Annual Monitoring Report 2008

Grapevine South Surface Mine
Grapevine Creek Stream Restoration

1.0 Applicant

Central Appalachia Mining, LLC (CAM) located at P.O. Box 1169, 265 Hambley Blvd., Pikeville, Kentucky 41502 is the entity responsible for this project. CAM contracted Heritage Technical Associates (HTA) of Chapmanville, WV to conduct annual monitoring for mitigation actions associated with the Grapevine South Surface Mine located near Edgarton in Mingo County, West Virginia (Attachment 1). If any questions should arise concerning this project please contact Heritage Technical Associates, Inc. (HTA) of Chapmanville, WV.

2.0 Introduction

Mitigation actions for Grapevine Creek have been completed. These actions included long-term physical structure and stability of the channel, establishment of native species within the riparian zone where appropriate and practicable, and enhancement to the aquatic habitat by the installation of Cross Vanes. Annual monitoring of the mitigation actions is required per the Compensatory Mitigation Plan (CMP). Field assessments of these actions have indicated that the stream channel has been contained by the placement of Cross Vanes, the riparian zone has a vegetative cover, and pools have been created that improve aquatic habitat.

3.0 Purpose

This is the third Annual Monitoring Report (AMR) that has been conducted for Grapevine Creek. The As-Built Report was submitted in January 2005. This is the fourth year for the project. This report assesses mitigation efforts implemented to compensate for impacts of the Grapevine South Surface Mine. Section I, Monitoring and Long-Term Management, of the CMP requires annual monitoring in order to determine the success of the restoration plan based on CMP performance standards. The CMP stipulates completion of in-stream structures and seeding of the stream restoration area within Grapevine Creek, a tributary of the Tug Fork River. The scope of the restoration efforts associated with Grapevine Creek includes: long-term physical structure and stability of the channel, establishment of native species within the riparian zone, and enhancement to the aquatic habitat by installation of Cross Vanes.

Grapevine Creek restoration was completed during Phases II and III of the mitigation plan. To achieve long-term channel stability, 30 rock Cross Vanes and 3 J-hooks were constructed within Grapevine Creek. Stream restoration began at Cross Vane 1(3+50), and terminated at Cross Vane 33 (81+81.64), compiling a total length of 7831.64 linear feet. Cross vanes were placed at approximately 235’ foot intervals, which

approximates seven bankfull widths, throughout the length of stream. Attachment 2 illustrates the As-Built location of the Cross Vanes and the J-hook structures in comparison to the proposed locations.

To quantify success of the in-stream structures, conditions of the structures were examined and compared to the initial as-built configuration. Additional monitoring conducted included analyses of benthic macroinvertebrate surveys, water chemistry, habitat survey, stream channel stability and documentation of vegetative cover. Vantage points, areas with long continual vistas of riparian disturbances, were selected along the stream to assist in annual evaluation and documentation. Annual photographs, taken from the same locations, were used to monitor and compare the progression and naturalization of the mitigation sites. A detailed description of management actions implemented throughout the year and photographic confirmation of the mitigation efforts are also incorporated.

4.0 Project Overview

The primary objective for this restoration plan was to construct a stream channel capable of supporting an ecosystem comparable to the pre-mitigation ecosystem, while minimizing impacts from past mining practices. The jurisdictional waters proposed for impact have a heterotrophic[1] food web[2]. In this type of system, coarse particulate organic matter (CPOM), such as leaves, sticks or wood, provides the primary source of energy to aquatic organisms. The organisms that feed on CPOM may be transported downstream, providing food for larger organisms and fish. The constructed stream channels are anticipated to maintain a similar heterotrophic ecosystem, while reducing channel instabilities.

The stream restoration techniques implemented more than compensate for the anticipated impacts to jurisdictional waters. The completion of mitigation efforts and water quality improvements, which are expected after the remining of this project, will provide a habitat with the potential for an increase in the number and diversity of organisms within the stream.

4.1 Project Goals and Objectives

Mitigation actions were implemented in order to produce a more stable stream channel with an equivalent or improved ecosystem in the areas of temporary impacts and below the valley fills.

Stream restoration structures have been constructed in Grapevine Creek to create a diverse habitat, dissipate energy within the channel, and control the anticipated erosional stresses. The stream restoration structures installed are capable of accommodating "bankfull" flow events and will enhance channel morphology.

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[1]Heterotrophic is defined as “obtaining nourishment from organic substances,...” (The American Heritage Dictionary, Second College Edition, 1982.)

[2]An heterotrophic food web derives its energy source from the contribution of organic matter from other sources such as leaves, sticks and wood as compared to an autotrophic system which produces energy from photosynthesis.

The jurisdictional waters impacted in the foot print of the Ponds 1 & 1A, Pond 2, Pond 11, Valley fills (1,2,3) and the Haulroad Crossing were offset by the stream restoration in Grapevine Creek of the Tug River.

The Grapevine Creek mitigation objectives also included the planting of native species of flora within the riparian zone. These remedial actions included seeding all disturbed areas in the riparian zones with native grasses and planting native shrubs and trees. These stream restoration measures are intended to increase soil stability, reduce erosion potential, and enhance the aquatic habitat by providing shade and CPOM to the ecosystem. Re-vegetation of the riparian zone assures that ecological functions, present prior to mitigation, return to the restored streams.

During construction, precautions were taken to minimize disturbance of the existing riparian zone and reduce or prevent erosion and sedimentation from occurring as presented in prior reports. Precautions taken included, leaving larger trees intact and placing hay bales downstream to impede sediment movement related to Cross Vane construction.

Thus far, the restoration plan has proven successful by accomplishing the primary goal: to establish a stable channel capable of supporting an ecosystem comparable to the pre-mitigation ecosystem, while minimizing impacts from past mining practices.

4.2 Performance Standards

The performance or success standards for this mitigation plan have established qualitative and quantitative gauges of success. Performance standards, set forth in the CMP previously accepted by the USACE, are described in detail below.

4.2.1 Riparian Zone Vegetation

The project will be considered successful if native species are established upon at least 80% of the mitigation sites. The species proposed for establishment upon the mitigation sites are considered to be native species. It is also anticipated that natural succession will occur and that tree species that are present around the mitigation sites will begin to migrate into the mitigation sites. The project will not be considered successful if non-native species prevent at least 80% of the site from being established in native species as proposed in this CMP. The success will be determined by visual inspection and inventory of the site.

4.2.2 Stream Stability

The stream morphology will be visually examined to determine if erosion is controlled. The project will be considered successful if the stream and the structures proposed to be installed are stable, both laterally and vertically.

4.2.3 Stream Geometry

The mitigation plan will be deemed successful if the structures proposed are constructed in the approximate location proposed in the preplans. The structures should have a vertical tolerance of ± 1 foot. Stream channel geometry will be surveyed on an as needed basis.

4.2.4 Benthic Populations

Benthic populations will be monitored until the project is determined successful by the USACE. Benthic analysis will help assess the overall health of the restored stream. However, benthic populations, including the presence of certain species, will not be used as a gauge of success.

4.3 Project Success

The overall project will be deemed a success once the following has occurred: 1) Construction of restored stream channels, 2) Vigorous vegetation has been established in appropriate areas, 3) Native species have been established in over 80 percent of the mitigation site, 4) The reclamation bond for the operation is released by the WVDEP. Since the reclamation bond can only be released after a minimum of five years, the five year project success time frame will be obtained.

Presently, the mitigation plan is progressing as planned and it is anticipated that the project will achieve the proposed performance standards. CAM is responsible for all phases of construction and compliance proposed within the original CMP. CAM is obligated to maintain compliance with criteria set forth in the CMP and make adequate repairs to the site when necessary. The site must meet requirements set forth by the State of West Virginia, including the requirements for water quality improvements stipulated by the WVDEP[3].

CAM has provided the financial assurances needed to achieve project success. Financial assurance guarantees implementation of the proposed mitigation actions and maintenance of the mitigation sites until final acceptance by the USACE. Thus, it is assured that CAM will adequately comply with the requirements within the original CMP.

CAM will not be responsible for damages to the site caused by violations of the proposed restrictive covenants or any damage caused by parties other than Central Appalachian Mining, LLC. Thus far, with the exception of the establishment of at least 80 percent native riparian vegetation, the majority of the mitigation efforts are progressing accordingly. There are no indications that the actions proposed within the CMP will not be successful. However, if mitigation cannot be implemented successfully in the proposed locations, adjacent jurisdictional waters that have also been impacted by mining may be included in a future, revised CMP.

[3] The variance from water quality was granted by the West Virginia Environmental Quality Board (EQB). The authority to grant water quality variances was transferred by the legislature to the WVDEP effective July 1, 2005.

4.4 Monitoring and Management

For at least five years following completion of the mitigation site construction, mitigated areas will be monitored annually to determine project success based on the determined performance standards. Annual monitoring will occur once each calendar year after completion of the project, until final WVDEP reclamation bond release and USACE approval. Areas to be inspected and monitored include the stability of the stream channel and success of the vegetation. Maintenance will be performed on an as-needed basis to assure that CMP objectives are accomplished.

Cross-sections established on as-built maps provide a baseline reference for the restored stream channels. Cross-sections were prepared for critical areas, such as restored channels through the reclaimed sediment pond areas. Cross-sections were also established in other reaches of the restored stream channels in intervals not exceeding 500 feet. These cross-sections will help identify any adverse changes to dimensions of the restored channels. Permanent survey markers were used to monument the cross-sections. Limits of the mitigation reaches were delineated by the establishment of a monument in the form of a marker or sign.

Mitigation sites were not fenced, since the restored streams provide water resources for the wildlife indigenous to the area.

Five representative sections, vantage points, with long continual vistas of riparian disturbances were selected along the stream to assist in annual evaluation and documentation. Photographs will be taken from the same locations annually to monitor and compare the progression and naturalization of the mitigation sites.

5.0 Site Integrity

The integrity of the site is guaranteed by CAM through the implementation of the restrictive covenants set forth in the agreement with the landowner. The current landowners are Logan Coal and Timber Corp., 37 North Road, Building 2, Paoli, PA 19301 and Heartwood Forestland Fund II, P. O. Box 916, Chapel Hill, NC 27515[4].

Restrictive covenant areas are depicted on maps enclosed in the CMP (Attachment 20) previously accepted by the USACE.

6.0 Mitigation Actions

For this AMR, CAM has proposed to revise the phases within the mitigation plan to reflect the actual impacts of the project and the mitigation required to offset the actual impacts. Fewer impacts occurred since the Haulroad Crossing, Haulroad Fill, and Pond 11 were never constructed, altering the mitigation requirements for the project. The proposed mitigation plan consists of four phases. The first three phases of the proposed plan have been successfully completed. Phase IV will be completed at the end of the project. This will see final mitigation within Ponds 2, 1, and 1a which will

[4] Restrictive covenants have been obtained from Logan Coal and Timber Corp. Because the amount of impacts have been lessened, as will be explained in more detail later in this AMR, restrictive covenants from Heartwood Forestland Fund II will not be necessary since restoration measures were not constructed on Heartwood property.

allow for final bond release. Mitigation actions taken to date are described below and illustrated in the phase map (Attachment 3).

6.1 Mitigation Phases

The re-mining operation (Re-mining No. 1 Mine) conducted on adjacent lands has improved the water quality. Thus, the primary restoration objective of this project was to enhance the physical structure of the same stream channel where the water quality improvements occurred. The installation of Cross Vanes (CMP Attachment 13) has accomplished the following: 1) added channel structure, 2) provided vertical stability to the stream, inhibiting further entrenchment, 3) provided lateral stability, preventing the stream from cutting into the natural hillsides and haul road fill banks, and 4) established the formation of channel features such as, pools, glides, riffles, and runs, improving the habitat and the occurrence of natural stream processes.

Phase I – Phase I called for the installation of the Haulroad Crossing on Grapevine Creek. The Haulroad Crossing was not constructed since an existing road was able to be upgraded. By up grading and using the existing road, no temporary impacts to jurisdictional waters occurred (Attachment 3).

Phase II – Completed measures of Phase II included the restoration[5] of Grapevine Creek from 0+00 to 39+00 (Attachment 3). This restoration work began at the most up stream point and progressed in a down stream direction. The restoration activities for this portion of Grapevine Creek added structure and bank stabilization to a stream previously impacted by mining through sediment loads and by construction of public roads, gas transportation lines, power lines and railways. The purpose of the restoration efforts undertaken was to add physical structure to the stream. The installation of the Cross Vanes and J- Hooks (Attachment 2) will provide structure to the streams and: 1) Provide vertical stability to the stream channel to prevent further entrenching, 2) Provide lateral stability to prevent the cutting of the stream into the natural hillsides and the haulroad fill banks, and 3) Provide for the formation of pools, riffles, runs and glides that provide the environment for natural stream processes such as macroinvertebrate reproduction to take place. The installation of Gabions (CMP Attachment 15) from approximately 18+00 to 20+50 on the stream right[6], were not installed. A low-water crossing was

[5] Due to the incised characteristics of the streams to be restored with this CMP which include narrow, confined floodplains and deep entrenchment ratios, it was determined that a "Priority 4" restoration would be most practical. "Priority 1" restoration can not be accomplished because the historical floodplain is very narrow and contains public roads and utilities to which reconnection is impracticable. "Priority 2" restoration cannot be accomplished because a new floodplain and stream pattern cannot be created within the narrow confines of the streams to be restored. "Priority 3" restoration cannot be accomplished because there is no room to widen the floodplain due to the narrow confines of the streams to be restored. "Priority 4" restoration can be accomplished and will stabilize the stream banks in their current location.

[6] Stream 'right' or 'left is based upon viewing the stream in a down-stream direction

constructed into the farm yard of Pliant Mahon by using rock sized 6" to 18". This rock was placed through the stream channel to a depth of 18" and extended outwards from the stream channel for a minimum of 15'. Cross Vanes or J- Hooks were installed at regular intervals in the existing stream channel from 0+00 to 39+00. These Cross Vanes and J- Hooks were installed at intervals of 235' which is approximately 7 bankfull widths[7] in lengths of reaches where no strong stream features were present. This interval was determined using evaluations of other natural streams as a guide. In undisturbed streams of this approximate type, pools have been found to occur on intervals of approximately 5-7:1[8]. Determination of a true bankfull event for this impacted stream was difficult. A portion of the stream appeared not to be impacted by past mining and the channel appears to be undisturbed in this portion. Bankfull width was determined to best of the preparer's knowledge at this location. In other areas, Cross Vanes and J- Hooks were installed to enhance or stabilize the stream features that were already in place. In areas where bedrock is controlling the vertical grade of the stream, emphasis was given to stabilization of the stream bank, if excessive amounts of erosion were present. The riparian zones were seeded and planted with the seed mixture appropriate for the season and tree species as per the CMP. Care was taken during field construction to assure that the large trees presently growing in the riparian zone were left intact and not disturbed. These trees help provide: bank stability, contribution of leaf litter and detritus to the stream, and contribution of seeds to the riparian area. Once the installation of the Cross Vanes and J- Hooks had been initiated, work then commenced in the jurisdictional waters in Valley Fills 1 & 2 and the installation of Pond 2 without additional financial assurances. The Haulroad Fill and Pond 11 were never constructed. Phase II saw the restoration of approximately 3900 lf of perennial stream in Grapevine Creek.

Phase III – Phase III saw the restoration of Grapevine Creek from 39+00 to 81+81.64 (Attachment 3). This restoration work began at the most up stream point and progressed down stream. The restoration activities completed for this portion of Grapevine Creek added structure and bank stabilization to a stream previously impacted by mining through sediment loads and by construction of public roads, gas transportation lines, power lines and railways. The purpose of the restoration efforts undertaken here will be to add physical structure to the stream. The installation of the Cross Vanes and J- Hooks (Attachment 2) provided structure to the stream and: 1) Provide vertical stability to the stream channel to prevent further entrenching, 2) Provide lateral stability to prevent the cutting of the stream

[7] Bankfull width is a typical top width of a stream at the occurrence of a bankfull storm event.
[8] Expressed as Bankfull Width to Distance Between Pools. This ratio tends to hold constant for smaller streams regardless of the actual size of the stream channels. A ratio of 7:1 means that the distance from pool to pool is 7x the width of the stream at bankfull.

into the natural hillsides and the haulroad fill banks, and 3) Provide for the formation of pools, riffles, runs and glides that provide the environment for natural stream processes such as macroinvertebrate colonization to take place. Cross Vanes and J- Hooks were installed at regular intervals in the existing stream channel from (39+00) to (81+81.64). These Cross Vanes and J- Hooks were installed at intervals of 235' which is approximately 7 bankfull widths[9] in lengths of reaches where no strong stream features are present. In other areas, Cross Vanes or J- Hooks were installed to enhance or stabilize the stream features already in place. In areas where bedrock is controlling the vertical grade of the stream, emphasis will be given to stabilization of the stream bank if excessive amounts of erosion are occurring. The riparian zones were seeded and planted with the seed mixture appropriate for the season and tree species set forth above. Care was taken during field construction to assure that the large trees growing in the riparian zone were left intact and not disturbed. These trees help provide bank stability and add detritus to the stream in the form of leaf litter. Once the installation of the Cross Vanes or J-Hooks has been initiated, work may then commence in the jurisdictional waters in Valley Fill 3 and the installation of Ponds 1 & 1A without additional financial assurances. Phase III saw the restoration of approximately 4281 lf of perennial stream in Grapevine Creek.

Phase IV – After mining is completed and final reclamation of the mine site is accomplished, a waiting period of at least two years must expire before the sediment control structures can be removed. At this time, Ponds 1 & 1A, and 2 will be removed and the stream restored through the former footprints of the ponds. Erosion control will be installed and an inner-channel or "bankfull" event channel will be established through the restored stream. Cross Vanes and J- Hooks will be installed to direct and control the stream flows as well as provide stream structure (CMP Attachment 16 for Ponds 1 & 1A, CMP Attachment 17 for Pond 2). These restored stream channels, due to their location at the toes of the valley fills, can be reasonably expected to be intermittent in nature because of the water retention and controlled release properties of valley fills. After restoration has been completed, a stream length of 9240lf (Grapevine Creek restoration) will be restored to compensate for permanent disturbances and a stream length of 1122 lf (pond area restoration) will be restored to offset temporary disturbances.

6.2 Mitigation Summary

A total stream length of 11351 lf will be restored through mitigation efforts (Table 2). The actual permanent stream disturbance length is 9240 lf(Table 1). After considering the temporal effects of 5% for every five year phase [9240+(9240*5%)+(9240*5%)], the total length of mitigation required is

[9] Bankfull width is a typical top width of a stream at the occurrence of a bankfull storm event.

10164 lf. Mitigation efforts will restore a greater length (1187 lf) of channel than is required to offset disturbances[10]. The mitigation efforts above what is required (1187 lf) may be used by CAM to offset future impacts to jurisdictional waters.

Table 1. Proposed Impacts versus Actual Impacts to Jurisdictional Waters

Proposed Impact Features	Proposed Permanent Stream Disturbance (lf)	Proposed Temporary Stream Disturbance (lf)	Actual Permanent Stream Disturbance (lf)	Actual Temporary Stream Disturbance (lf)
Valley Fill 1	1100 lf of intermittent 691 lf of ephemeral	0 lf	1791 lf	0 lf
Valley Fill 2	1768 lf of intermittent	0 lf	1768 lf	0 lf
Valley Fill 3	3381 lf of intermittent 2300 lf of ephemeral	0 lf	5681 lf	0 lf
Pond 1 and 1a	0 lf	700 lf of intermittent	0 lf	700 lf
Pond 2	0 lf	422 lf of intermittent	0 lf	422 lf
Pond 11	0 lf	200 lf of intermittent	0 lf	0 lf
Haulroad fill	700 lf of intermittent 400 lf of ephemeral	0 lf	0 lf	0 lf
Haulroad Crossing	0 lf	100 lf of perennial	0 lf	0 lf
Total Disturbance	**10340 lf total stream**	**1422 lf total stream**	**9240 lf total stream**	**1122 lf total stream**

Table 2. Proposed and Completed Stream Restoration Actions

Stream	Proposed Restoration	Completed Restoration	Phases Addressed
Grapevine Creek	8181 lf of perennial	8181 lf of perennial	II and III
V ditch Channel at Toe of Valley Fill 1	600 lf of ephemeral	0 lf	III
V ditch Channel at Toe of Valley Fill 2	600 lf of ephemeral	0 lf	III
V ditch Channel at Toe of Valley Fill 3	1970 lf of ephemeral	0 lf	III
Total Restoration	**11351 lf total stream**	**8181 lf total stream**	

[10] [Completed stream restoration (4488lf)] minus [Adjusted actual stream disturbance (1531)] = [2957 lf of restored stream above what is required]

7.0 Monitoring and SamplingMethods

Environmental scientists for Heritage Technical Associates, Inc. of Chapmanville, West Virginia conducted the annual monitoring for Grapevine Creek on November 2, 2008. Benthic and water sampling occurred November, 11 2008 for Grapevine Creek. Monitoring and sampling methods are described in detail in the following sections.

7.1 Structures

In stream structures were visually assessed in the field for noticeable changes to structure configuration. Photographs of the structures were taken in order to compare to the previous years pictures of the structures

Grapevine Creek restoration involved the construction of 30 rock Cross Vanes and 3 J-hooks within the stream. Mitigation practices began at Cross Vane 1 (3+50) and terminated at Cross Vane 33 (81+81.64), amassing a total stream length of 7831.64 lf. Cross vanes were installed at intervals of 235' which is approximately 7 bankfull widths[11] in lengths of reaches where no strong stream features were present.

Cross Vane 9 was repaired after the 2007 AMR considered the structure as failing due to the fact that the water is traveling along the side of the structure eroding the bank rather than flowing over the cross vane structure as planned. Bank erosion has been reduced however the streams major flow is still traveling along the left descending bank of the structure. Cross Vane 32 continued to appear washed out and there was no pool forming as a result. Corrective measures will be taken to fix the problematic areas. Representative photographs for these problematic cross vane structures can be found in Attachment 6.

During the 2005 annual monitoring it was observed that structure 10 was not constructed in its proposed location (25+62) and was relocated to (25+95). Although the J-hook was only moved 33 feet downstream, the exact, proposed location of this structure was crucial to ensure functionality. J-hooks are generally constructed upstream from meander bends with erosive outer banks in order to decrease erosional stresses. This is accomplished by diverting flow away from the bank and creating a pool behind the structure. The structure was constructed within the downstream portion of a meander bend and was located in the glide of a natural pool.

Since the structure was located downstream from the bank that it was intended to protect and form a natural pool, the structure has not performed as intended. During 2006 annual monitoring it was observed that the functionality of structure 10 has continued to decrease within the past year. The stream now flows beside, rather than over the structure. During the 2008 monitoring, generally no water was flowing over structure 10. Although there is still some sediment that continues to fill in the pool, limiting its function, a small pool has begun to be created. Since structure 10 is not functioning as well as intended it will continue to be monitored closely.

[11] Bankfull width is a typical top width of a stream at the occurrence of a bankfull storm event. See Footnote 13 above.

The 2007 AMR determined structure 11, a J-hook located 75 feet downstream from structure 10, did not appear to be functioning as intended and although the J-hook appears to be in a location that does not contradict channel morphology, the structure has not generated a pool feature within the channel. Currently there is a small pool forming within the channel. The functionality of this structure will continue to be monitored closely.

Representative photographs depicting the current Cross Vane and J-Hook configurations are located on the map in Attachment 2.

7.2 Erosion Control

Stream morphology was visually examined to determine if erosion had been controlled during the past year. The stream channel and restoration structures were inspected to determine if they were stable, both laterally and vertically. The channel appears to have a similar morphology to the channel form assessed immediately after as-built completion. Since no noticeable bank instabilities have occurred as a result of undercut banks, it is concluded that the in-stream structures have successfully dissipated energy, relieved near bank stresses and achieved lateral stability.

Thirty-one of the 33 water control structures (Cross Vanes and J-Hooks) are functioning as intended, with the exception of cross vanes 9 and 32, however cross vane 32 is not causing any bank erosion problems. The water flowing around cross vane 9 is still causing a small amount of bank erosion but less than was observed in previous monitoring. The cross vane structure is still in place and would function properly, however the water is not flowing over the structure as intended. J hooks 10 and 11 appear to have begun functioning as intended creating pools and preventing bank erosion. During the 2006 AMR J hook structures 10 and 11 proved to be problematic areas, however, corrective measures taken during the previous years have enabled the structures to begin functioning properly.

7.3 Vegetation

Five representative sections, Vantage Points, with long continual vistas of riparian disturbances along the stream were used to quantify the vegetative progression of the restored sites in comparison to the pre-existing vegetative conditions. Vantage Points 1 through 5 were located along Grapevine Creek (Attachment 5). Each Vantage Point has an upstream and downstream photograph and can be found in Attachment 5. Vantage Point photographs and visual evaluations conducted in the field were used to document and compare annual site assessments.

During construction, precautions were taken to minimize disturbances to the existing riparian zone. Precautions included leaving larger trees intact and placing hay bales downstream to impede sediment movement relating to Cross Vane construction. After completion of the in-steam structures, disturbed areas were seeded to maintain bank stability and reduce erosion. Fertilizer was applied during seeding at the rate of 600 lbs/ac. The fertilizer rate was 10-20-10.

The vegetative seed mixture applied to the streambanks was seed mix 1 (CMP, Section D) that naturally occur on streambanks and was selected for optimal growth. Seeding was conducted on July 7, 2006. The established grasses have yet to be documented.

Tree planting occurred during March of 2006 when the trees became available from the nursery. Trees were planted on five foot staggered intervals immediately above the restored stream channel. The trees selected for the riparian zone enhancement are native to riparian zones and include Wild Black Cherry (*prunus serrotina*), Sycamore (*Plantinus occidentalis*), and Willow Cuttings (*Salix purpurea*). These trees will help supply bank stability to prevent erosion, shade the stream, and produce Course Particulate Organic Matter (CPOM) from detrital input for the aquatic ecosystem.

The vegetation survey for the 2006 Annual Report was conducted in September. The planted sycamore appeared to have the largest presence. Wild Black Cherry was observed but most of these saplings did not survive. Willow was also observed but less frequent than sycamore. Common vegetation, apart from the planted species, identified throughout the Vantage Point areas include jewel weed (*Impatiens capensis*), joe pye weed (*Eupatorium fistulosum*), japanese knotweed (*Polygonum aviculare*), colts foot (*Tussilago farfara*), lespedeza (*Lespedeza sp.*), autumn olive (*Elaeagnus umbellata*), and grass species.

Mitigation areas were examined to determine if invasive species such as knotweed or kudzu had invaded. Knotweed comprises most of the vegetation at vantage points 1, 2, 3, 5 and surrounding areas (Attachment 5). Lespedeza was also observed near vantage point 2 (Attachment 5) in the upper reach of Grapevine Creek. Efforts may be implemented to maintain native species within these sites if the invasive species is deemed controllable.

7.4 Benthic Macroinvertebrate Survey Analysis

Benthic macroivertebrates were monitored to help assess the overall health of the restored stream. However, benthic population, including the presence of certain species, will not be used for the gauge of success for this restoration project.

Benthic macroinvertebrates were sampled in accordance with the Standard Conditions for Environmental Assessments on Wadeable Streams issued by the West Virginia Division of Natural Resources and Scientific Collection Permits, which are based upon the United States Environmental Protection Agency (EPA) Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers. This survey provides taxonomical baseline data on the benthic macroinvertebrates collected, substrate composition, habitat composition, and physical stream characteristics present between October 15, 2008 and December 15, 2008.

The benthic macroinvertebrate site was chosen based on stream features, pre-determined Vantage Points and on the Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers.[12] Approximate location of the collection site in

[12] Site locations for benthic samples were based upon the EPA Interim Chemical and Biological Protocols for Mountaintop Removal

relation to proposed permit boundaries, stream delineation, valley fills, and associated sediment ponds are indicated in Attachment 1.

The sample were collected with a 0.5 meter rectangular dipnet. The bottom substrate was disturbed for approximately 0.25m² by foot and hand in front of the net. The coarse Particular Organic Matter (CPOM) and Fine Particulate Organic mater (FPOM) were allowed to flow into the dipnet. After suspended materials settled the net was lifted from the sample location. The net contents were washed into a five-gallon bucket. Larger materials (pebbles > 20 mm, leaves or sticks) were washed and discarded from the sample. The sample was poured into a sieve to remove excess water and fine soil particles. The sieve was rinsed into a one liter sample container. This procedure was repeated until four riffle/run sections were sampled. After completion of the final sample location the rectangular kick net and five gallon bucket were closely examined for any remaining debris and or macroinvertebrates. Remaining debris and or macroinvertebrates found were placed into the sample container. Ninety-five percent ethanol was added to each sample for preservation.

Benthic Macroinvertebrates sample sorting and identification was based on a 200 ± 20 percent organism sub-sample procedure. Samples were rinsed and spread evenly over a 36 cm x 30 cm pan. A 6 cm x 6 cm grid was placed over the sample and random generated numbers determined the grid that would be identified. This was repeated until a sub-sample of 220 organisms was removed. All grids were inspected in situations where 200 organisms were not present. Species were identified to the family level using the key in Aquatic Insects of North America. Attachment 4 contains benthic survey results in detail, habitat assessments, stream characterization, representative photographs, watershed features and sediment/substrate types.

Ranges and ranks of the WVSCI are shown in Table 3.

Table 3. Scoring Criteria for the WVSCI

WVSCI Scoring Criteria	
Not-Impaired	78.01-100 = Very Good
	68.01-78.00 = Good
	60.61-68.00 = "Gray Zone"
Impaired	45.01-60.60 = Slightly Impaired
	22.01-45.00 = Moderately Impaired
	0-22.00 = Severely Impaired

8.0 Proposed or Implemented Corrective Measures

Cross vane structures 9 and 32 will be closely monitored and corrective measures will be applied if necessary. No major corrective measures are

necessary to assure structure stability. All other structures are stable and functioning properly.

9.0 Discussion of Success Criteria

Annual monitoring has been conducted on Grapevine Creek for the stream impacts associated with the Grapevine South Surface Mine in order to evaluate success of the restoration plan. Mitigation actions should produce a more stable stream channel with an equivalent or improved ecosystem in the areas of temporary and permanent impacts associated with valley fills. The CMP stipulates completion of in-stream structures (As-Built) and seeding of the stream restoration area within Grapevine Creek. The project will be deemed a success once the following have occurred: 1) Restored stream channels have been constructed, 2) Vigorous vegetation has been established in appropriate areas, 3) Native species are present in over 80 percent of the mitigation sites, 4) The reclamation bond for the operation is released by the WVDEP.

The restored stream channel has been constructed. Control structures were established within Grapevine Creek to create a diverse habitat, dissipate energy within the channel, and control the anticipated erosional stresses. 33 rock structures were constructed to stabilize Grapevine Creek. To quantify success of the in-stream structures, stability conditions were visually examined and compared to initial as-built configurations. Thirty-one of the 33 water control structures appeared to be functioning as intended, with the exception of cross vane structures 9 and 32 within Grapevine Creek. Corrective actions will be taken to fix these problematic areas if deemed necessary along with continued monitoring .

Stream morphology was visually examined to determine if erosion has been controlled during the past year. The stream channel was inspected to determine if the bed and banks were stable, both laterally and vertically. Since no measurable bank instabilities have occurred since the mitigation actions, it is concluded that the in-stream structures have successfully dissipated energy and relieved near bank stresses.

Riparian zone enhancement involved seeding with native grasses and planting native shrubs and trees. These restoration practices are anticipated to increase soil stability, reduce erosion potential, and enhance the aquatic habitat by providing shade and CPOM to the ecosystem. Vegetating the riparian zone will assure that ecological functions, present prior to mitigation, return to the restored streams.

Annual Vantage Point photographs have proved to be an efficient method to determine the naturalization of vegetation within the mitigation sites. Planted tree saplings were observed on Grapevine Creek. The propagation of knotweed along vantage points (1, 2, 3, 5) could be hindering the establishment of native species. These areas will be monitored and, as the mitigation sites mature, if the invasive species can be controlled corrective actions will be taken.

Two of the 3 planted tree species (sycamore and willow) were identified along Grapevine Creek. The black cherry saplings did not survive. The presence of some invasive species including knotweed and autumn olive will need to be monitored.

10.0 Conclusions

Mitigation actions have increased channel stability, and decreased erosion potential by reducing near bank stresses with water control structures. It is anticipated

that an equivalent or improved ecosystem will develop in the areas of temporary and permanent impacts associated with valley fills. Results from the annual monitoring conducted during November of 2008 will be compared to future monitoring to evaluate habitat, vegetative progression and channel morphology.

No major corrective measures associated with channel stability were found to be necessary. Channel geometry appeared stable, with all structures intact and functioning as intended, except for cross vane structures 9 and 32 which will be reevaluated in 2009.

Planted saplings will be monitored closely during the next calendar year to determine their survival status. Vegetation will be monitored and if the invasive species are controllable corrective actions will be taken.

The benthic assessment conducted in 2008 was slightly different from results from 2007 and 2006. Analyses from 2008 indicate that the stream is "Slightly Impaired", while past data characterized the stream as "within the Gray Zone". The gray zone indicates that further research is necessary to adequately describe the stream. The number of organisms per amount of sample was not a limiting factor in 2008. The sample was overflowing with organisms, but these organisms were dominated by Elmidae taxa. Accordingly, the WVSCI score in 2008 was directly affected by this lack of diversity. In previous sampling years, there was slightly greater species diversity but the identified species were comparable. Future sampling will accurately characterize this portion of Grapevine Creek. The habitat assessment score remained in the suboptimal range.

Thus far, the restoration plan has accomplished the primary restoration objective: to achieve long-term physical structure and stability of the channel. The establishment of native vegetation within the riparian zone may be complicated by invasive species. Planted saplings will be monitored closely during the next calendar year to determine their survival status. Stream restoration has been completed. This year's annual report has demonstrated success of the mitigation actions: channel stability, and the establishment of vegetation.

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