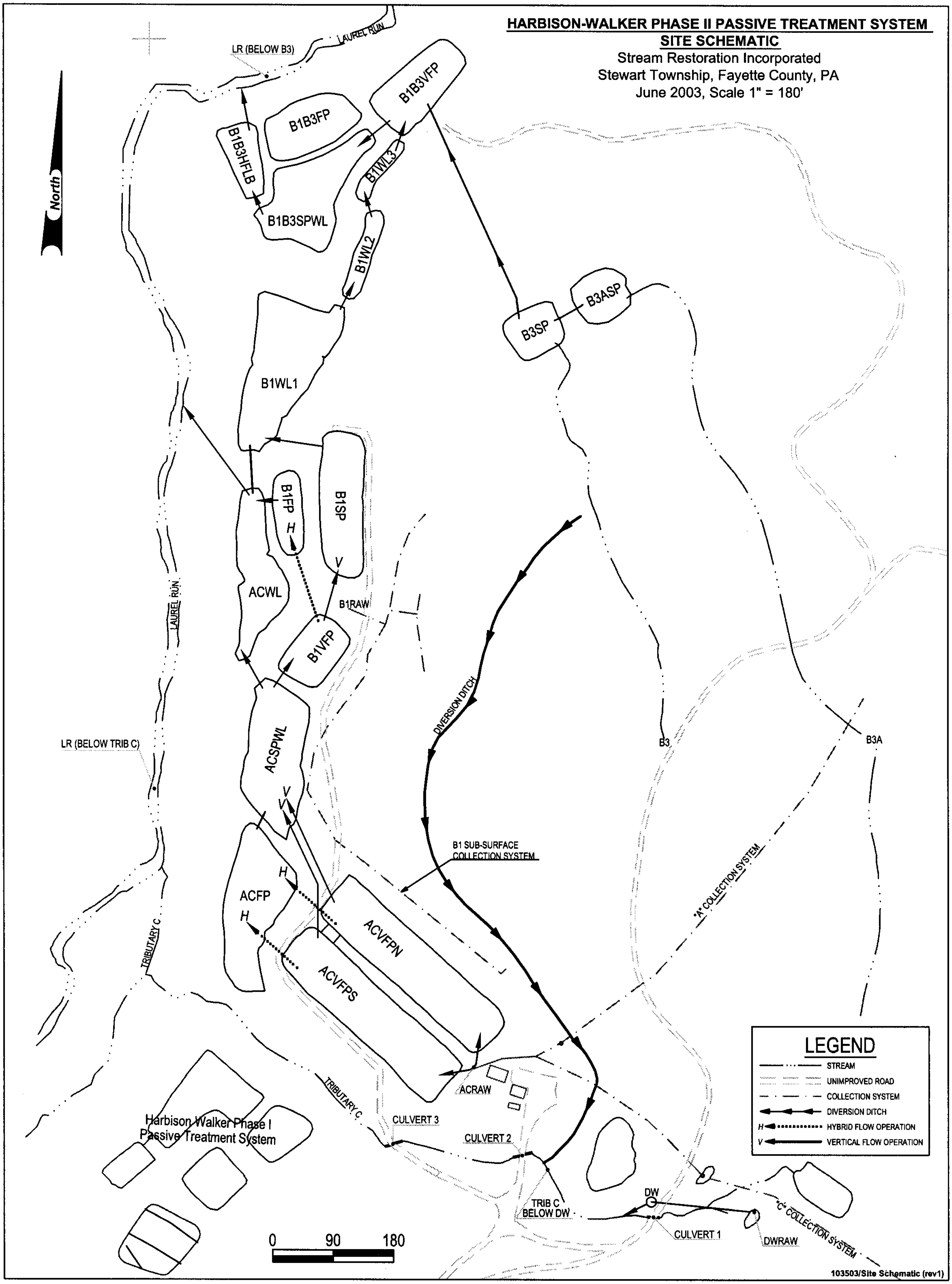
ANNUAL WETLAND PLANT DIVERSITY REPORT

Inspection Date:	______________	Project Name:	**Harbison Walker Restoration Effort – Phase II**
Inspected by:	______________	Municipality:	**Stewart Township**
Organization:	______________	County:	**Fayette** State: **PA**
Time Start: ________	End: ________	Project Coordinates:	**39° 50' 39''** Lat **79° 29' 30''** Long
Receiving Stream:	**Laurel Run**	Subwatershed: **Meadow Run**	Watershed: **Youghigheny River**

Weather (circle one): Snow Heavy Rain Rain Light Rain Overcast Fair/Sunny **Temp(°F):** #32 33-40 41-50 51-60 60+

Wetland: ____

Common Name	Scientific Name	Plot #	Plot Location	Number



HARBISON-WALKER PHASE II PASSIVE TREATMENT SYSTEM
SITE SCHEMATIC
Stream Restoration Incorporated
Stewart Township, Fayette County, PA
June 2003, Scale 1" = 180'
North
LAUREL RUN
LR (BELOW B3)
B1B3VFP
B1B3FP
B1B3HFLB
B1WL3
B1B3SPWL
B1WL2
B3SP
B3ASP
B1WL1
B1FP
B1SP
H
V
ACWL
B1RAW
B1VFP
DIVERSION DITCH
LAUREL RUN
LR (BELOW TRIB C)
ACSPWL
B3
B3A
B1 SUB-SURFACE
COLLECTION SYSTEM
"A" COLLECTION SYSTEM
ACFP
ACVFPN
ACVFPS
TRIBUTARY C
ACRAW
Harbison Walker Phase I
Passive Treatment System
CULVERT 3
CULVERT 2
TRIB C
BELOW DW
DW
CULVERT 1
DWRAW
"C" COLLECTION SYSTEM
0
90
180
LEGEND
STREAM
UNIMPROVED ROAD
COLLECTION SYSTEM
DIVERSION DITCH
HYBRID FLOW OPERATION
VERTICAL FLOW OPERATION
103503/Site Schematic (rev1)

ANNUAL SLUDGE ACCUMULATION ASSESSMENT REPORT

Inspection Date:	______________________	Project Name:	**Harbison Walker Restoration Effort – Phase II**
Inspected by:	______________________	Municipality:	**Stewart Township**
Organization:	______________________	County:	**Fayette** State: **PA**
Time Start: __________	End: __________	Project Coordinates:	**39° 50' 39''** Lat **79° 29' 30''** Long
Receiving Stream:	**Laurel Run**	Subwatershed:	**Meadow Run** Watershed: **Youghigheny River**

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Provide sludge assessment for each component including sludge description.

Component	Color	Estimated Depth	Comments
ACVFPN			
ACVFPS			
ACFP			
ACSPWL			
ACWL			
B1VFP			
B1SP			
B1WL1			
B1WL2			
B1WL3			
B3SP			
B3ASP			
B1B3VFP			
B1B3SP/WL			

HARBISON-WALKER PHASE II PASSIVE TREATMENT SYSTEM

SITE SCHEMATIC

Stream Restoration Incorporated
Stewart Township, Fayette County, PA
June 2003, Scale 1" = 180'