OPERATION AND MAINTENANCE PLAN

MORGAN RUN 7 (MR 7)
ACID MINE DRAINAGE TREATMENT SYSTEM

DECATUR TOWNSHIP, CLEARFIELD COUNTY
PENNSYLVANIA

Prepared For:

CLEARFIELD COUNTY CONSERVATION DISTRICT

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TABLE OF CONTENTS

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OPERATION AND MAINTENANCE PLAN

MORGAN RUN 7 (MR 7) ACID MINE DRAINAGE TREATMENT SYSTEM

BACKGROUND

The Morgan Run 7 (MR 7) Acid Mine Drainage (AMD) Treatment System was constructed beginning in the spring of 2012, when initial dewatering activities occurred. The majority of the system construction occurred in the fall of 2012, with completion in December of 2013. The system was brought online in late May of 2013, and has been treating water since. The project site is located in Decatur Township, Clearfield County, Pennsylvania. The project was constructed on property owned by Dan Dixon and Steven Schenenberger. A project location map is provided in Appendix A.

This project was initially proposed to treat AMD discharge known as the Morgan Run 7 discharge located at the project site, plus several other nearby, smaller discharges. The MR7 discharge consists of a high flow discharge from abandoned underground clay mines (Passmore Mine). This flow forms an unnamed tributary to Morgan Run. This treatment system was constructed to remove metals, primarily acidity, aluminum, and iron before the AMD degrades the unnamed tributary to Morgan Run and Morgan Run. Morgan Run is a tributary to Clearfield Creek.

Water quality and flow data collection conducted prior to and during project design monitored the individual AMD flow contributions to the site, and leaving the MR 7 site. Average flow and water quality for the combined AMD flows leaving the MR 7 site were as follows:

Peak Flow	213 gpm
Design Flow	250 gpm
Acidity	179.07 mg/L
Iron	32.74 mg/L
Aluminum	14.2 mg/L
Manganese	9.2 mg/L

mg/L = milligrams per liter
gpm = gallons per minute

The treatment system was originally designed to treat 300 gpm of the MR7 discharge, which is slightly higher than the average calculated flow. Other design parameters for the original system were a pH of 3.4, acidity of 190 mg/L, iron concentration of 46 mg/L and aluminum concentration of 9 mg/L. The loading rates in turn were 420 lbs/day of acidity, 140 lbs/day of

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iron and 32 lbs/day of aluminum. The original treatment system design consisted of three vertical flow ponds and four settling basins to provide capacity for 300 gpm. No bypass features were provided in the original design.

The amount of funding awarded for the construction of this treatment system was significantly less the amount required to construction all four settling basins and three vertical flow ponds. In addition, the designers had some concerns about the effectiveness of vertical flow ponds for long-term treatment of the AMD with severe water quality. Upon discussions with the Pennsylvania Department of Environmental Protection, the treatment concept was revised to include construction of two settling basins and two test cells to receive limited flow and test the effectiveness of passive treatment. See Appendix for a description of the Scope of Work for this project.

The revised scope of work for this treatment system involved the construction of two different treatment cells which were designed to each treat 10 gpm (for a total treated flow of 20 gpm). The design chemistry was based on a pH of 3.4, acidity of 200 mg/L, iron of 50 mg/L, aluminum of 10 mg/L, manganese of 15 mg/L and a sulfate concentration of 750 mg/L. The design loadings rates were 6 lbs/day of iron, 1.2 lbs/day of aluminum, and 24 lbs/day of acidity. These values were based on sampling during the development of the restoration plan in 2003 and 2004. Design values are determined using the 90% confidence interval of the water quality data set.

The treatment system, as-built, consists of a settling basin A (SBA), a vertical flow pond test cell B (VFPTCB), a vertical flow pond test cell C (VFPTCC), and a second settling basin (SBD). Flow from the AMD discharges enters settling basin A as via an existing collapsed mine entrance. The treatment system discharges to wetlands/an unnamed tributary to Morgan Run.

Wetland and stream impacts associated with this project were authorized under a Joint Permit E17-428 from the Pennsylvania Department of Environmental Protection. Federal Authorization for wetland and stream impacts and wetland mitigation was granted by the U.S. Army Corps of Engineers (USACOE) authorizations NAB-2007-09183-PO8 and 2007-09183-P12.

A National Pollutant Discharge Elimination System (NPDES) Permit for Stormwater Associated with Construction Activities (PAG-2 001707005) was issued for this project. Erosion and Sediment Pollution Control Plan approval was issued for the project by the Clearfield County Conservation District. A separate erosion and sediment pollution control plan was approved in 2012 for the borrow/materials disposal area. All permits and authorizations were issued to the Clearfield Creek Watershed Association.

The Clearfield County Conservation District conducted the project. The treatment system was designed by Alder Run Engineering, LLC, of Osceola Mills, PA, and New Miles of Blue Stream, of Mansfield, PA and constructed by E.M. Brown, Inc., Clearfield, PA. Construction oversight was also provided by Alder Run Engineering and New Miles of Blue Stream. The Clearfield Creek Watershed Association assisted with the project by serving as the permittee for the wetland and stream encroachment permitting.

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DESCRIPTION OF TREATMENT SYSTEM COMPONENTS

The treatment system consists of one vertical flow pond test cell, one bioreactor test cell and two settling basins. Each treatment system component is discussed in detail in the following paragraphs. As-built drawings are provided in Appendix A to illustrate the treatment system components as they were constructed.

SYSTEM INFLOW AND BYPASS

Flow from the AMD discharge enters settling basin A (SBA) as deep mine discharge that exits the ground at the normal pool elevation or as deep mine discharge directly into the SBA. SBA was created from an old mine entry/drain area that was formerly impounded by a beaver dam. The beaver dam was removed, and an earthen berm with clay core constructed to replace the beaver dam and impound the AMD. All flow into the treatment system enters the system via SBA.

As discussed in the following section, SBA contains three outlets, two of which currently allow high flows in excess of the 20 gpm combined design flow to bypass the treatment test cells. The SBA primary outlet conveys most of the MR7 treatment system inflow around the test cells and discharges to settling basin D (SBD). SBA also includes an emergency spillway that can discharge extremely high flow events. Flows over the emergency spillway will enter a wetland area that conveys other AMD discharges into the area of the AMD treatment system, and all flows are collected in a 24-inch diameter SBA bypass pipe, which also currently discharges into SBD. The current piping system provides two means for flow to bypass the two test treatment cells. Both of the test treatment cells were designed to receive ten gallons per minute. Any flow over this is bypassed into SBD. See also photos 1 and 2.

SETTLING BASIN A (SBA)

Settling Basin A (SBA) receives flow from the existing deep mine discharge. Flow from the discharge is retained by an earthen berm with clay core. SBA has been designed to allow iron from the MR 7 discharge to settle out before flow enters the remainder of the treatment system. SBA was an existing impoundment created by a beaver dam prior to construction of the treatment system, and water levels varied depending on beaver activity. Iron was naturally precipitating in the area of SBA prior to improvements to the area of SBA, and the earthen berm was constructed to try to increase retention time and the amount of precipitation of iron.

SBA contains an intake that directs flows into the test cells. See photo 1. The design flow was 10 gpm per treatment test cell for a total flow in the intake of 20 gpm. The intake was designed to collect flow from near the surface of SBA to collect the “cleanest” water where most of the

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precipitates had settled out, but not from the absolute top of the water surface where floating debris such as leaves are likely to be present.

The intake consists of a six-inch diameter pipe with 90 degree elbow. The elbow ensures that flow is taken from near the surface of SBA. The intake pipe is divided by a tee into separate intakes for Vertical Flow Pond Test Cell B (VFPTCB) and Bioreactor Test Cell C (BTCC). Separate valves, valve b and valve c, control flow into VFPTCB and BTCC, respectively.

Valves B and C have been set to control the average inflow to VFPTCB and BTCC to 10 gpm each. The intake pipe and valve were sized to be slightly larger than necessary to accommodate any leaves, debris, iron precipitates, etc. However, to reduce inflows to 10 gpm, the valves are mostly closed, and serve as a "pinch point" that tends to collect leaves and clumps of iron precipitates. These valves should be opened and closed at a monthly frequency, at minimum, during time periods when they are set to allow 10 gpm of inflow. During spring and fall, more frequent maintenance is suggested.

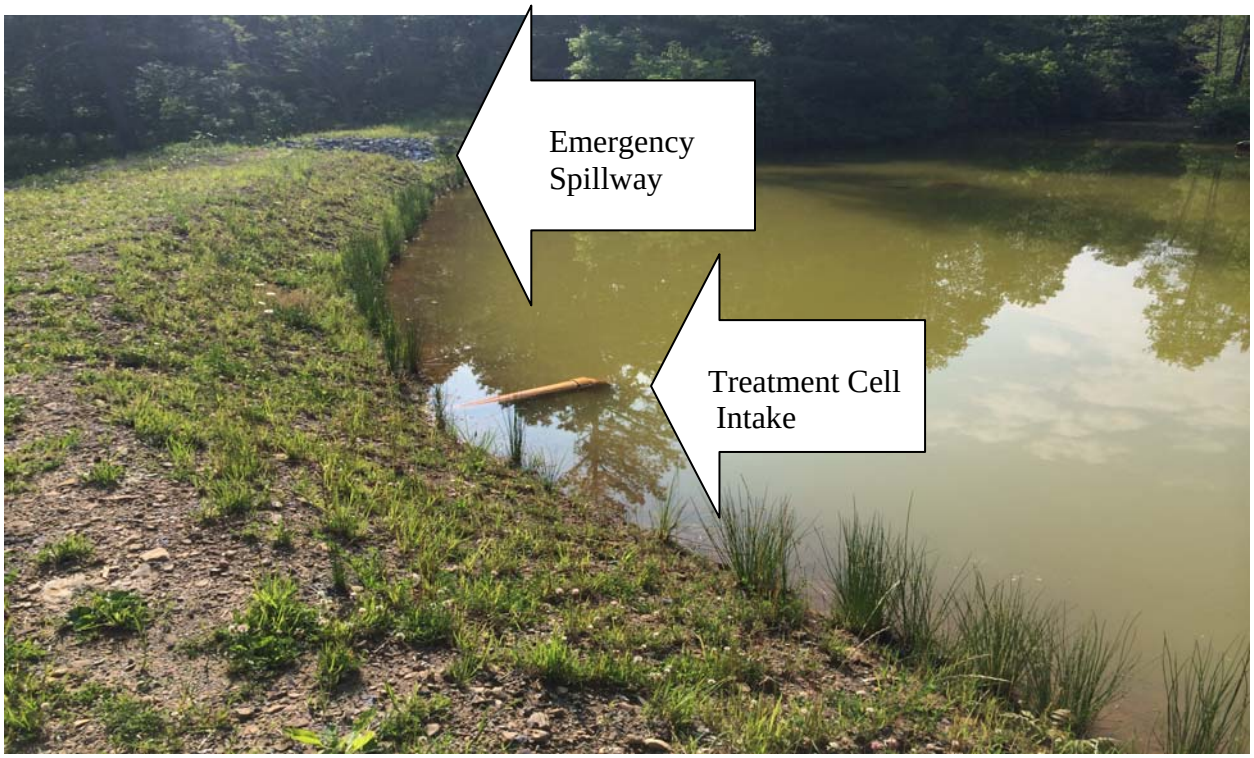

Photo 1: Settling Basin A-Treatment Cell Intake and Emergency Spillway

An inlet water level control structure serves as the primary outlet and allows for the control of water depth in SBA. See photo 2. This outlet takes flow from the top of the water surface elevation to direct the "cleanest" flows into SBD. The primary outlet directs flows around the west side of the AMD treatment system.

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The inlet water level control structure that serves as the primary basin outlet can be used to adjust the water level in the basin, although the water level was adjusted to what should be its final elevation at the completion of construction. The structure contains stoplogs that are located in the open face of the inlet water level control structure, and these stoplogs can be moved to adjust the water level. Stoplogs were adjusted to their permanent elevation, which is shown on the site plans, at the completion of construction. A wooden dock structure has been constructed to allow access to the inlet structure without walking in the water of the settling basin. This structure may require periodic flushing to remove leaves and woody debris, although this was not necessary during the one-year post-construction monitoring period.

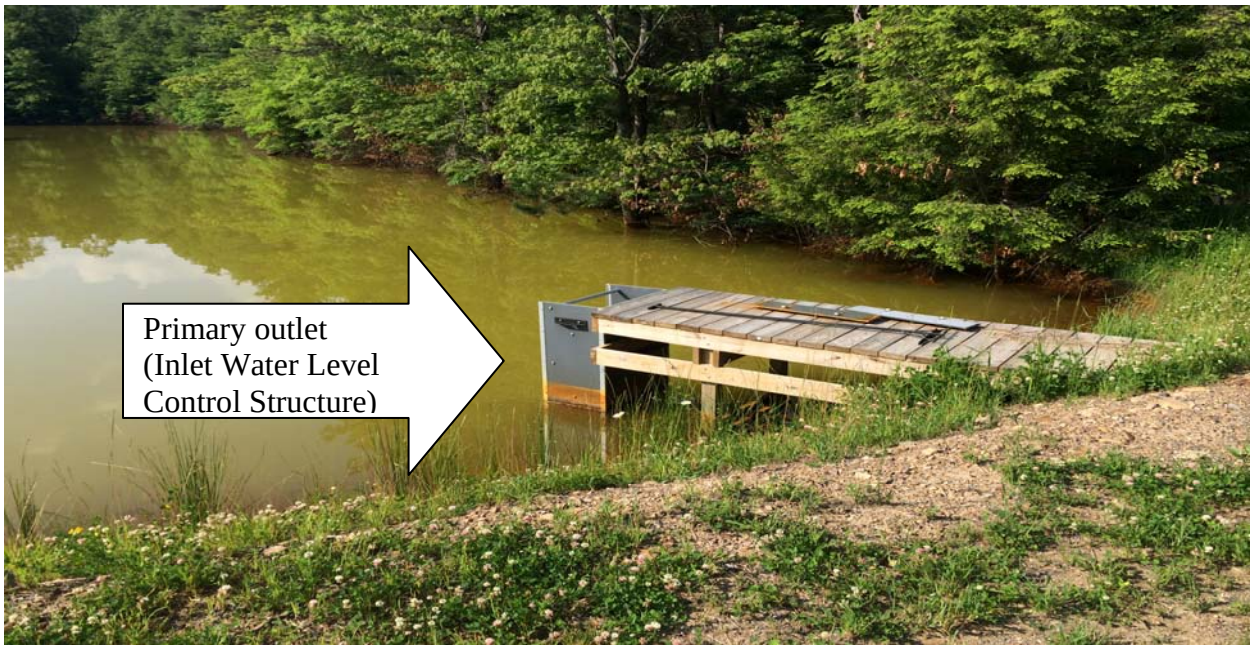

Photo 2: Settling Basin A Primary Outlet

SBA contains a rock-lined emergency spillway which can discharge more than the maximum measured downstream flow of 2123 gpm. The emergency spillway will activate when flows exceed the capacity of the primary outlet. See photo 1. Flows discharged via the emergency spillway are collected by a flared end section and 24-inch SLCPP (smooth-lined corrugated polyethylene pipe) (Basin A bypass pipe) which directs flow into SBD.

VERTICAL FLOW POND TEST CELL B (VFPTCB)

Up to 10 gpm of outflow from SBA discharges to vertical flow pond test cell B (VFPTCB). Flow from SBA into VFPTCB is controlled by valve B (see As-built Drawings in Appendix A). See photo 3. Valve B can be closed to prevent flow into VFPTCB or opened more to increase flows into the test cell (which is not recommended, however). As discussed previously in this narrative, this valve should be opened and closed to "flush" the valve on a monthly or more

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frequent basis to ensure continual inflow into the test cell. VFPTCB discharges to settling basin D (SBD).

VFPTCB is a modified vertical flow pond (VFP) or modified vertical flow wetland. The treatment success of VFPs is based on a combination of limestone dissolution and alkalinity production by sulfate reducing bacteria in the compost. It is necessary to maintain a carbon source long-term for bacterially-mediated processes. VFPTCB contains a modified organic layer which consists of a mixture of woodchips, mushroom compost, and limestone chips. This mixture was selected to have larger carbon source material than mushroom compost alone to breakdown over time and to have limestone chips to maintain pH levels within this layer for the bacteria to survive.

VFPTCB consists of a limestone layer under a layer of compost. Geotextile was placed underneath the limestone, and between the limestone and the compost. The geotextile serves to separate the limestone from the underlying earthen layer, to prevent the limestone from sinking into the earthen layer, and to prevent the compost from washing down into the limestone. The earthen layer below the limestone was compacted to prevent leakage from the cell. The pond is filled with limestone having a high calcium carbonate content to add alkalinity to the AMD discharges. A layer of mushroom compost, limestone chip, and wood chip mixture two feet thick was placed over the limestone.

The pond has a perforated underdrain system designed to help flush aluminum precipitates from the limestone. A header pipe collects the flow from the underdrain and discharges the flow to the outlet structures, which are connected to the header pipe. Both a primary and a flushing outlet were provided for VFPTCB.

By flushing the pond regularly, we hope to remove all precipitates from the limestone. Cleanout ports were provided to allow access to the underdrain for inspection and maintenance, as discussed later in this narrative. An automatic flushing outlet was provided to allow for automatic flushing at least once per week.

The VFPTCB primary outlet is a standard inline water level control structure housed in a pipe casing. The structure contains adjustable stoplogs which have been set at the appropriate level to ensure that the pond contains a minimum of two feet of water over the top of the compost. This structure can discharge at all times via flow over the top of the stoplogs. The primary outlet structure discharges flows after the cell has become full in between flush events. See photo 4.

Stoplogs in the outlet structure were adjusted to their final elevation at the completion of construction. The stoplogs should be adjusted to maintain a water surface elevation that is two feet above the top of the compost in the pond during normal flow conditions.

The flushing or secondary outlet structure is an automatic inline water level control structure containing an automatic, solar-powered gate valve that is programmed to open to flush the VFP. This structure is also housed in a pipe casing, and a lid could be added to limit access to the structure. The valve is powered by a solar panel mounted on a post, which provides power to a

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small, simple computerized control panel. The panel can be programmed to open and close the flush valve daily up to two times per day. A flush period of approximately 10 minutes at a frequency of three times per week is recommended to flush the lower level of the limestone, but not dewater the compost layer of the cell. The flush time of 10 minutes is less than flush times in similar systems in the watershed to prevent the cell from dewatering during the flush. See photo 4.

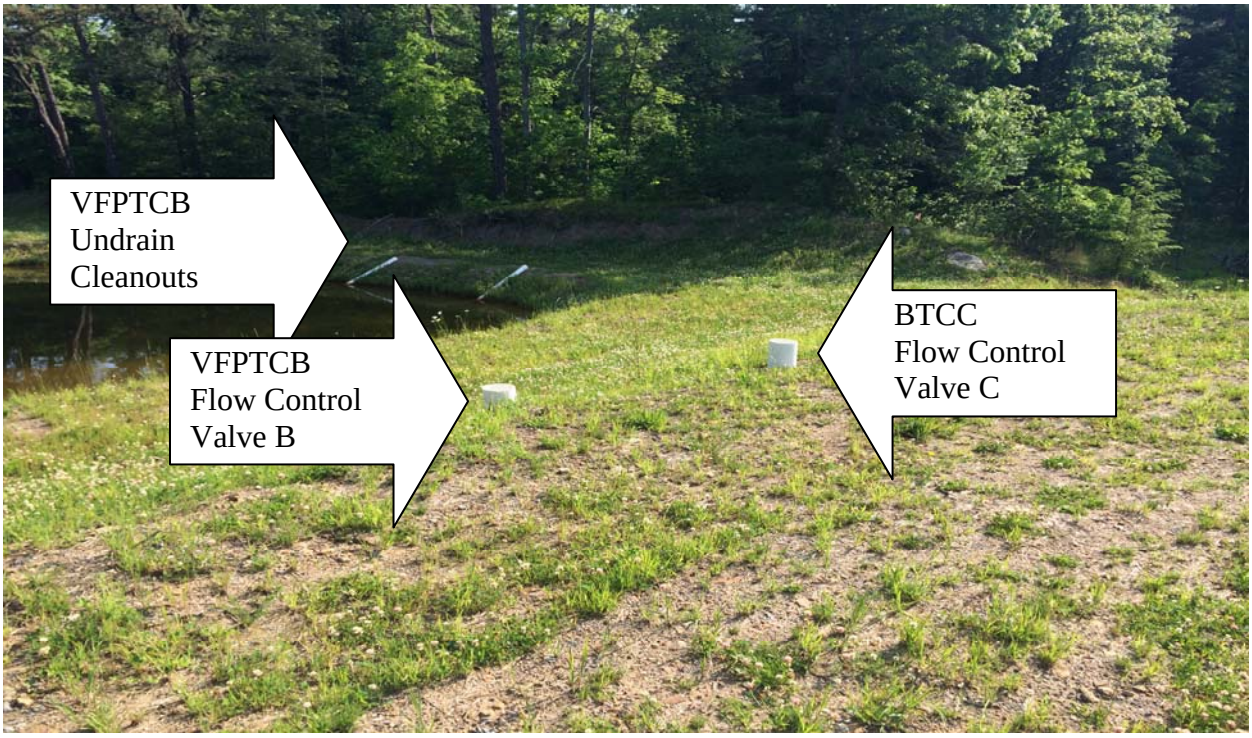

Photo 3: VFPTCC Inflow Control Valves and Underdrain Cleanout Ports

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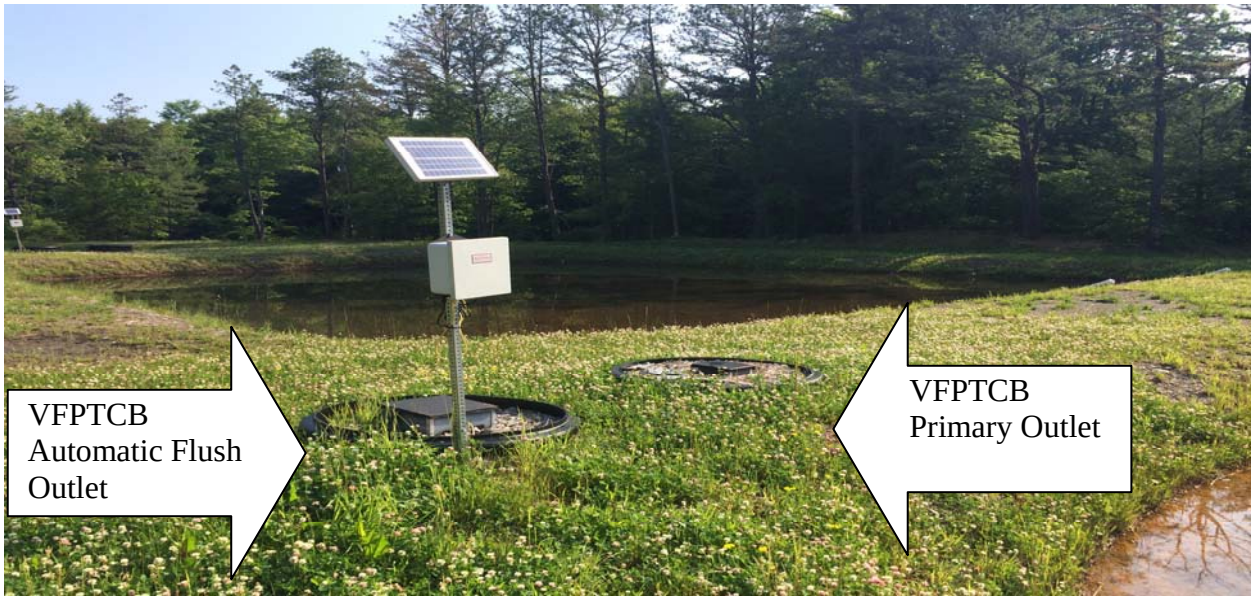

Photo 4: VFPTCC Outflow Structures

BIOREACTOR TEST CELL C (BTC C)

Bioreactor Test Cell C (BTCC) also receives up to 10 gallons per minute of flow from settling basin A. Flow from SBA into BTCC is controlled by valve C (see As-built Drawings in Appendix A). See photos 1 and 3. Valve C can be closed to prevent flow into BTCC or opened more to increase flows into the test cell (which is not recommended, however). As discussed previously in this narrative, this valve should be opened and closed to "flush" the valve on a monthly or more frequent basis to ensure continual inflow into the test cell. BTCC discharges to settling basin D (SBD).

BTTC is a bioreactor which is sized based on an alkalinity generation rate of 35 g/m^2/day. The organic layer is a mixture of spent mushroom compost, hay, limestone (size AASHTO No. 3), and wood chips. The material was mixed thoroughly before being placed in the cell.

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Photo 5: BTTC Inlet and Underdrain Cleanout Ports

BTTC contains sandstone layers above and below the layers of compost mixture. Geotextile was placed underneath the sandstone, and between the sandstone and the compost layer. The geotextile serves to separate the sandstone from the underlying earthen layer, to prevent the sandstone from sinking into the earthen layer, and to prevent the compost from washing down into the sandstone. The earthen layer below the sandstone was compacted to prevent leakage from the cell. The bioreactor is filled with a compost-woodchip-hay-limestone mixture with the limestone having a high calcium carbonate content to add alkalinity to the AMD discharges. Sandstone was used around the underdrain to direct flow into the underdrain without reacting with the AMD, and above the compost to keep the compost layer in place and evenly distribute flows over the compost.

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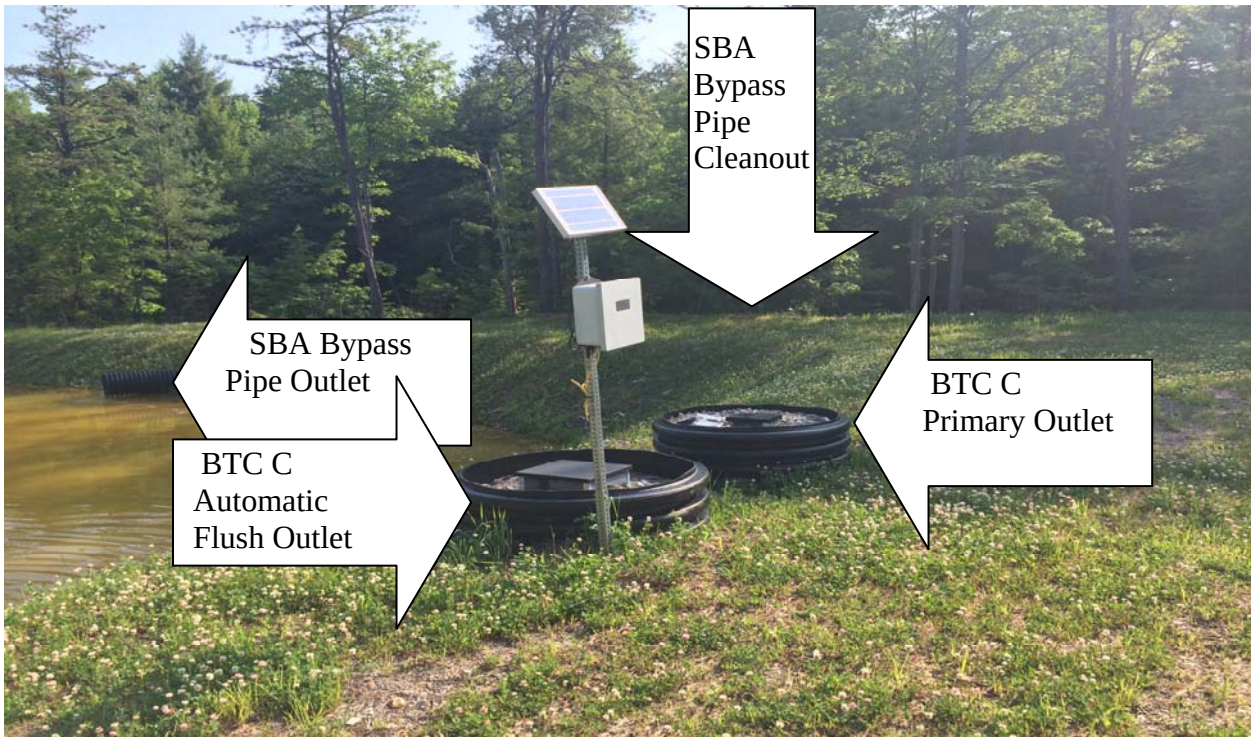

Photo 6: BTTC Outflow Structures

The bioreactor has a perforated underdrain system designed to help flush aluminum precipitates from the bottom of the sandstone layer. A header pipe collects the flow from the underdrain and discharges the flow to the outlet structures, which are connected to the header pipe. Both a primary and a flushing outlet were provided for the BTCC.

By flushing the bioreactor regularly, we hope to remove all precipitates from the underdrain, sandstone, and bottom of the bioreactor. Cleanout ports were provided to allow access to the underdrain for inspection and maintenance, as discussed later in this narrative. An automatic flushing outlet was provided to allow for automatic flushing at least once per week.

The BTTC primary outlet is a standard inline water level control structure housed in a pipe casing. The structure contains adjustable stoplogs which have been set at the appropriate level to ensure that the pond contains water over the top of the sandstone layer This structure can discharge at all times via flow over the top of the stoplogs. The primary outlet structure discharges flows after the cell has become full in between flush events. See photo 6. Stoplogs in the outlet structure were adjusted to their final elevation at the completion of construction. The stoplogs should be adjusted to maintain a water surface elevation above the top of the sandstone in the pond during normal flow conditions.

The flushing or secondary outlet structure is an automatic inline water level control structure containing an automatic, solar-powered gate valve that is programmed to open to flush the bioreactor. This structure is also housed in a pipe casing, and a lid could be added to limit access to the structure. The valve is powered by a solar panel mounted on a post, which provides power

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to a small, simple computerized control panel. The panel can be programmed to open and close the flush valve daily up to two times per day. A flush period of approximately 10 minutes (or less) at a frequency of three times per week is recommended to flush the lower level of the sandstone, but not dewater the compost layer of the cell. The flush time of 10 minutes is less than flush times in similar systems in the watershed to prevent the cell from dewatering during the flush. See photo 6.

SETTLING BASIN D (SBD)

Outflow from VFPTCB and BTTC discharge to settling basin D (SBD). Outflow from VFPTCB is located between the SBA primary outlet outfall location and the BTCC outfall location, and is sometimes not visible during high flow conditions. See photo 7. The SBA bypass pipe and SBA primary outlet also currently discharge to SBD. so treated water is mixed with untreated water in SBD. The SBA bypass and SBA primary outlet mix with treated water from the test cells in the present configuration to try to increase the pH of these flows and precipitate some metals, although only 20 gpm of the average 250 gpm flow is treated in the test cells. The settling basin provides time for settling and removal of metals precipitates. Settling basin 2 discharges to a rock apron at wetlands/the unnamed tributary to Morgan Run.

Discharge from the basin is controlled by an inlet water level control structure manufactured by AgriDrain, Inc. Outflow is taken from the top layer of water in the basin to try to discharge the water from which most precipitates have settled. The outlet structure discharge pipe flows to a rock apron which dissipates energy from the discharge and protects the channel of the unnamed tributary from erosion.

A rock-lined emergency spillway that discharges to wetlands below SBD has been provided for the basin for discharge of high flows in emergency situations. The emergency spillway will activate only if the discharge capacity of the outlet structure is exceeded, which should only occur very rarely if the outlet structure becomes clogged.

The inlet water level control structure that serves as the basin outlet can be used to adjust the water level in the basin, although the water level was adjusted to what should be its final elevation at the completion of construction. The structure contains stoplogs that are located in the open face of the inlet water level control structure, and these stoplogs can be moved to adjust the water level. Stoplogs were adjusted to their permanent elevation, which is shown on the site plans, at the completion of construction. A wooden dock structure has been constructed to allow access to the inlet structure without walking in the water of the settling basin. See photo 8.

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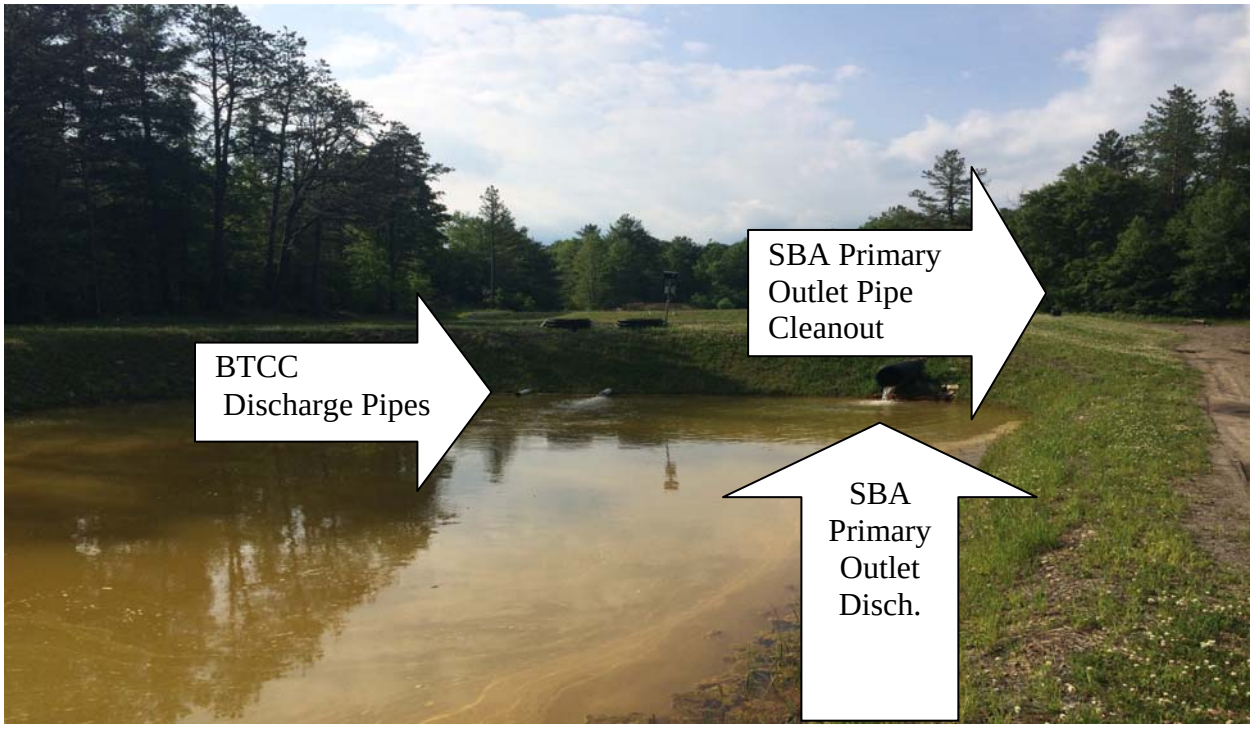

Photo 7: Discharges to SBD

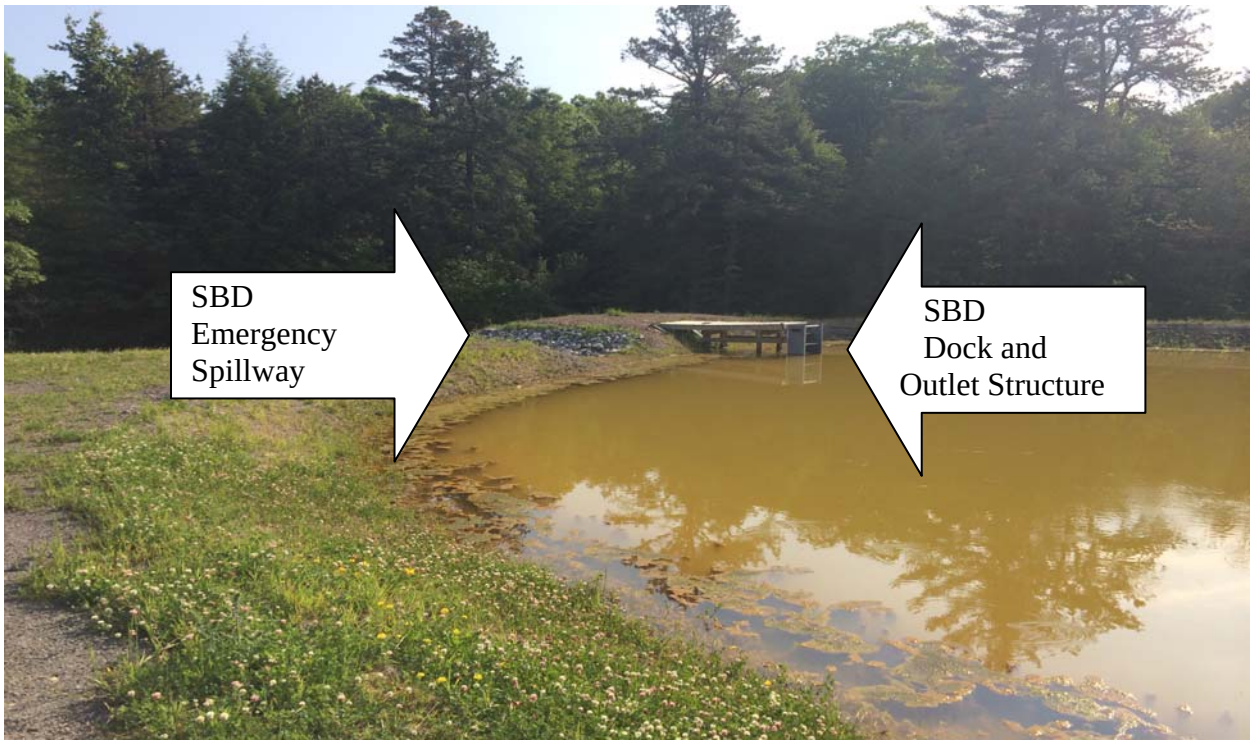

Photo 8: Dock Structure and Settling Basin D Outlet

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COLLECTION PIPE

After initial construction was complete, a 12-inch SLCPP drain pipe (AMD collection pipe) was added to the treatment system in June 2014. After the treatment system was complete and final water levels were achieved, AMD exited the ground in the area of the borrow/disposal area. Modifications to the water surface elevation in SBA were able to reduce the water level in SBA sufficiently to prevent most of this discharge and still have inflow into the test cells, but flows through the borrow area still occurred following precipitation events. The water quality of this discharge was very similar to the quality of the main MR7 discharge, and they are believed to be the same water. A collection pipe was added to collect the additional AMD located in the borrow/disposal area, and direct the flow into SBD for mixing with the treated water from the test cells. See photos 9 and 10.

Photo 9: Collection Pipe Intake (Prior to Seeding)

The entrance to the collection pipe is a flared end section. Due to budgetary constraints, there is no trash rack on the inlet. The inlet/entrance will need to be periodically maintained to ensure that off-site sediment, debris, leaves, etc. do not enter and clog the pipe. Due to the length of the pipe (over 450 feet), and limited access to the pipe except at the intake and outfall, maintenance to prevent clogging is critical because removing a clog will be very difficult.

This pipe was installed with very minimal cover due to elevations (i.e. the pipe needed to be high enough to still discharge into SBD but also low enough to capture the AMD discharge). Unless additional fill is added over the top of the pipe, vehicular traffic over the pipe should be prohibited to prevent damage to the pipe.

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Photo 10: Collection Pipe Outfall at SBD (Prior to Seeding)

OPERATION OF SYSTEM COMPONENTS

INLINE WATER LEVEL CONTROL STRUCTURES

Inline water level control structures were installed to control the discharge from the VFPTCB and BTTC. The inline water level control structures installed at this site were provided with a locking top on the inline box to allow the box to be locked as desired to prevent unauthorized personnel from accessing the structure. The top (and lock if installed) must be removed to access the stoplogs.

The inline boxes were installed in plastic pipe casing to prevent damage to the boxes during installation. The casing will accommodate the installation of lids if desired to prevent water from entering the casing. See photos 4 and 6.

Each stoplog in the inline water level control structures has a rubber seal on the bottom and sides of the stoplog. The hooks on the back of the stoplogs point down (toward the bottom), with the arch of the hook pointing up. The flat side of the stoplog without the hooks should face into the direction of flow. The rubber seal should be placed on the bottom when installing stoplogs. The bottom stoplog in the stack has a thicker rubber seal on the bottom than the other stoplogs.

A handle that can be used to aid in the addition or removal of the stoplogs is stored by the Clearfield County Conservation District. It is advisable to keep the handle dry and not in contact with AMD. The flat base of the handle can be used to push down stoplogs, while the bars on the

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handle can be used to catch the hooks and pull upwards to remove stoplogs. Stoplogs must be pushed down tightly so that they seal together and do not allow flow between the stoplogs. Any debris such as small rocks or straw between the stoplogs will not allow the stoplogs to seal properly. Pressing on stoplogs with debris in between will quickly ruin the seals and cause the stoplogs to leak.

If the stoplogs are not sealed properly in place, as indicated by flow through the inline water level control structures when the stoplogs are in place, there may be debris that has washed into the seals. Debris will prevent the seals from closing properly and will allow flow between or around the seals. Debris should be removed to prevent damage to the seals. In order to flush the debris from the seals, use the handle to remove the stoplogs with the sealing problem. Allow high flow through the inline water level control structure for at least several minutes, then re-install the stoplogs. If the water level was recently drawn down, such as when a test cell has recently flushed it may take several hours to build up enough hydraulic head or water depth in the cell to obtain enough flow volume and velocity to flush debris from the seals. Flow should be allowed to accumulate in the cells for several hours by partially installing the stoplogs without forcing them together or to the bottom of the structure before attempting to flush the debris from the seals.

AUTOMATIC INLINE WATER LEVEL CONTROL STRUCTURES

The automatic inline water level control structure installed in the test cells were provided with locking tops on the inline boxes. The top (and lock if provided) must be removed to access the valve and stoplogs. The inline boxes were installed in plastic pipe casing, and the casing can be provided with a lid to prevent water from entering the casing. See Photo 6. The casing for the automatic structure can be differentiated from the casing for the standard inline structure by the presence of the wire leading from the solar panel into the casing for the automatic inline structure.

The automatic inline structure contains an automatic Valterra gate valve. Other associated components include the solar panel, battery box, and wiring between the panel, the battery box, and the valve. The structure also contains removable stoplogs located near the top of the box, above the valve. The Owner's Manual for these structures is provided in Appendix C.

The valve is installed in a special panel in the bottom of the inline box. The valve panel fits into the grooves in the sides of the box for the stoplogs. This panel and the associated wiring should not be removed unless there are significant problems requiring valve replacement. There are stoplogs located above the valve panel, but the stoplogs should not be adjusted unless absolutely necessary due to the wiring in the area. The stoplogs should have a high enough elevation that water does not overtop the stoplogs and contact the wiring in the box, although the wiring can withstand occasional exposure to flows.

The solar panel creates solar energy which is stored in the battery contained in the battery box. The panel was installed to face to the south as much as possible to ensure maximum sun exposure.

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A small computer containing the flushing program, a clock, and battery data is contained in the top of the battery box, which is mounted on the pole of the solar panel. Cables with screw-on connections lead from the solar panel to the battery box, and from the battery box to the valve. The box should be locked to prevent unauthorized alterations to the flushing program, and the box should be securely closed when not in use so the box seals prevent entry of water into the box.

The valve opens based on a pre-programmed signal from the computer. At the time this plan was developed, the valves were set to open to flush the test cells for 10 minutes three times per week. Adjustments to the length of the flush increments may be desirable to modify the flush time or frequency depending on flows and weather conditions so that the lower layers of the cells are flush thoroughly but the cells are not fully dewatered, which is especially important in BTCC.

When performing an inspection of the automatic inline structures, the following items should be checked:

- Verify solar panel is intact, not broken, standing straight up, and is exposed to the sun (not obscured by vegetation or debris);
- Verify cables are connected from solar panel to battery box, and battery box to valve;
- Open battery box.
    - Check battery energy level on computer to make sure it is within the range needed to open the valve (range needed is given on the screen with the battery reading);
    - Manually open valve to check that valve is opening properly;
    - Flush system manually for 10-15 minutes;
    - Close valve to make sure it closes and seals properly (remove the top of the inline box to ensure that there is no flow through the valve when the valve is closed);
    - Close and lock the battery box, making sure to re-install the insulation and making sure the box casing seals properly to keep water out of the box.

If battery power is low, the battery box may not be getting enough sunlight due to vegetation or snow or dirt on the panel, or extended periods of little sunlight. Clean the panel, and check the connections of the cables. The batteries will need to be replaced after a number of years. Battery life is expected to be at least three to five years based on similar systems.

If the valves do not re-set properly, as indicated by flow through the valve when the valve is in the closed position, there may be debris that has washed into the valves. Debris will prevent the valve from closing properly and will allow flow through the valve when it is in the closed position. Debris should be removed to prevent damage to the valve. In order to flush the debris from the valve, use the control panel to quickly open the valve to the fully-open position. Allow high flow through the valve for at least several minutes, and re-close the valve. If the cell was recently flushed, it may take several hours to build up enough hydraulic head or water depth in the cell to obtain enough flow volume and velocity to flush debris from the valve, so it may not be possible to flush debris from the valve immediately after completing a flushing cycle of the

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limestone cell. Flow should be allowed to accumulate in the cell for several hours before attempting to flush the debris from the valve.

Automatic inline water level control structures installed in colder climates have occasionally displayed a tendency for the valves to freeze during the winter. Freezing has occurred primarily during periods when the temperature has remained constantly below freezing for over a month. In order to avoid this situation at the MR7 site, the bottom of the inline structure within the casing was installed below the freeze/thaw line, and the structure was buried in stone to surround the structure and avoid air space around the structure.

Freezing may also be avoided by changing the flushing time to a more frequent, shorter flush period during extremely cold weather. The system currently flushes three times per week, depending on how the system is currently programmed by the Clearfield County Conservation District. Leaving the valve in the "open" position where it is closer to the ground surface for a long period of time may increase the potential for freezing.

If the valve does freeze in the open position, the AMD will still contact the treatment media in the cells, but detention time will be less than optimal. If the valve freezes in a closed position, the cell will not flush until the valve thaws. Flushing could be accomplished manually by the removal of the stoplogs from the standard inline water level control structure as discussed previously in this narrative. A brief period of flushing suspension should not cause long-term harm to the treatment cells. If the system does not flush for a period of time, it should be manually flushed for 15-30 minutes to "reset" the test cell without fully dewatering the cell.

The computer program controlling the flush cycle of the automatic inline structure contains both an "on" and "off" control for both the open and shut functions (i.e. if the valve freezes open (or closed) and does not shut (or close), the computer will turn off the "shut command" (or "open command") after a short period of time to conserve battery charge). If the valve freezes shut, the secondary outlet is in place to handle the flows, and normal operation of the valve will resume when it thaws without harm to the valve or actuator. Should the cells not be flushed for a period of up to 1-2 months, there should not be significant harm to the cell. If this situation occurs, the cell should be flushed for 15-30 minutes to "re-set" the system, then normal operations resumed.

INLET WATER LEVEL CONTROL STRUCTURES

Inlet water level control structures were installed to control the discharge from the settling basins. These structures allow discharge from the top of the water in the basins, which should contain the least amount of precipitates. The inlet water level control structures installed in the settling basins were furnished with a wooden dock structure to allow dry access to the adjustable stoplogs located in the open, front face of the inlet box. Stoplogs can be adjusted or added/removed after as desired to adjust the water level in the settling basins.

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Each stoplog has a rubber seal on the bottom and sides of the stoplog. The hooks on the back of the stoplogs point down (toward the bottom), with the arch of the hook pointing up. The flat side of the stoplog without the hooks should face into the direction of flow. The rubber seal should be placed on the bottom when installing stoplogs. The bottom stoplog in the stack has a thicker rubber seal on the bottom than the other stoplogs.

A handle that can be used to aid in the addition or removal of the stoplogs is stored by the Clearfield County Conservation District. It is advisable to keep the handle dry and not in contact with AMD. The flat base of the handle can be used to push down stoplogs, while the bars on the handle can be used to catch the hooks and pull upwards to remove stoplogs. Stoplogs must be pushed down tightly so that they seal together and do not allow flow between the stoplogs. Any debris such as small rocks or straw between the stoplogs will not allow the stoplogs to seal properly. Pressing on stoplogs with debris in between will quickly ruin the seals and cause the stoplogs to leak.

If the stoplogs are not sealed properly in place, as indicated by flow through the inlet water level control structures when the stoplogs are in place, there may be debris that has washed into the seals. Debris will prevent the seals from closing properly and will allow flow between or around the seals. Debris should be removed to prevent damage to the seals. In order to flush the debris from the seals, use the handle to remove the stoplogs with the sealing problem. Allow high flow through the inlet water level control structure for at least several minutes, then re-install the stoplogs. If the basin water level was recently drawn down, it may take several hours to build up enough hydraulic head or water depth in the basin to obtain enough flow volume and velocity to flush debris from the seals. Flow should be allowed to accumulate in the basin for several hours by loosely installing the stoplogs (i.e. not forcing them together or to the bottom of the outlet box) before attempting to flush the debris from the seals.

VALVES

Manually-operated gate valves were installed to control the inflow into the two test treatment cells. The As-Built Drawing provided in Appendix A, shows the location of these two valves.

Table 1 provides description of each valve and the necessary position of the valve (open or closed) during anticipated operation and maintenance activities.

Table 1: Purpose and Position of Valves During Normal Treatment System Operation

VALVE	PURPOSE	POSITION DURING NORMAL OPERATION
B	Control Flow into VFPTCB	Quarter turn open
C	Control Flow into BTCC	Quarter turn open

All valves were placed in a PVC casing with a removable cap. The cap to the valve casing can be removed as needed. The cap prevents flow into the top of the casing and prevents

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precipitation, debris, etc. from entering the casing, so the cap should be replaced tightly to prevent flow into the casing each time it is removed.

A valve key is necessary to open and close the valves. A standard one inch square valve key is used to open and close these valves. A valve key is stored by the Clearfield County Conservation District.

Valves should be periodically opened and closed to ensure that they remain functional. Because the flow opening is so small to control flow to 10 gpm to each test cell, debris tends to accumulate in the small opening. Monthly opening to clean the valves is recommended, with more frequent opening in spring and fall as long as the valves are set to discharge 10 gpm. If valves are open further, a minimum opening frequency of one year is recommended, and 6 months is preferred to ensure long-term functionality of the valves.

CLEANOUT PORTS

Cleanout ports have been provided at ends of the underdrain in VFPTCB and BTCC. The caps on the cleanout ports can be removed for observation of flow conditions in the underdrain. These ports will allow a plumbing snake or other instrument to be used to remove any clogs in the underdrain piping. Some future clogs from debris or precipitates can be anticipated due to the high metals concentration present in the AMD. The ports were incorporated into the design to allow for future maintenance. Watertight caps prevent flow into the top of the port, although the normal and maximum design water levels in the treatment cells will be below the elevation of the top of the cleanout ports.

OPERATION AND MAINTENANCE RESPONSIBILITIES

Site inspections and operation and maintenance will be conducted by the Morgan Run Watershed Group and Clearfield County Conservation District and/or its agents. Operation and maintenance activities and responsibilities are described in the following paragraphs of this narrative.

OPERATION ACTIVITIES

Normal day-to-day operation of the system will consist of periodic inspections followed by corrective actions to address any problems noted during the periodic inspections. The site has been designed to involve as little day-to-day operation activities as possible. Flushing of the VFPTCB and BTCC will be done by automatic flushing structures.

Piping, outlet structures, and water level control structures should be inspected and cleaned of debris, and the proper operation of the valves verified on a regular basis by opening and closing the valves. Valves will be need to be maintained regularly to ensure proper operation.

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MAINTENANCE AND CORRECTIVE ACTIONS

Any problems identified during inspections should be addressed immediately, and any necessary maintenance performed.

Maintenance activities will consist of corrective actions such as removal of debris and litter and maintenance of outlet structures, vegetation, rock linings, and rip rap. Any problems identified during inspections should be addressed immediately.

Debris and sediment should be removed from the entire site, but especially from treatment cells and settling basins as debris could clog the intake and outlet structures. Spillways, pipes, water level control structures, and outlet structures should be cleaned of debris to ensure proper functionality of the structures.

Litter control shall be done any time that the site is visited. Litter is not expected to be a reoccurring problem due to limited site access, but it should be addressed if it occurs. A visual inspection will also need to be done anytime there is a period of heavy rain or storm in the area so that no litter has washed into the system. Any accumulated litter shall be removed from the site and disposed of properly.

Inspections for leaves should occur at least monthly during the fall, and any accumulated leaves should be removed from the water level control structures and outlet structures immediately. Periodic removal of sticks and leaves may be necessary.

Area of erosion should be immediately repaired either through installation of rip rap or re-establishment of vegetation. Measures such as installation of erosion control mat may be necessary. Causes of erosion should be identified and corrected to prevent future problems.

Areas of rip rap shall be inspected to ensure design thicknesses and dimensions are maintained at all times. Additional rip rap shall be added as needed to maintain the design dimensions.

Areas showing signs of animal habitation such as beaver dams at outlet structures and burrowing by muskrats shall be addressed immediately to protect the integrity of the project. Contact the Pennsylvania Game Commission for advice or assistance.

The establishment of vegetation on the site is the major component of the post-construction stormwater management plan. Any areas of dead, dying, or stressed vegetation shall be identified, and the cause of the problem identified and corrected as soon as possible.

Vegetation management shall consist of periodic mowing or brush hogging at a frequency of every two to three years to ensure that woody vegetation does not become established on the embankment. This practice should be done to prevent tree roots from growing through the embankments and causing leakage.

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Correct any vandalism or damage, such as removal of stoplogs in the outlet structures or clogging of the spillways and outfall pipes.

Correct water levels have been established in the treatment system cells. Water level should be approximately two feet above the top of compost in VFPTCB and at least six inches above the sandstone in theBTCC. The maximum water level should be no higher than six inches below the emergency spillways in the settling basins, with a normal pool of approximately 12 inches below the spillway crest. Should water levels be out of adjustment, remove any debris from the outlet structures and/or try to identify the problem. Contact the Clearfield County Conservation District for assistance as needed.

Periodically oil and open and close locks to ensure the continual functioning of the locks.

Periodically open and close all valves to ensure the continual functioning of the valves.

VFPTCB and BTCC will need to be flushed on a regular basis. Flushing is programmed to occur three times per week for 10 minutes or as established by the Clearfield County Conservation District. Manual flushing twice per year in spring and fall is recommended.

LONG TERM MAINTENANCE

Long term maintenance for this treatment system is different from that of a typical passive treatment system since the test cells may not have a typical functional life. The small test cells were designed to treat 10 gpm passively, in hope that the test will show that the AMD can be treated passively. If these test cells are successful, they will likely be removed for the construction of a larger passive treatment, or left in place as part of a larger system. If the cells are successful and they are left in place, the limestone and compost will need to be replaced at a frequency of less than 20 years.

The settling basins will need to be cleaned out, and precipitates disposed of in the future. Based on current flows and loadings, the need to clean the basins will occur sometime between 15-20 years, unless there are substantial changes in flows or loadings. The Morgan Run Watershed Group will address these long term maintenance needs.

OTHER INFORMATION

ACCESS

Landowner-Grantee Agreements between the Clearfield County Conservation District and the property owners (Dan Dixon and Steve Schenenberger) have been developed for long-term access to the site and operation and maintenance of the treatment system. Copies of the Landowner-Grantee agreements are provided in Appendix D.

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A lock has been installed on an existing gate on the access road for this project to limit unauthorized access to the treatment system. The Landowner-Grantee agreement allows access through this gate for the life of the treatment system. Keys and locks are maintained by the Morgan Run Watershed Group. Although an outdoor-grade lock was provided, the lock should be oiled on a regular basis to prevent rusting of the lock.

STORAGE OF ITEMS

The key to the gate lock, extra stoplogs for the inline and inlet water level control structures, and a valve stem are currently stored by Clearfield County Conservation District. In the event of an emergency, Alder Run Engineering has a valve stem that can be used to operate the valves and an extra key to the locks.

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MORGAN RUN 7 AMD TREATMENT SYSTEM
OPERATION AND MAINTENANCE PLAN CHECKLIST

INSPECTION INSTRUCTIONS

1. Inspect the entire treatment system.

2. Look for:
   - areas of erosion or accumulation of sediments (except for accumulations of sediments in the settling basins)
   - displaced (washed out) vegetation or rip rap
   - dead or dying vegetation
   - system functionality problems
     - overtopping of berms or flow in emergency spillways
     - debris in intake and outlet structures, pipes, or spillways
     - water levels are too low or too high
   - infestation by beavers or muskrats and related issues such as clogging of outlets or digging in the embankments
   - vandalism
   - valves in correct position
   - solar panel unobstructed, batteries displaying sufficient charge, and valves able to open and close (by manual trigger)

3. Check and record water quality including treatment system inflow in settling basin A, effluent from the test cells, and settling basin D effluent.

OPERATION AND MAINTENANCE INSTRUCTIONS

1. Remove any debris or sediment that harms the system or prevents it from working as designed.
2. Repair any areas of erosion.
3. Address any areas of damage by animals such as beaver dams and muskrats burrowing through berms.
4. Contact Clearfield County Conservation District if water levels are too low or too high.
5. Correct any vandalism or damage, such as removal of stoplogs in the outlets or clogging of the outlet pipes.
6. Follow instructions in the Operation and Maintenance Plan for manual flushing of test cells B and C at a recommended minimum interval of every 6 months.
7. Open and close valves at a minimum interval of every 6 months to maintain functionality.

OTHER

1. Contact Clearfield County Conservation District (814-765-8130) for technical assistance if there are questions or problems at the site that cannot be immediately and easily corrected.

APPENDICES

APPENDIX A

MAPS AND FIGURES

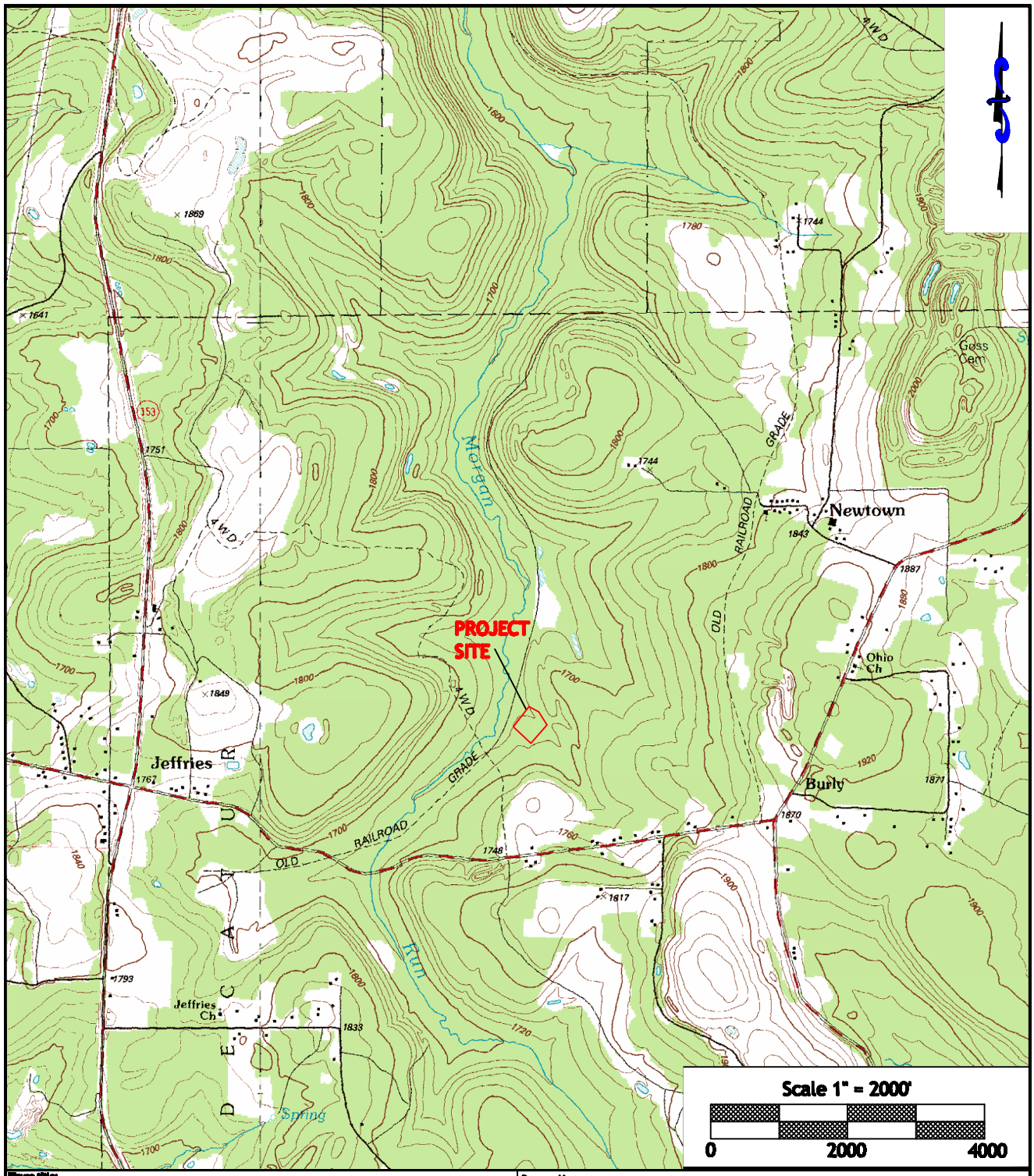

Figure title:

Figure 1: Location Map showing Site Topography

Prepared for:

Clearfield Creek Watershed Association

Site Information:

Morgan Run 7 Acid Mine Drainage Treatment Project

Decatur Township | Clearfield County | Pennsylvania

Prepared by:

ALDER RUN ENGINEERING

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Reference: United States Geological Survey, 7.5' Topographic Quadrangles, Wallaceton, Pennsylvania.

MR7 Treatment System Justification/Scope of Work Revision

Due to the severity of chemistry and the high flow rates at MR7, we are requesting a change to the scope of work for the funds received. After much debate and review of the proposed passive treatment system originally designed at this site, project partners have decided to construct "test" cells to determine the efficiency and success of two different treatment cells. In order to minimize cost, but still determine treatment success, 10 gpm will be treated in each of the "test" cells. Samples will be taken monthly for 12-months on the effluent of each system to determine the potential efficiency of each cell and to determine the probability of treating the entire discharge successfully using passive treatment technology.

The original site design chemistry was based on a flow rate of 300 gpm, a pH of 3.4, acidity of 190 mg/L, iron concentration of 46 mg/L and aluminum of 9 mg/L. The loading rates in turn were 420 lbs/day of acidity, 140 lbs/day of iron and 32 lbs/day of aluminum. Upon further review and failures observed at other passive treatment systems, the project partners want to further investigate the treatment potential at MR7 to insure long term success while minimizing cost.

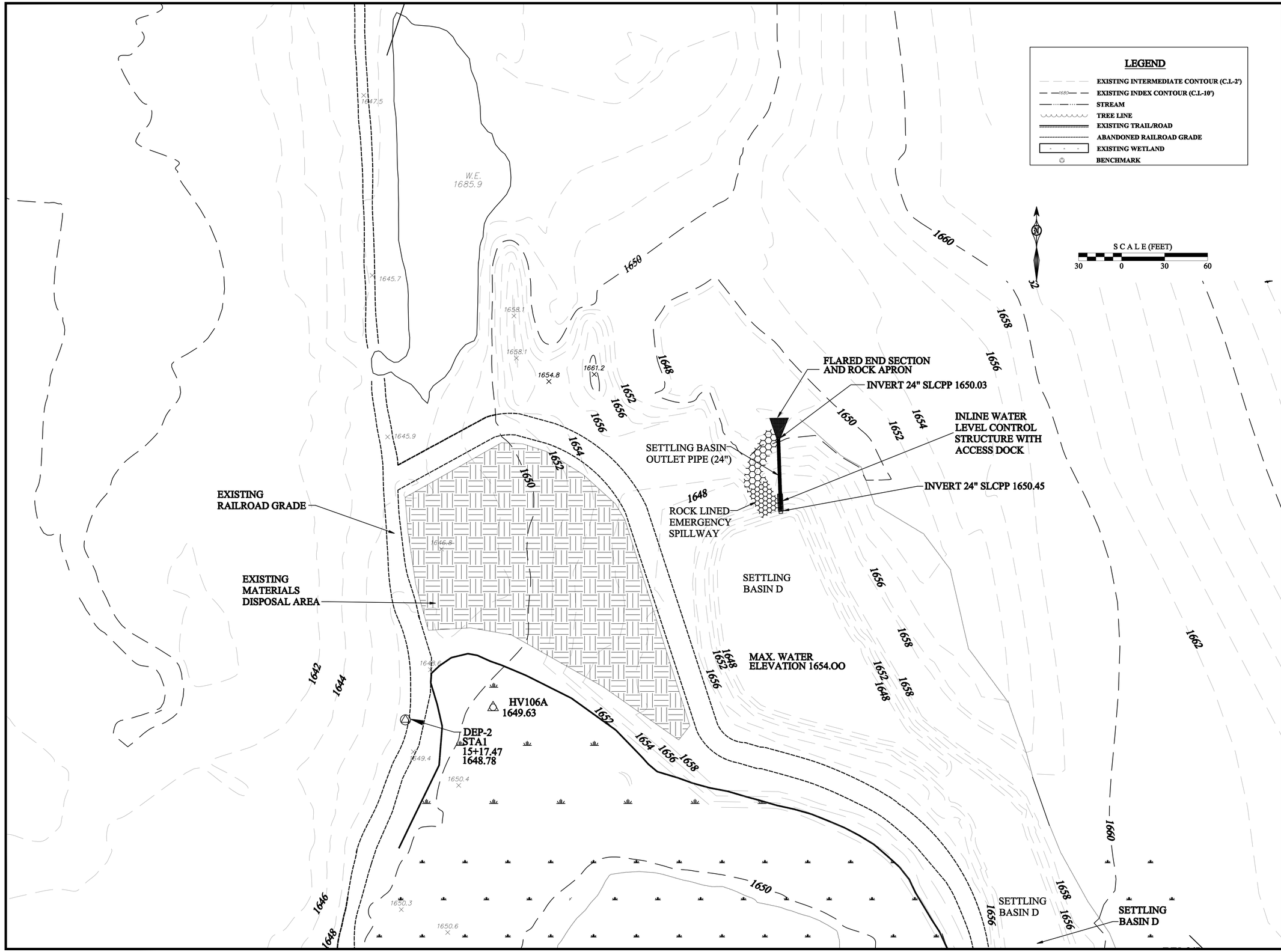
The proposed change of scope will include constructing two different treatment cells which will each treat 10 gpm. The design chemistry is based on a pH of 3.4, acidity of 200 mg/L, iron of 50 mg/L, aluminum of 10 mg/L, manganese of 15 mg/L and a sulfate concentration of 750 mg/L. The loadings rates will therefore be 6 lbs/day of iron, 1.2 lbs/day of aluminum, and 24 lbs/day of acidity. These values are based on sampling during the development of the restoration plan in 2003 and 2004. Design values are determined using the 90% CI of the data set.

Treatment cell one will be a modified VFW. The treatment success of VFWs is based on a combination of limestone dissolution and alkalinity production by sulfate reducing bacteria in the compost. It is necessary to maintain a carbon source long-term for bacterially-mediated processes. Therefore, the second cell will contain a modified organic layer which will be a mixture of woodchips, manure and limestone chips. This will serve to have larger carbon source material to breakdown over time and limestone chips to maintain pH levels within this layer for the bacteria to survive. This cell will contain 300 tons of limestone and will be of similar size as the first.

The second treatment cell will be a bioreactor which is sized based on an alkalinity generation rate of 35 $g/m^2/day$. The organic layer would be a mixture of 24 cu yds manure (13 tons), 92 cu yds of hay (10 tons), 171 cu yds of limestone (218 tons), and 335 cu yds wood chips (82 tons). The material will be mixed thoroughly before being placed in the cell. It will be approximately three feet in depth containing 692 cu yds of freeboard volume with a top length of freeboard at 110' and width of top freeboard at 65'.

The grant funding for the project was requested in two phases, with funding received for the first phase. In addition to the test cells described above, site access and the majority of the proposed treatment system would be constructed. Site access would be improved, and necessary treatment system accessories such as an upslope diversion channel and new discharge culverts under the existing railroad grade would be installed. The existing beaver dam would be modified into its permanent settling basin configuration. Settling basins would be constructed as shown on the plan. After the test period is over,

the settling basins could be converted to the VFW or other treatment mechanism, and the test areas converted to the appropriate treatment. Should passive treatment not prove to be highly successful at the site, the basins could still be used as settling basins for an active treatment system such as a lime doser, and the test areas converted to a mixing channel area.



SHEET NO. AB-1 1 OF 2

SEAL: COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL MICHELLE M. MERROW ENGINEER 1606 PROJECT

Michelle M. Merrow PE066677

REVISIONS

NO.	DESCRIPTION	DATE

PREPARED BY:
ALDER RUN ENGINEERING
107 COAL STREET
OSCEOLA MILLS, PENNSYLVANIA 16666
PHONE: (814) 339-6998

DATE: SEPTEMBER 12, 2013

SCALE: 1" = 30'

PROJECT:
MORGAN RUN 7
AMD TREATMENT SYSTEM
AS BUILT
DECATUR TOWNSHIP, CLEARFIELD COUNTY, PA

TITLE: AS BUILT

PREPARED FOR:
New Miles of Blue Stream NMBS
1602 OREBED ROAD
MANSFIELD, PENNSYLVANIA 16933
PHONE: (570)-662-8631

SEE ALSO SHEET AB-1

EXISTING ROAD

MR TUFF WETLAND MITIGATION AREA

SETTLING BASIN D

SETTLING BASIN D

INV. 24" CPP 1657.74

INV 24" SLCPP 1658.69

ROCK APRON

4" PVC

4" PVC

FLUSH OUTLET

PRIMARY OUTLET (INLET WATER LEVEL CONTROL STRUCTURE)

ROCK APRON

SOLAR PANEL 1657.0

BIOREACTOR TEST CELL C

TOP GRAVEL AVERAGE 1659.0
MAX. WATER AVERAGE 1660.0

SETTLING BASIN A OUTLET 24" SLCPP

4" PVC CO

4" PVC CO

INV. 6" PVC 1660.48

12" SLCPP DRAINPIPE

BASIN A BYPASS PIPE 24" SLCPP

2

VERTICAL FLOW POND TEST CELL B

BIOREACTOR INFLOW PIPE

4" PVC CO

FLUSH OUTLET

SOLAR PANEL

4" PVC CO

CLEAN OUT A INV 24" SLCPP 1659.04

INV. 6" PVC 1660.27

FLARED END SECTION INV 24" SLCPP 1658.12

VALVE C

VALVE B

1

TOP 8" PVC 1662.82

W.E. 1651.4

SETTLING BASIN A PRIMARY OUTLET 24" SLCPP

TOP OF OUTFLOW BOX 1665.81 INVERT
INVERT 24" SLCPP 1660.22

INLET WATER LEVEL CONTROL STRUCTURE WITH DOCK

ROCK LINED EMERGENCY SPILLWAY

W.E. 1651.4

12" SLCPP DRAINPIPE

ACCESS ROAD

SETTLING BASIN A

SCALE (FEET)
30 0 30 60

LEGEND

- EXISTING INTERMEDIATE CONTOUR (C.I.-2')
- EXISTING INDEX CONTOUR (C.I.-10')
- STREAM
- TREE LINE
- EXISTING TRAIL/ROAD
- ABANDONED RAILROAD GRADE
- EXISTING WETLAND
- BENCHMARK

NUMBERED NOTES:

1. INTAKE FOR TEST CELLS B AND C
2. PRIMARY OUTLET - INLINE WATER LEVEL CONTROL STRUCTURE

NOTE:
AS-BUILT SURVEY PROVIDED BY LAND AND MAPPING SERVICES, CLEARFIELD, PA.

SHEET NO. AB-2 2 OF 2

SEAL: COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL MICHELLE M. MERROW ENGINEER 1005 PROFILE PENNSYLVANIA

Michelle M. Merrow PE0606677

REVISIONS

NO.	DESCRIPTION	DATE
1	ADD DRAINPIPE	6/26/14

PREPARED BY:
ALDER RUN ENGINEERING
107 COAL STREET
OSCEOLA MILLS, PENNSYLVANIA 16666
PHONE: (814) 339-6998

DATE: SEPTEMBER 12, 2013

SCALE: 1" = 30'

PROJECT:
MORGAN RUN 7
AMD TREATMENT SYSTEM
AS BUILT
DECATUR TOWNSHIP, CLEARFIELD COUNTY, PA

TITLE: AS BUILT

PREPARED FOR:
New Miles of Blue Stream NMBS
1602 OREBED ROAD
MANSFIELD, PENNSYLVANIA 16933
PHONE: (570)-662-8631

APPENDIX B

OPERATION AND MAINTENANCE CHECKLIST

INSPECTION ACTIVITIES

Inspection requirements are documented in the following paragraphs. An inspection checklist has been developed to aid with inspection activities.

INSPECTION SCHEDULE

The sites shall be inspected according to the following minimal inspection schedule:

- Following major precipitation and runoff events (including snowmelt events)—Inspect following all major precipitation events on a perpetual basis. Inspect after precipitation events in addition to the monitoring schedule provided below.
- During and immediately following construction until vegetation is established (70% uniform vegetative cover)—Inspect on a weekly basis, minimum.
- For the first year following construction—Inspect on a monthly basis.
- For the second year following construction—Inspect on a quarterly basis.
- For later years—Inspect on a yearly basis.

INSPECTION RESPONSIBILITIES

Inspections shall be conducted by the Morgan Run Watershed Group, Clearfield County Conservation District, and/or its agents.

INSPECTION INSTRUCTIONS

Inspections should be made for debris (especially in the intake and outlet structures, pipes, and spillways); areas of erosion; accumulation of sediments (except in the settling basins, where accumulation of precipitates is expected); displaced vegetation or rip rap; dead or dying vegetation; infestation by beavers or muskrats; vandalism; and problems with functionality of the system including overtopping of berms, flow through emergency spillways, and incorrect water levels.

Inspection of the automatic inline water level control structures shall be performed to verify that the solar panel is unobstructed, that the batteries are sufficiently charged, and the valves open and close.

Inspection of water quality should also be made. Samples should be collected during inspections at the SBA outflow, VFPTCB and BTCC outfalls, and SBD outfall. Samples should be analyzed for the standard AMD parameters of pH, acidity, alkalinity, conductivity, iron, aluminum, manganese, and sulfate. If funding is not available for laboratory analysis of samples, then field testing such as with a HACH kit shall be done, and the effluent pH shall be determined, at minimum.

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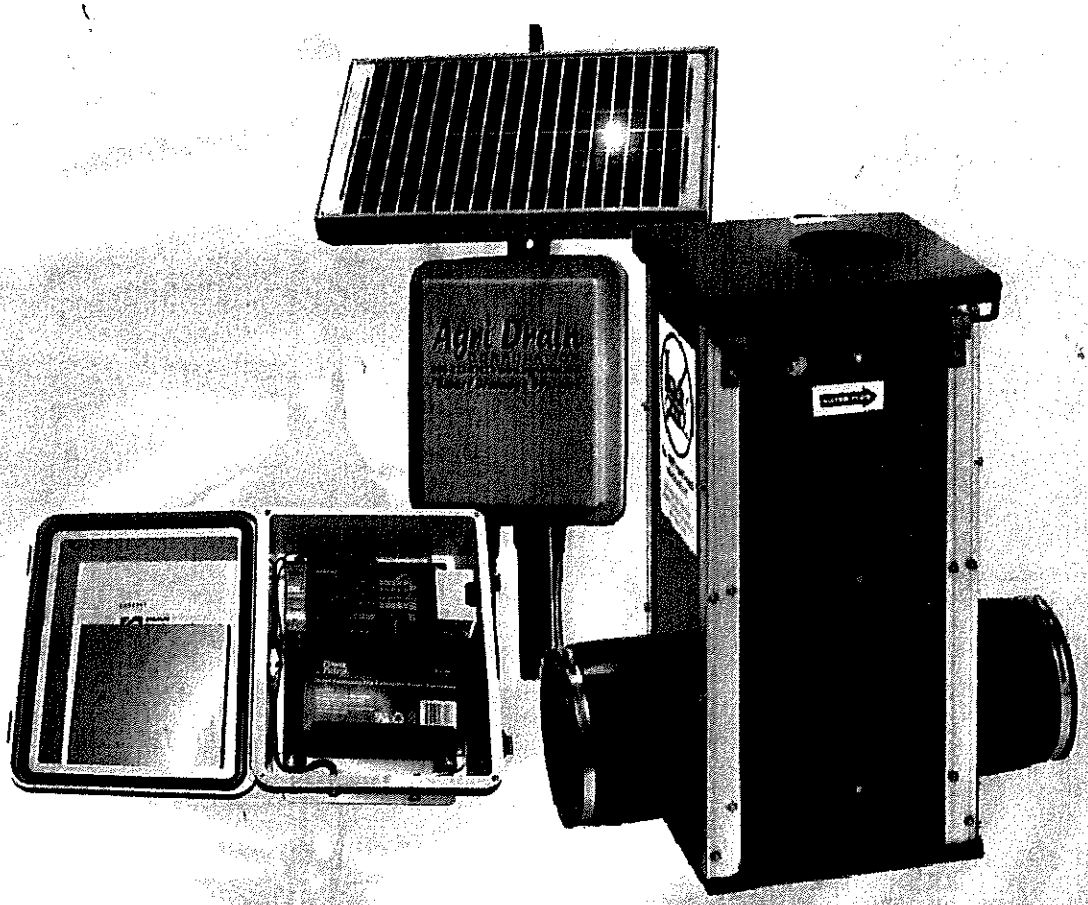
APPENDIX C

OWNER'S MANUAL FOR AUTOMATIC INLINE STRUCTURES

OWNERS MANUAL

Mine Reclamation Edition



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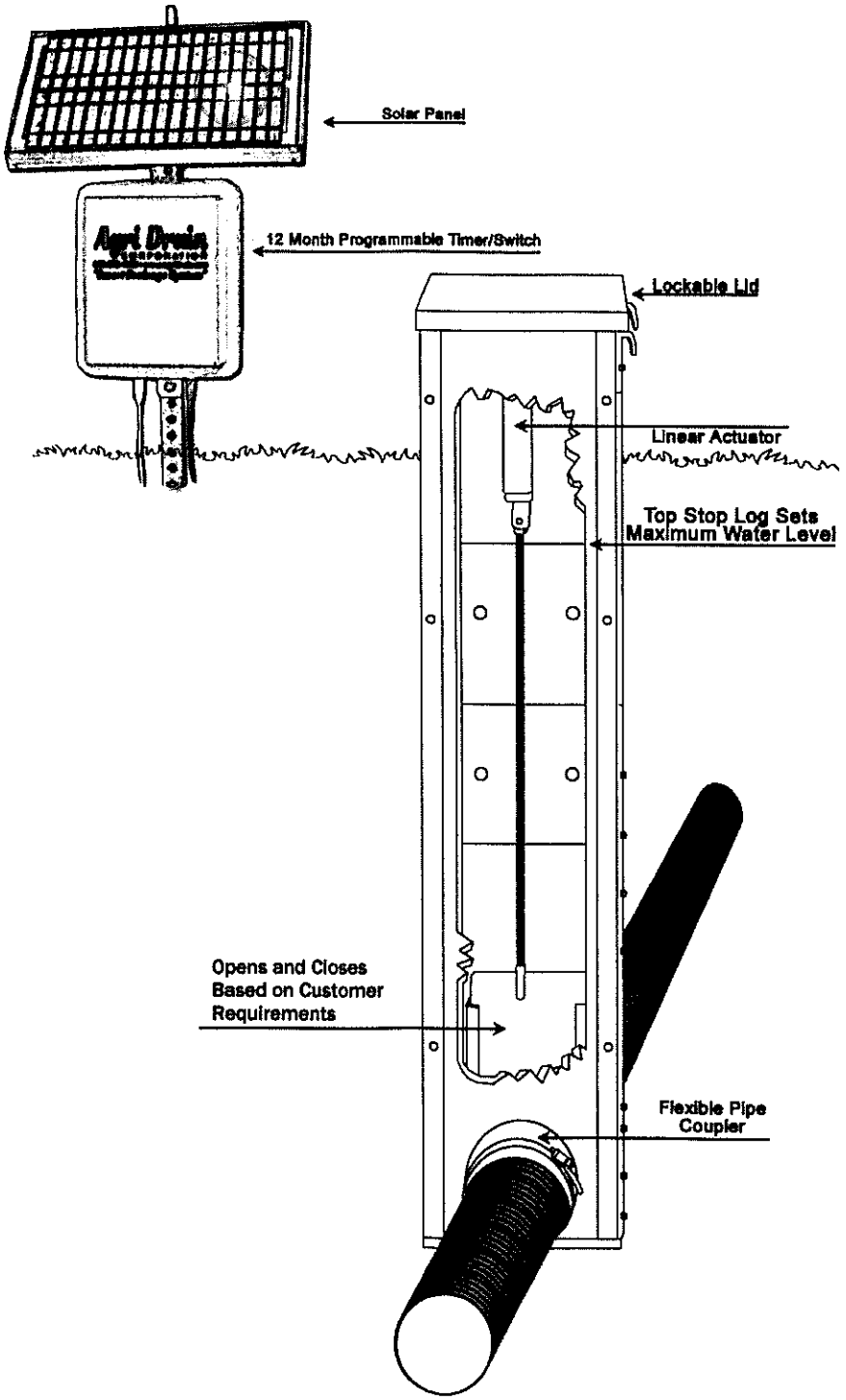


OPERATING PRINCIPLE

The Agri Drain "Smart Drainage System" is designed to allow the operator to open and close the slide gate based on the desired schedule.

The steps required to program the controller for this function are explained in the *"Setting Timers"* section of this manual.

The unit has a solar panel which keeps the battery charged, a controller which is programmed to control the slide gate, and an actuator that raises and lowers the slide gate. The electronic components are housed in a weather tight enclosure.

INSTALLATION OF INLINE WATER CONTROL STRUCTURE

1.) ***EXCAVATION AND GRADING***

The structure base, the inlet pipe, and the outlet pipe must be set on firm, flat surfaces of compacted soil or fill sand to provide a solid, stable base. This will prevent settling and reduce stress or misalignment of pipe connections.

2.) ***PIPE CONNECTION***

Remove black tape from both inlet and outlet flex couplers exposing the stainless steel clamps. The flex couplers must be placed directly over the outside diameter of the pipes; then secured by tightening the stainless steel clamps as shown in the illustration.

3.) ***BACK FILL AND COMPACTION***

Level the structure vertically before placing backfill. Backfill around the control structure by hand in 6" lifts. Hand tamp only - **do not** mechanically compact. **Do not** use a backhoe or blade to place backfill directly against the water control structure.

****Excessive compaction may cause structural damage or failure.**

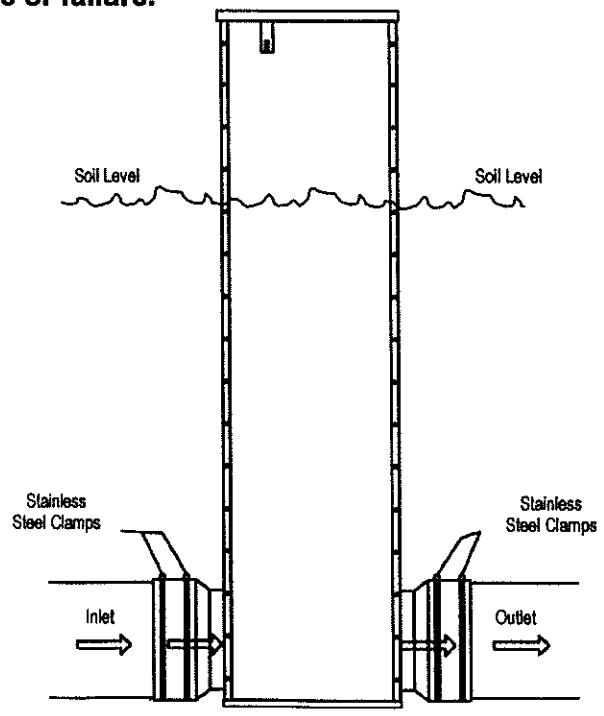
The inline structure may be used for primary or secondary outlet with larger pipe or emergency spillway as primary.

Inline structure removes sub-surface water.

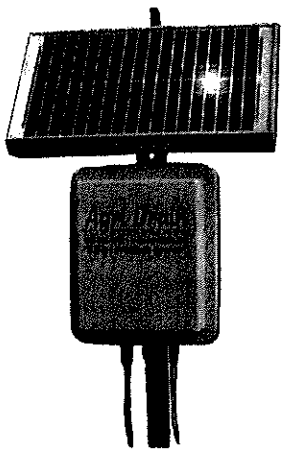
On the inline installation, the inlet end of the pipe should be held off the bottom of the impoundment to allow for siltation and be protected with an inlet guard. The outlet end should be protected with a rodent guard.

In a controlled drainage or sub-surface irrigation application, the structure nearest the outlet should be installed with a minimum of 20' of non-perforated pipe on the down stream end. Anti-seep collars are recommended.

(The above mentioned companion products are available from Agri Drain Corp.)



INSTALLATION OF SOLAR PANEL & CONTROL BOX



Install the Inline water control structure as explained in *"Installation of Inline Water Control Structure"* in this manual.

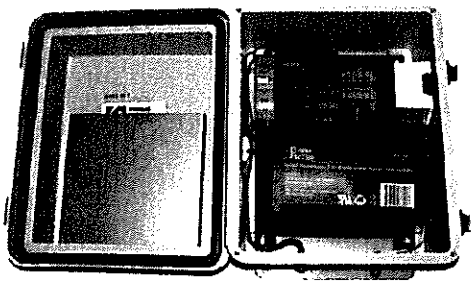
There will be two pieces of square tubing: One 6' piece of 1 3/4" and One 8' piece of 1 1/2". The 6' piece of 1 3/4" should be buried next to the side of the structure that has the receptacle. (Leave about two inches sticking out of the ground.)

- Mount the solar panel and one of the "T" brackets on one end of the 1 1/2" tube using one of the 3/8" bolts and nuts provided.
- Mount the other "T" brackets to the 1 1/2" tube using one of the 3/8" bolts and nuts so that the four holes line up with the four holes on the control box. Use four of the 1/4" bolts and nuts to secure the control box to the "T" brackets. (Make sure the receptacles are on the bottom, facing the ground.)
- Insert the 1 1/2" tube with the control box and solar panel into the 1 3/4" tube in the ground. Make sure the solar panel is facing South so it receives as much sunlight as possible. Insert the remaining 3/8" bolt through the two tubes and tighten down with the nut.
  (The height of the control box and solar panel is determined by placement of the bolt through the two tubes. For start-up and testing, adjust it to a point at or near eye level.)
- Connect the cable from the solar panel to the male receptacle on the control box.
- Connect the male end of the provided cable to the female receptacle on the control box. The other end of the cable connects to the receptacle on the structure.
- Open the control box and remove the packaging material.
- Connect the wires to the battery terminals. The unit is now ready to be programmed and tested.
- Set the clock, time, and date as explained in the *"Set Clock, Time, and Date"* section of this manual.
- Insure the actuator is operating correctly by using the key strokes as explained in the *"Manual Activation"* section.
- Set the timers as explained in the *"Setting Timers"* section.
- Close the control box and set to desired height.

SET CLOCK, TIME, AND DATE

When the unit is first powered up by connecting the battery, it will be necessary to insure that the correct time and date are entered into the control unit. A few seconds after the battery is connected, the screen will display Day, Time, and Date. To set the clock follow the directions below:

- Push ESC key
- Push the Down Arrow to "Set Clock"
- Push the OK key
- Arrow up or down to correct Day
- Arrow Right to set Hour (Military Time)
- Arrow up or down to correct Hour
- Arrow Right to set Minute
- Arrow up or down to correct Minute
- Arrow Right to set Year
- Arrow up or down to correct Year
- Arrow Right to set Month
- Arrow up or down to correct Month
- Arrow Right to set Day
- Arrow up or down to correct Day
- Push the OK key
- Push the ESC key



SETTING TIMERS

From the screen that displays the Day and Time, push ESC then follow directions below:

- Arrow down to "Set Param" and push the OK key
- Arrow up or down until "Open 1" is displayed (This is the open gate timer)
- To program, push the OK key
- Push the Right arrow to move the cursor to the days of the week the gate is to open
- Arrow up to set the day or down to turn it off
- Arrow Right to On Time (Military Time)
- Arrow up or down to set On Time
- Push the Right arrow to set Off Time (Always set this for one minute later than On Time)
- Push the OK key after the Day, On, and Off Time has been set
- Arrow up or down until "Close 1" is displayed
- Program the Close day and time the same as the "Open 1" directions
- Push the ESC key twice to get back to the screen that displays Day and Time

SMART DRAINAGE SYSTEM ® OPERATIONS

The slide gate movement is controlled by programming the Open and Close timers. Set the Open timer for the day and time the gate needs to open. Set the Close timer for the day and time the gate is to close. When setting the timers always set the Off Time for one minute after the On Time. The signal to move the gates will activate on the On Time and turn off on the Off Time. Set the gate movements to happen at a time of day when there is a chance of optimal sunshine. This will help to keep the battery charged.

MANUAL ACTIVATION

When the slide gate needs to be moved to a different position or tested, it can be activated at any time using the keys on the controller. From the screen that displays the date and time, push the left arrow key. The screen will display ESC+C and four directional arrows. The up arrow is used to raise the gate; the bottom arrow is used to lower the gate. To activate the gate, first push and hold the ESC key and then the arrow for the direction desired. The chosen arrow will be highlighted on the screen. Hold the arrow until the gate stops moving. There is an internal limit switch in the linear actuator that will stop the movement when fully extended or retracted. If the ESC key is held too long before a directional arrow is pressed, another screen will appear. Press the ESC key to get back to the correct screen.

LOW BATTERY

The battery voltage is monitored at all times. If the voltage drops below a certain level, the message "LOW BATTERY" will be displayed on the controller. The date and time that the incident occurred will also be displayed. This message will continue to be displayed until the voltage rises to an acceptable level and the OK key on the controller is pressed. If the battery voltage stays low for too long, the slide gate will move to a safe position.

MONITORING BATTERY VOLTAGE

Timer "Bat Volt" will display the current voltage level of the battery. Access "Bat Volt" using the same key strokes as explained earlier for *"Setting Timers"*. When "Bat Volt" is displayed it will look like this:

"Bat Volt"
On = 551
Off = 550
Ax = (See below)

Ax will display the current voltage level of the battery. This value should be between 600 and 725. If the value is not in this range, please consult the factory.

PARTS LIST

Description	Part #
Battery	800218
Solar Panel	800272
Actuator	800298
Actuator Connector	800606
Fuse	800617

CONTACT INFO

Smart Drainage System®
Manufactured by
Agri Drain Corporation
1462 340th Street
Adair, IA 50002
Ph: 800-232-4742 or 641-742-5211
Fax: 800-282-3353 or 641-742-5222
Email: info@agridrain.com
Website: www.agridrain.com

Rev. November 2006, *Mine Reclamation Edition*

APPENDIX D

LANDOWNER-GRANTEE AGREEMENTS

1000-FM-OA0076 Rev. 5/2009

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Document Number

LANDOWNER – GRANTEE AGREEMENT

This Agreement, made this 10-8-09 (Date)

by Daniel R. Dixon

Karen L. Dixon

(Landowner(s))

residing at 478 Old Fort Road telephone # 814-364-1207

Spring Mills

, PA 16875
(city) (ZIP)

and *Clearfield County Conservation District*
(Grantee)

Project description: MR7 AMD Construction Project

The Project is located at: MR7 Discharge in the Morgan Run watershed, the old Passmore Mine

Latitude: 40.90589 Longitude: 78.36005

Section 1 – Agreement Provisions

A. In consideration of the benefits that incur from the investment in the property, and/or monies received, the Grantee and the undersigned Landowner agree to participate in the Pennsylvania Department of Environmental Protection ("PA DEP") Growing Greener Grants Program and comply with the terms set forth in this Agreement.

B. Landowner represents and agrees that he/she is the sole owner of the real property on which the Project is to be performed, or has secured a sufficient property interest, including any easements or right-of-ways, necessary to grant access for the completion and maintenance of the Project. A map of the Project site, including adjacent streams and roads, is attached hereto as Exhibit A ("Premises").

1. Landowner agrees that the PA DEP and/or Grantee, its employees, agents and contractors shall have the right to enter upon the Premises to perform the work described in "Attachment D, Scope of Work" of the DEP Grant Agreement. The right to enter shall also include periodic monitoring visits for the life of this Agreement.

2. By offering the Premises for implementation of this Project, Landowner agrees to allow access, design preparation and implementation and repair of the Project for the duration of construction and for the time period identified in Section 1, Paragraph B (11) of this Agreement.

3. Grantee agrees that the Conservation Practices/Best Management Practices ("CP/BMPs") needed to correct the problems identified in "Attachment D, Scope of Work" of the DEP Grant Agreement shall be performed according to the *(Check all that apply)*:

   ☐ a) The NRCS Pennsylvania Field Office Technical Guide,
   ☐ b) The Guidelines for Natural Stream Channel Design in Pennsylvania,
   ☐ c) The USDA NRCS National Engineering Handbook,
   ☐ d) A Handbook for Constructed Wetlands, Volume 4, Coalmine Drainage,
   ☐ e) The Stormwater Best Management Practices Manual,
   ☒ f) Plans developed by or certified by a Registered Professional Engineer and approved by PA DEP.

4. The CP/BMPs shall be maintained pursuant to Section 2, Paragraph C of this Agreement.

5. The ☐ Landowner ☒ Grantee shall be responsible for adherence to the standards set forth in Section 2, Paragraph C and shall not act in any manner inconsistent with the terms of this Agreement.

6. The ☒ Landowner ☒ Grantee agrees not to destroy, alter or modify the CP/BMPs, except to perform needed repairs, for the period covered by this Agreement, nor to undertake any action on land under the Landowner's control which tends to defeat the purposes of this Agreement.

7. Any marketable credits toward nutrient effluent limits (nutrient reduction credits) that may be realized on account of the Commonwealth funded portion of this Project and recognized by the DEP, are the property of the Commonwealth of PA, which maintains full ownership thereof. The Landowner and Grantee recognize and release all rights, claims, title or ownership to the nutrient reduction credits that are generated as a result of the Commonwealth funded portion of the work specified in this Agreement, for the time period covered by this Agreement.

8. Any aquatic resource compensation credits, including but not limited to wetland, waterway, aquatic habitat, floodplain or riparian credits, realized from the Commonwealth funded portion of the project, and recognized by the Pennsylvania Department of Environmental Protection, are the property of the Commonwealth of Pennsylvania, which maintains full ownership thereof. The Landowner and Grantee recognize and release all rights, claims, title or ownership to the aquatic resource compensation credits, in perpetuity, that are generated as a result of the Commonwealth funded portion of the work specified in this Agreement.

9. Landowner agrees to refund all or part of the grant money paid to it, as determined by the Grantee, if before the expiration of the term of this Agreement, the Landowner (a) destroys, alters or modifies the CP/BMPs installed, or (b) voluntarily relinquishes control or title to the land on which the CP/BMPs have been established, and the new landowner and/or operator of the land does not agree to maintain the CP/BMPs for the remainder of the term of this Agreement. If the new landowner agrees to assume Landowner's obligations and to maintain the CP/BMPs for the remainder of the term of this Agreement, then a new Landowner-Grantee Agreement shall be executed by the new landowner.

10. This Agreement shall be binding on the parties, their heirs, legal representatives, successors, and assigns.

11. The term of this Agreement shall be for the duration of Project construction and a period of 20 years thereafter.

Section 2 – Additional Agreement Provisions

A. Tenant provision

"Landowner" is a Tenant under a _____ _____
(Term of Lease) (Oral/Written)

Lease agreement effective _____, with _____
(Date) (Landlord Name)

as Landlord, covering property located at _____
(Address)

Landowner enters this Agreement subject to the superior rights of the landlord in the Premises, and for a term subject to the duration of Landowner's leasehold interest.

B. Special Conditions (Site specific concerns)

See Landowner Attachment

C. Operation, Maintenance and Repair Plan (To be attached)

Section 3 – Agreement Signatures

Richard R. Dixon (Landowner Signature)	10-8-09 (Date)
Daniel R Dixon (Landowner Name Please Print)	10-8-09 (Date)
Karen L. Dixon (Landowner Signature)	10-8-09 (Date)
Karen L. Dixon (Landowner Name Please Print)	10-8-09 (Date)
(Grantee Representative Signature) Must be an officer of the organization	(Date)
(Grantee Representative Please Print)	(Date)

Document Number

OPERATION, MAINTENANCE AND REPAIR PLAN

Proper operation and maintenance of Best Management Practices "(BMPs)" is critical for their success and longevity. The goal of this project is the establishment of a mine drainage treatment system for the improvement of water quality of a deep mine discharge to Morgan Run.

(List BMPs)

for improvement of water quality.

1) Components of the Project (List all practices being installed within this project):

Equalization Basin	Vertical Flow Pond A	Settling Basin A
Vertical Flow Pond B	Settling Basin B	Vertical Flow Pond C
Settling Basin C	Limestone Pond	

2) Parties agree to perform all Maintenance Tasks as described in the chart at the end of this document.

3) Allowed activities:
   - Hiking
   - Hunting with permission
   -

   Prohibited activities:
   - Destruction of treatment system
   - Illegal dumping
   -

4) The ☐ Landowner(s) ☒ Grantee shall be considered to be in breach of this Agreement if he/she does not maintain and repair the project in compliance with this agreement or willfully neglects any other terms of this agreement.

5) The ☒ Landowner(s) ☒ Grantee agrees to comply with all Federal, State, local laws, rules and regulations. This would include noxious weed control.

6) The ☐ Landowner(s) ☒ Grantee or appropriate project partners shall be responsible for all normal, routine maintenance and normal, routine repair of the site and project.

7) Other Special Conditions:
   -
   -
   -
   -

Maintenance Tasks

Practice	Check for problems
Maintenance required	Visually check systems for problems: leaves, animals, etc.
Schedule	Monthly
Responsible Party	CCD, MRWG, or CCWA
Practice	Check automatic flushing
Maintenance required	Check systems for automatic flushing
Schedule	Monthly
Responsible Party	CCE, MRWG, or CCWA
Practice	Manually flush systems
Maintenance required	Manually flush systems quarterly
Schedule	March, June, September, December
Responsible Party	CCCD, MRWG, or CCWA
Practice	Monitor water quality
Maintenance required	Field testing of water quality exiting system
Schedule	Monthly for 1 year, quarterly after
Responsible Party	CCD, MRWG, or CCWA

Attachment D, Scope of Work of the DEP Grant Agreement

The Scope of Work is referenced to construction activities that will take place on the MR7 discharge in the Morgan Run watershed. An acid mine drainage passive treatment system will be constructed which will consist of a series of vertical flow ponds and settling basins. The project has been discussed with landowners and their recommendations included in the final design. The landowners will be invited to the pre-bid meeting and their input will be incorporated into any project changes.

The system consists of an equalization basin in the existing impoundment followed by the first vertical flow pond. This water will discharge to a settling basin. A second vertical flow pond will capture basin discharge along with treat water for a side tributary. This pond will discharge to another settling basin. A final treatment pond and basin will be constructed. In addition to the main "treatment train" a spring discharge will be treated using a limestone pond.

In addition to the treatment system being constructed, wetland mitigation will be constructed along with reclamation of the spoil area.

All activities will take place after securing funds through the Growing Greener grant process or other funding sources.

Please contact Jennifer Demchak, consultant, with further questions. (814-343-5676).

Landowner Attachment

1: Land owner shall be notified prior to any PADEP visits after final construction of site.

2: Landowner and their heirs, may conduct any legal activity that does not destroy, alter, or modify the operation or maintenance of site.

3: If Grantee its employees, agents and contractors fail to uphold this Operation, maintenance and repair plan for a period of 6 months this agreement is VOID and all marketable credits toward nutrient effluent limits (nutrient reduction credits) will be returned to the landowner or their heirs.

Landowner –Grantee Agreement

This agreement, made this March 17 2007
(Date)

by J. Steven Shenenberger
(Landowner(s))

residing at 847 Miller Spring Rd telephone # 717 592 6300

York, PA 17404
(city) *(zip)*

and Clearfield County Conservation District
(Grantee)

This project is located at: MR7 discharge in the Morgan Run discharge, the old Passmore Mine

Latitude: 40.90589 Longitude: 78.36005

Section 1: Agreement Provisions

A. In consideration of the benefits that incur from the investment in the property, and/or monies received, the Grantee and the undersigned Landowner agree to participate in the Pennsylvania Department of Environmental Protection ("PADEP") Growing Greener Grants Program and comply with terms set forth in this Agreement.

B. Landowner represents and agrees that he/she is the sole owner of the real property on which the project is to be performed, or has secured a sufficient property interest, including easements or right-of-ways necessary to grant access for the completion and maintenance of this project. A map of the project site, including adjacent streams and roads, is attached hereto as Exhibit A ("Premises").

1. Landowner agrees that the PADEP and/or Grantee, its employees, agents and contractors shall have the right to enter upon the Premises to perform work described in "Attachment D, Scope of Work of the DEP Grant Agreement." The right to enter shall also include periodic monitoring visits for the life of this Agreement.
2. By offering the Premises for implementation of this project, Landowner agrees to allow access, design preparation and implementation and repair of the Project, subject to available funds, for the duration of construction and for the time period identified in Section 1, Paragraph B (10) of this Agreement.
3. Grantee agrees the Conservation Practices/Best Management Practices ("CP/BMPs") needed to correct the problems identified in Attachment D

shall be performed according to: Plans Developed by or certified by a Registered Professional Engineer and approved by PADEP.

4. The CP/BMPs shall be maintained pursuant to Section 2, Paragraph C of this Agreement.
5. The Grantee shall be responsible for adherence to the standards set forth in Section 2, Paragraph C and shall not act in any manner inconsistent with the terms of this Agreement.
6. The Landowner and Grantee agree to not destroy, alter or modify CP/BMPs, except to perform needed repairs, for the period covered by this Agreement, not to undertake any action on land under the Landowners control which tends to defeat the purposes of this Agreement.
7. Any marketable credits toward nutrient effluent limits (nutrient reduction credits) that may be realized on account of the Commonwealth funded portion of this project and recognized by the DEP, are the property of the Commonwealth of PA, which maintains full ownership thereof. The Landowner and Grantee recognize and release all rights, claims, title or ownership to the nutrient reduction credits that are generated as a result of the Commonwealth funded portion of the work specified in this Agreement, for the time period covered by the Agreement.
8. Landowner agrees to refund all or part of the grant money paid to it, as determined by the Grantee, if before the expiration date of this Agreement, the Landowner (a) destroys, alters or modifies the CP/BMPs installed, or (b) voluntarily relinquishes control or title to the land on which the CP/BMPs have been established, and the new landowner and/or operator of the land does not agree to maintain the CP/BMPs for the remainder of the terms of this Agreement. If the new landowner agrees to assume Landowner's obligations and to maintain CP/BMPs for the remainder of the terms of this Agreement, then a new Landowner-Agreement shall be executed by the new landowner.
9. This Agreement shall be binding on the parties, their heirs, legal representatives, successors, and assigns.
10. The terms of this Agreement shall be for a period of 20 years.

Section 2 – Additional Agreement Provisions

A. Tenant Provisions N/A

B. Special Conditions (Site Specific Concerns)

_____

_____

_____

_____

_____

C. Operation, Maintenance and Repair Plan (To be attached).

Section 3 – Agreement Signatures

(Landowner Signature)	3-17-07 (Date)
J. Steven Shenenberger (Landowner Name, Please Print)	3-17-07 (Date)
(Landowner Signature)	(Date)
(Landowner Name, Please Print)	(Date)
(Grantee Representative Signature)	(Date)
(Grantee Representative, Please Print)	(Date)

Operation, Maintenance and Repair Plan

Proper operation and maintenance of Conservation Practices is critical for their success and longevity. The goal of this project is the construction of a mine drainage treatment system for the improvement of water quality of a deep mine discharge to Morgan Run.

1. Components of the Project:
    a. equalization basin
    b. vertical flow pond A
    c. settling basin A
    d. vertical flow pond B
    e. settling basin B
    f. vertical flow pond C
    g. settling basin C
    h. limestone pond

2. Parties agree to perform all Maintenance Tasks as described in the chart at the end of the document.

3. Allowed Activities:
    a. Hiking
    b. Hunting with permission

    Prohibited Activities:
    a. Destruction of treatment system
    b. Illegal dumping

4. The Grantee shall be considered to be in breach of this Agreement if he/she does not maintain and repair the project in compliance with this agreement or willfully neglects any other terms of this agreement.

5. The Landowner and Grantee agrees to comply with all Federal, State, local laws, rules and regulations.

6. The Grantee or appropriate project partners shall be responsible for all normal, routine maintenance, routine repair of the site and project.

7. Other Special Conditions:

Maintenance Tasks

Maintenance Required	Visually check systems for problems: leaves, animals, etc.
Schedule	Monthly
Responsible Party	CCCD, MRWG, or CCWA
Maintenance Required	Check systems for automatic flushing
Schedule	Monthly
Responsible Party	CCCD, MRWG, or CCWA
Maintenance Required	Manually flush systems quarterly
Schedule	March, June, September, December
Responsible Party	CCCD, MRWG, or CCWA
Maintenance Required	Field testing of water quality exiting system
Schedule	Monthly for 1-year, quarterly after
Responsible Party	CCCD, MRWG, or CCWA