Permit Number

USACE Individual Permit No. 200500359

WVDEP Permit No. S-5009-05

NPDES No. WV1022822

Contact Information

Permittee: Consol of KY, Inc.
1800 Washington Road
Pittsburgh, Pennsylvania 15241
(304) 369-8132

Consultant: P & A Engineers and Consultants, Inc.
P.O. Box 279
Louisa, KY 41230
(606) 673-4413

1. Monitoring Parties

P&A Engineers and Consultants, Inc. (P&A) was retained by Consol of Kentucky, Inc. (Consol) to document and evaluate the off-site mitigation for the MT-500 Surface Mine and prepare the Year 2 Monitoring Report. The stream mitigation specified herein provides compensation for the permanent impacts to jurisdictional waters, as well as offsets temporal loss, as it was constructed prior to or concurrent with the occurrence of stream impacts on MT-500 Surface Mine. Blue Line commenced construction in October 2008 and P&A performed the as-built surveying and Year 1 monitoring assessments in December 2009. P&A Engineers and Consultants, Inc evaluated the project again in December 2011 to satisfy monitoring requirements as part of the Compensatory Mitigation Plan (CMP; REIC 2006; JCS 2006).

1.2 Summary of Project Purpose

The purpose of the approved CMP was to replace resource functions impacted by the proposed valley fills, sediment ponds, and temporary impact areas at the MT-500 Surface Mine, and to offset those impacted functions by providing enhancements, creations, and restorations at the permit area. The total jurisdictional water impacts at the MT-500 Surface Mine were originally permitted for 22,800 linear feet (2.819 ac) of intermittent and ephemeral impact, of which 2,889 linear feet (0.537 ac) is temporary impact and 19,911 linear feet (2.282 ac) is permanent impact. However the project as currently constructed and finished resulted in far fewer impacts than originally planned, having only 12,040 linear feet of permanent stream impact and 1,642 linear feet of temporary stream impacts (see CONSOL letter to USACE dated December 22, 2012).

1.3 Location Description and Direction to Mitigation Area

The project is located on the Williamson 7.5-minute USGS quadrangle, two miles northeast of the community of Nolan, in Mingo County, West Virginia. The mitigation project proposes to enhance sections of Miller Creek, a tributary of the Tug River and sections of Mill Creek, a tributary of Miller Creek. Sections of Miller Creek will be enhanced from the approximate location where Peg Fork enters Miller Creek approximately located at 37º 44' 36.9" Latitude and 82º 16' 52.1" Longitude, and extending downstream to the mouth of Mill Creek approximately located at 37º 44' 34.2" Latitude and 82º 17' 26.7" Longitude. The Mill Creek habitat enhancements will encompass approximately 1,335 linear feet (0.495 ac) from an old ATV crossing located approximately at 37º 44' 14.7" Latitude and 82º 17' 19.3" Longitude, downstream to a road crossing approximately at 37º 44' 26.3" Latitude and 82º 17' 22.8" Longitude.

1.4 Performance & Progress

In October of 2008, Blueline Stream commenced construction on the approved Compensatory Mitigation Project for the impacted waters of Consol of Kentucky's MT-500 Surface Mine. As of January 2010, 100% of the mitigation has been completed for the Mill Fork segments of the approved CMP. Most of the Miller Creek mitigation was implemented as of January 2010, however approximately 2,500 linear feet of mitigation on Miller Creek is currently being installed. This implementation schedule proposed in the September 12, 2011 CONSOL letter to the USACE was approved by the USACE in a letter dated October 12, 2011. On site mitigation for sediment ponds and associated temporary impacts at Consol's MT-500 Surface Mine will be completed upon Phase II bond release. December 2009, P&A Engineers conducted an As-Built Survey and Year 1 monitoring for the completed areas, and completed an As-Built Status Report in February on 2010. For this report, P&A conducted the Year 2 monitoring in December 2011. Unfortunately, due to high flow events monitoring assessments were limited to only habitat assessments and vegetation plots. Consol anticipates conducting a full monitoring assessment in the spring of 2012.

1.5 Performance Standard Compliance

Success of mitigation activities are dependent upon the use of natural design techniques and concepts applicable for enhancing and restoring stream channels proposed in the Compensatory Mitigation Plan (CMP). Construction must proceed in a manner that will ultimately provide a stable environment for aquatic habitat and comply with performance standards predicted in the CMP. During monitoring, evaluations to measure success will be conducted by qualified personnel to quantify success as it relates to the specific performance standards provided in the mitigation plan.

Low and high gradient habitat assessments and representative pebble counts were conducted throughout the project reaches during the as-built survey and Year 1 monitoring. As specified in the performance standards of the approved CMP, one year after completion, annual functional assessments will be conducted each following year

for a period of five (5) years. In the process of the as-built surveys, the mitigation sites were monitored and measured for detailed morphology, habitat, substrate, and riparian parameters. Photographs were taken to visually confirm channel stability and proper construction. Utilizing EPA's Rapid Bioassessment Protocol, habitat assessments were also conducted at mitigation. Although not required in the approved CMP, representative pebble counts were conducted in order to evaluate substrate composition. Riparian evaluations were conducted, and compared to pre-mining data to demonstrate success. A series of Rosgen-type morphological cross-sections were collected to monitor the morphology pre- and post-mitigation.

1.6 Corrective/Maintenance Activity Dates

Mitigation reaches shall be monitored and maintained in accordance with all directives stated in the IP Authorization Special Conditions. If and/or when corrective or maintenance measures are required, Consol of Kentucky, Inc. will ensure that correct procedures are utilized to rectify identified deficiencies. Since construction, there have been no corrective or maintenance measures required for the mitigation sites of Mill Fork and Miller Creek. However, based in part on results from annual monitoring, Consol has taken steps toward commencing minimal maintenance work associated with structures within Mill Fork and Miller Creek.

2.0 MONITORING ASSESSMENTS

2.1 Stream Survey

Throughout the two (2) mitigation reaches, a total of eight (8) cross-sections were measured during the as-built survey; four (4) were established in Mill Fork, and four (4) were established in Miller Creek. Because the drainage area of the two streams does not change in the mitigation reachs of Mill Fork and Miller Creek, the measurements from those cross sections are averaged in Table 1. The average bankfull width of Mill Fork was 14.81 feet, while the average mean depth was 0.60 feet, resulting in a width/depth ratio of 8.71. The average bankfull width of Miller Creek was 19.16 feet, while the average mean depth was 0.57 feet, resulting in a width/depth ratio of 11.44.

The as-built maps for Mill Fork and Miller Creek show the specific habitat monitoring "stations", locations of the cross-sections measured in each mitigation reach, and include the cross-sections themselves. During the field visit for annual monitoring the watershed was experiencing heavy inundation due to storm events. Longitudinal profiles and cross sections were not conducted due to the heavy flows. A summary of the averaged mitigation morphological parameters for each reach is provided in **Table 1**.

Table 1: As-Built Morphological Parameters of Mill Fork and Miller Creek Upper & Lower Reaches

Parameters		Mill Fork Reach	Miller Creek Reach
Rosgen Stream Type		B4	B4c
Drainage Area (sq mi)		1.6	4.7
Reach Length (ft)		1444	3116
Dimension	Bankfull Width (ft)	14.8	19.2
	Bankfull Area (sq ft)	33.6	36.1
	Mean Depth (ft)	0.6	0.6
	Width/Depth Ratio	8.7	11.4
	Max Depth (ft)	1.8	1.7
	Flood prone Width (ft)	20.1	25.6
	Entrenchment Ratio	1.4	1.3
	Bank Height Ratio	2.0	2.0
Profile	Channel Slope (%)	2.2	1.1
	Average Pool to Pool Spacing (ft)	114.1	101.8
Pattern	Sinuosity	1.2	1.2
	Average Radius of Curvature (ft)	52.8	102.8

2.2 Longitudinal Profile

The mitigation reaches of Mill Fork and Miller Creek are classified as low gradient, perennial stream channels. Neither reach qualified as a high gradient stream. The Mill Fork reach was measured to be approximately 1444 linear feet long with an average channel slope of 2.2%. The Miller Creek reach was measured to be approximately 3116 linear feet long with an average channel slope of 1.1%.

2.3 Habitat Assessments

A total of four (4) habitat assessments were conducted throughout the reaches. Two (2) low gradient assessments in Miller Creek (one at each station), and two (2) assessments in Mill Fork (one at each station). The assessment sites selected for each reach are representative of the conditions along the entire length of each mitigation reach. These habitat assessments resulted in a Habitat Assessment Value (HAV) for each station. HAV scores for the entire project ranged from 143 to 149 with an average score of 146 **(Table 2)**.

Table 2: Habitat Assessment Values for Enhanced Reaches of Mill Fork and Miller Creek 2010

Habitat Parameters	Mill Fork Station 1	Mill Fork Station 2	Miller Creek Station 1	Miller Creek Station 2
1. Epifaunal Substrate/ Cover	9	14	12	12
2. Pool Substrate Characterization*	9	8	11	8
3. Pool Variability*	8	9	9	9
4. Sediment Deposition	12	7	12	17
5. Channel Flow Status	11	13	18	9
6. Channel Alteration	11	8	11	8
7. Channel Sinuosity*	12	13	9	8
8a. Bank Stability (left)	7	3	7	8
8b. Bank Stability (right)	9	4	7	8
9a. Vegetative Protection (left)	8	3	6	5
9b. Vegetative Protection (right)	6	5	6	5
10a. Riparian Vegetative Zone Width (left)	9	3	9	9
10b. Riparian Vegetative Zone Width (right)	2	8	9	7
HAV Score	113	98	116	113

Table 3: Habitat Assessment Values for Enhanced Reaches of Mill Fork and Miller Creek 2011

Habitat Parameters	Mill Fork Station 1	Mill Fork Station 2	Miller Creek Station 1	Miller Creek Station 2
1. Epifaunal Substrate/ Cover	14	16	16	15
2. Pool Substrate Characterization*	13	16	12	12
3. Pool Variability*	16	16	14	14
4. Sediment Deposition	15	11	16	14
5. Channel Flow Status	16	13	16	15
6. Channel Alteration	16	16	16	16
7. Channel Sinuosity*	11	11	13	13
8a. Bank Stability (left)	9	8	8	8
8b. Bank Stability (right)	9	8	8	8
9a. Vegetative Protection (left)	8	8	7	8
9b. Vegetative Protection (right)	7	8	6	6
10a. Riparian Vegetative Zone Width (left)	8	8	7	8
10b. Riparian Vegetative Zone Width (right)	7	8	6	6
HAV Score	149	147	145	143

2.3.1 Mill Fork Station 1 Habitat Assessment

This habitat assessment was conducted at cross-section 1-1' in a riffle downstream from rootwad 1, and approximately 260 feet upstream from the mouth of the mitigation reach (Mill Fork Mitigation Map). The structures throughout this mitigation reach included 3 rootwads, 1 stream crossing, and improvements to riparian vegetation.

The reach contains a mix of stable habitat and is well suited for full colonization potential. Large woody debris was somewhat restricted, but is expected to increase as the the project matures. Overall, there was a mixture of fine particle sizes with some cobble and gravel substrate resulting in sub-optimal Epifaunal Substrate and pool substrate. In this segment of the stream the number of shallow pools had increased due to the installation of structures, resulting in an optimal score for Pool Variability. Because the channel dimension was restored throughout this segment of Mill Fork, there was minimal sediment deposition. Channel Flow Status at this station received an optimal score with over 75 percent of the channel being filled with water, while water reached the base of both lower banks. The lack of past channelization or dredging resulted in an optimal score in Channel Alteration. Various meanders occurred in this segment leading to a score of sub-optimal in Channel Sinuosity. Bank Stability for both the left and right banks received a score of optimal due to the success of stabilization measures and riparian planting. Both left and right banks scored sub-optimal in Vegetative Protection due to a slight amount of bare soil being visible through the bank vegetation. Riparian Vegetation for the left bank scored sub-optimal because of some past timbering and an existing road. Overall, the low gradient HAV score was 149 (optimal) for Mill Fork Station 1 during the assessment.

2.3.2 Mill Fork Station 2 Habitat Assessment

This habitat assessment was conducted at cross-section 4-4' in a riffle downstream from root wad 1, and approximately 1324 feet upstream from the mouth of the mitigation reach (Mill Fork Mitigation Map). The structures throughout this enhancement reach included 3 rootwads, 1 stream crossing, and improvements to riparian vegetation.

This station contains a mix of stable habitat and is somewhat suited for full colonization potential. The abundance of cobble and gravel substrate with low surrounding sediment deposition resulted in a low optimal score for Epifaunal Substrate. A higher content of sand and mud rather than cobble substrate in the pool areas resulted in this station receiving a sub-optimal score for Pool Substrate. In this segment of the stream an increased number of shallow pools existed, resulting in a sub-optimal score for Pool Variability. This segment of Mill Fork exhibited little or no enlargement of islands or point bars formations, and therefore received an optimal score for Sediment Deposition. Channel Flow Status at this station received an optimal score with over 75 percent of the channel being filled with water, while water reached the base of both lower banks. Channel Alteration received a score of optimal score due to the success of riparian protection. Various meanders occurred in this segment leading to a score of sub-optimal in Channel Sinuosity. Bank Stability for the left and right banks received a score of sub-optimal due to the success of riparian protection. Both left and right banks scored low sub-optimal in Vegetative Protection because of some areas are not fully vegetated.

Riparian Vegetation for the left and right bank received a score of sub-optimal having a thicker abundance of woody vegetation. Overall, the low gradient HAV score was 145 (suboptimal) for Mill Fork Station 2 during the survey.

2.3.3 Miller Creek Station 1 Habitat Assessment

This habitat assessment was conducted at cross-section 4-4' in a riffle slightly downstream from Log Cross Vane 4, and approximately 2,527 feet upstream from the mouth of the mitigation reach (Miller Creek Mitigation Map). The structures throughout this enhancement reach included 6 log cross vanes, 6 log vanes, and improvements to riparian vegetation.

This station contains a mix of stable habitat and is suited for full colonization potential. The abundance of cobble and gravel substrate with low surrounding sediment deposition resulted in a sub-optimal score for Epifaunal Substrate. A low content of sand and mud in the pool areas resulted in this station receiving a sub-optimal score for Pool Substrate. An increased number of shallow pools existed for this segment of stream, resulting in a sub-optimal score for Pool Variability. Formation of bars and other forms of sediment deposits for this segment were low, therefore resulted in a sub-optimal score for Sediment Deposition. Channel Flow Status at this station received a sub-optimal score with approximately 75 percent of the channel being filled with water. Channel Alteration received a score of optimal due to mitigation structures successfully restoring channel dimension. A slightly lower amount meanders occurred in this segment leading to a sub-optimal score in Channel Sinuosity. Bank Stability for the left and right banks received a score of sub-optimal due to a large amount of vegetation on both banks aiding in stabilization. Vegetative Protection for both left and right banks scored sub-optimal due to the abundance of stream bank vegetation. Riparian Vegetation for the left and right banks scored sub-optimal because no zones of impact exist for various native vegetative species. Overall, the low gradient HAV score was 143 (sub-optimal) for Miller Creek Station 1 during the survey.

2.3.4 Miller Creek Station 2 Habitat Assessment

This habitat assessment was conducted approximately 200 feet below cross section 1-1', in a riffle approximately 650 feet upstream from the mouth of the Miller Creek reach (Miller Creek Mitigation Map) in between Log Vane 2 and Log Cross Vane 1. The structures throughout this enhancement reach included 6 log cross vanes, 6 log vanes, and improvements to riparian vegetation.

This station contains a healthy mix of stable habitat and is suited for full colonization potential. The abundance of cobble and gravel substrate with low surrounding sediment deposition resulted in a low optimal score for Epifaunal Substrate. A higher content of sand and mud in the pool areas, rather than cobble and gravel resulted in this station receiving a sub-optimal score for Pool Substrate. An increased number of shallow pools existed for this segment of stream, resulting in a sub-optimal score for Pool Variability. Some new increase in bar formation, mostly from gravel and sand and resulted in a sub-

optimal score for Sediment Deposition. Channel Flow Status at this station received a sub-optimal score with approximately 75 percent of the channel being filled with water, and some substrate was exposed. Channel Alteration received a score of optimal to restored channel dimension. A low amount of meanders occurred in this segment leading to a sub-optimal score in Channel Sinuosity. Bank Stability for the left and right banks received a score of sub-optimal due to an abundance of vegetation on both banks aiding in stabilization. Vegetative Protection for both left and right banks scored sub-optimal due to sparse and spotty vegetation. Riparian Vegetation for the left and right banks scored sub-optimal because native vegetation looks to be undisturbed. Overall, the low gradient HAV score was 147 (sub-optimal) for Miller Creek Station 2 during the survey.

2.4 Pebble Count Evaluations

A total of four (4) pebble count evaluations were conducted during the as built certification at the habitat assessment sites in each reach. A total of 100 samples were measured for each evaluation. The pebble count results indicated that the mitigation channels and in-stream structures are successfully maintaining sediment transport and retaining and preserving coarse substrate in the riffles. However, during the field visit for annual monitoring the watershed was experiencing heave inundation due to storm events. Pebble count evaluations were not conducted due to the heavy flows. Therefore, Consol will conduct pebble counts during the spring of 2012.

Table 4: As-built Pebble Count Scoresin 2010

	Mill Fork Station 1	Mill Fork Station 2	Miller Creek Station 1	Miller Creek Station 2
Bedform Composition	Riffle	Riffle	Riffle	Riffle
% Silt/Clay	0	0	0	2
% Sand	9	13	8	9
%Gravel	70	64	52	69
% Cobble	21	23	39	20
% Boulder	0	0	1	0
% Bedrock	0	0	0	0

2.5 In-stream Structures

Construction within the mitigation reaches of Mill Fork and Miller Creek included installation of a total of 16 in-stream structures. The installed structures included 3 sets of rootwads/bank boulder combinations, 6 log cross vanes, 6 log vanes, and 1 low water stream crossing. By restoring existing stream channel, the mitigation segments can be utilized as profitable habitat for amphibians, benthic macroinvertebrates, and other terrestrial organisms.

Most of the installed structures are creating in-stream pool habitat for aquatic and terrestrial organisms. All these areas are providing in-stream habitat in the form of large woody debris input, organic storage, and habitat for benthic macro invertebrates and small fish. The structures are providing bank protection by deflecting water away from the bank during high flow events and therefore, keep the structures and stream morphology stable as per the design parameters.

During the monitoring, there was some noticeable water piping observed between the header rocks and vane logs and then underneath of the vane logs. (See Photo 1 below) Backer logs/footer logs will, therefore, be installed on every structure, where deemed appropriate, with associated filter fabric. Due to some slight incision noticed on some of the structures, header elevations will also be decreased slightly.

In Mill Fork, there is some noticeable erosion in two of the small upstream meanders. Those are proposed be corrected by installing bank toe protection. In one section of stream along the road crossing, it is overly wide. Therefore, one to two log cross vanes are proposed to be installed to redirect the thalweg appropriately. The road crossing at the downstream end of the project is proposed also proposed to be stabilized. A footer log will be installed to protect the stream from incision at a gas line (See Photo 2) and to protect a gas line so the combined structure functions more like a step pool. The mouth section is also proposed to be repaired due to issues associated with the road crossing.

Due to recent mitigation completion and re-vegetation measures, bank vegetation has not fully established itself, and HAV scores have not yet reached their maximum potential. Nonetheless, it is expected total HAV scores will meet performance standards, exceeding baseline conditions prior to the end of the five-year monitoring period.

Photo 1

Photo2

3.0 Establishment of Riparian Vegetation

Due to recent mitigation completion and re-vegetation measures, bank vegetation has not fully established, and HAV scores have not yet reached their maximum potential. Nonetheless, it is expected total HAV scores will meet performance standards, exceeding baseline conditions prior to the end of the five-year monitoring period.

Due to the lack of a detailed protocol for monitoring vegetation in West Virginia, P&A used North Carolina's Ecosystem Enhancement Program's Carolina Vegetation Survey (CVS).

The NC CVS-EEP Protocol Data collection consisting of field investigation to perform geomorphic surveys, establish permanent photo points, and establish and monitor vegetation plots using the latest North Carolina Vegetation Survey (CVS-EEP) protocol. The protocol was used to establish total woody stem inventory by size class.
The following Data has been generated from implementation of the NC CVS-EEP Level 2 Protocol.

Plot	Plot Level	Year	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Natural (Volunteer) Stems	Total Living Stems
001-Miller-0001-year:2	2	3	9	7	4	13
001-Miller-0002-year:2	2	3	8	8	1	9
001-Miller-0003-year:2	2	3	9	9	18	27
001-Miller-0004-year:2	2	3	8	7	24	32
001-Miller-0005-year:2	2	3	10	10	35	45
002-Mill-0001-year:2	2	3	5	2	2	7
002-Mill-0002-year:2	2	3	1	0	12	13
002-Mill-0003-year:2	2	3	7	5	40	47

Plot	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems PER ACRE	Volunteer Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE
001-Miller-0001-year:2	11	364.21	283.28	161.87	526.09	445.15
001-Miller-0002-year:2	9	323.74	323.75	40.47	364.22	364.22
001-Miller-0003-year:2	27	364.21	364.22	728.43	1,092.65	1,092.65
001-Miller-0004-year:2	31	323.74	283.28	971.25	1,294.99	1,254.53
001-Miller-0005-year:2	45	404.68	404.69	1,416.40	1,821.09	1,821.09
002-Mill-0001-year:2	4	202.34	80.94	80.94	283.28	161.87
002-Mill-0002-year:2	12	40.46	0.00	485.62	526.09	485.62
002-Mill-0003-year:2	45	283.27	202.34	1,618.74	1,902.02	1,821.09

The NC CVS-EEP protocol demonstrates that while the planted vegetation survival rates has not been as successful as predicted volunteer trees have replaced the unsuccessful plantings. The average of all plots is 930 total living stems per acre.

4.0 Conclusion

The mitigation activities in Mill Fork and Miller Creek have been designed and constructed using natural stream design techniques in order to create a relatively stable pattern, dimension, and profile through the mitigation reaches. This mitigation project was comprised mainly of restoring sections of Mill Fork and Miller Creek by creating bank full benches, where appropriate, and establishing channels with proper dimension, pattern, and profile, while also installing in-stream structures to protect banks and provide additional in-stream habitat. The final stream lengths for Mill Fork and Miller Creek after construction were surveyed and their conditions were found to be as anticipated, as discussed above. Construction for on-site mitigation will take place upon Phase 2 release.

Construction within the mitigation reaches consisted of a total of 16 in-stream structures and 1 stream crossing in Mill Fork. Mill Fork utilized 3 sets of root wads/boulder combinations, and 1 low water stream crossing for its mitigation. Miller Creek utilized 6 log cross vanes, and 6 log vanes for its mitigation. All the structures were designed and continuing to function to deflect the main flow away from the banks, while enhancing local flow velocities and protecting the stream banks. Additionally, the structures continue to create scour pools and provide grade control to increase variety of habitat, reduce incision, and allow for sediment transport through the reaches, while maintaining a natural and aesthetic appearance.

Based in part on results from annual monitoring, Consol has taken steps toward commencing minimal maintenance work associated with structures within Mill Fork and Miller Creek. In Miller Creek, backer logs/footer logs will be installed on structures, where deemed appropriate, with associated filter fabric. Due to some slight incision noticed on some of the structures, header elevations will also be decreased slightly. In Mill Creek, some small erosion areas will be corrected, an additional structure will be installed, and the road crossing and subsequent gas line crossing will involve stability repairs.

Overall, the two (2) mitigation reaches are consistent with construction plans and are successful within the design parameters. The area will continue to be monitored for the approved five-year period and annual monitoring results will be compared to the baseline conditions of the as-built survey in order to determine if there is a need for maintenance or corrective measures. Results of the survey will also be used to determine project success in accordance with the performance criteria in the approved plans. Consol of Kentucky, Inc., encourages the USACE to schedule a site visit at their convenience. As-built plans can be found in **Appendix A**, and photographs documenting mitigation can be found in **Appendix**

5.0 References

R.E.I. Consultants Inc. (REIC). 2006. Compensatory Mitigation and Stream Restoration Plan for the MT-500 Surface Mine, WVDEP Permit No. S-5009-05 Submitted to Consol of Kentucky, Inc., February 2006.

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