

Adverse Effects From Impoundments

In evaluating a project area containing aquatic resources, consideration must be given to avoiding impacts on these resources. If a site cannot be avoided, impacts must be minimized. Following minimization of impacts, the unavoidable impacts must be mitigated. Permits to discharge dredged or fill material into waters of the U.S will not be granted if it will cause or contribute to significant degradation of waters of the U.S.

In-stream ponds have been designed to control and treat higher runoff velocities and volumes. Pond designs allow retention of this increased runoff while allowing the pre-disturbance flow to be maintained. Specific design calculations are included in the SedCAD analysis included in this package. Those calculations allow for sediment removal within the pond as to meet effluent standards while maintaining pre-disturbance stream flows. The mining areas have been designed to minimize the amount of jurisdictional streams to be impacted by the proposed project. Stream impacts, to the extent practicable, were limited to areas where previous impacts had occurred. This has allowed only previously degraded streams to be impacted. No impacts to jurisdictional streams are proposed within the mining areas. Impacts are limited to pond construction to control and treat sediment runoff from the project area.

918-0504
AM-04
25 Year, 24 Hour Storm Event
Pre-Mining

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.030 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	OBP-43

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	106.620	106.620	222.58	19.45

Structure Detail:

Structure #1 (Null)

OBP-43

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	65.160	0.086	0.206	0.290	73.000	S	161.64	12.498
	2	25.540	0.020	0.186	0.259	73.000	S	63.36	4.899
	3	15.920	0.186	0.000	0.000	73.000	S	18.80	2.057
	Σ	106.620						222.58	19.453

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	31.67	95.00	300.00	1.420	0.058
		4. Cultivated, straight row	45.60	285.00	625.00	6.030	0.028
#1	1	Time of Concentration:					0.086
#1	2	3. Short grass pasture	30.00	96.00	320.00	4.380	0.020
#1	2	Time of Concentration:					0.020
#1	3	3. Short grass pasture	5.28	65.00	1,230.01	1.830	0.186
#1	3	Time of Concentration:					0.186

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	30.00	96.00	320.00	4.380	0.020
		3. Short grass pasture	5.28	65.00	1,230.01	1.830	0.186
#1	1	Muskingum K:					0.206
#1	2	3. Short grass pasture	5.28	65.00	1,230.00	1.830	0.186
#1	2	Muskingum K:					0.186

918-0504
AM-04
25 Year, 24 Hour Storm Event
During Mining

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.030 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	OBP-43

#1 <i>Pond</i>

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	106.620	106.620	247.09	21.99
	Out			220.37	21.99

Structure Detail:***Structure #1 (Pond)****OBP-43*

Pond Inputs:

Initial Pool Elev:	8.70 ft
Initial Pool:	5.24 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
8.70	8.00	1.00:1	1.00:1	6.00

Pond Results:

Peak Elevation:	12.80 ft
Dewater Time:	0.68 days

*Dewatering time is calculated from peak stage to lowest spillway***Elevation-Capacity-Discharge Table**

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
0.00	0.448	0.000	0.000	
0.50	0.465	0.228	0.000	
1.00	0.481	0.465	0.000	
1.50	0.499	0.710	0.000	
2.00	0.516	0.963	0.000	
2.50	0.534	1.226	0.000	
3.00	0.552	1.497	0.000	
3.50	0.570	1.778	0.000	
4.00	0.588	2.067	0.000	
4.50	0.606	2.366	0.000	
5.00	0.624	2.673	0.000	
5.50	0.643	2.990	0.000	
6.00	0.662	3.316	0.000	
6.50	0.681	3.652	0.000	
7.00	0.700	3.997	0.000	
7.50	0.719	4.352	0.000	
8.00	0.739	4.717	0.000	
8.50	0.759	5.091	0.000	
8.70	0.767	5.244	0.000	Spillway #1

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
9.00	0.779	5.475	4.510	4.30
9.50	0.799	5.870	12.026	8.65
10.00	0.820	6.275	28.182	2.20
10.50	0.840	6.690	49.998	0.55
11.00	0.861	7.115	76.888	0.25
11.50	0.882	7.551	109.159	0.15
12.00	0.903	7.997	146.929	0.10
12.50	0.924	8.454	190.348	0.05
12.80	0.937	8.739	220.369	0.10 Peak Stage
13.00	0.945	8.921	239.575	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
0.00	0.000	0.000
0.50	0.000	0.000
1.00	0.000	0.000
1.50	0.000	0.000
2.00	0.000	0.000
2.50	0.000	0.000
3.00	0.000	0.000
3.50	0.000	0.000
4.00	0.000	0.000
4.50	0.000	0.000
5.00	0.000	0.000
5.50	0.000	0.000
6.00	0.000	0.000
6.50	0.000	0.000
7.00	0.000	0.000
7.50	0.000	0.000
8.00	0.000	0.000
8.50	0.000	0.000
8.70	0.000	0.000
9.00	4.510	4.510
9.50	12.026	12.026
10.00	28.182	28.182
10.50	49.998	49.998
11.00	76.888	76.888
11.50	109.159	109.159
12.00	146.929	146.929

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
12.50	190,348	190,348
13.00	239,575	239,575

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	65.160	0.086	0.202	0.301	73.000	S	161.64	12.498
	2	25.540	0.016	0.186	0.259	86.000	F	85.76	7.433
	3	15.920	0.186	0.000	0.000	73.000	S	18.80	2.057
	Σ	106.620						247.09	21.987

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	31.67	95.00	300.00	1.420	0.058
		4. Cultivated, straight row	45.60	285.00	625.00	6.030	0.028
#1	1	Time of Concentration:					0.086
#1	2	5. Nearly bare and untilled, and alluvial valley fans	30.00	96.00	320.00	5.470	0.016
#1	2	Time of Concentration:					0.016
#1	3	3. Short grass pasture	5.28	65.00	1,230.00	1.830	0.186
#1	3	Time of Concentration:					0.186

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	30.00	96.00	320.00	5.470	0.016
		3. Short grass pasture	5.28	65.00	1,230.01	1.830	0.186
#1	1	Muskingum K:					0.202
#1	2	3. Short grass pasture	5.28	65.00	1,230.00	1.830	0.186
#1	2	Muskingum K:					0.186

918-0504 AM-04 Impacts Aerial Map

Label	lat	long	Pre-FCI	length	Pre-HGM	Post-FCI	Post-HGM
Int 01	36.83992	-84.01702	0.56	444	248.64	0.78	346.32

 918-0504 AM-04 Permit Boundary
 Proposed Impact Streams
2022 KY Aerial Imagery



0 250 500 750 1,000 ft



918-0504 AM-04 Impacts Topo
Map

Label	lat	long	Pre-FCI	length	Pre-HGM	Post-FCI	Post-HGM
Int 01	36.83992	-84.01702	0.56	444	248.64	0.78	346.32

 918-0504 AM-04 Permit Boundary
 Proposed Impact Streams
USGS Topographic Maps



0 250 500 750 1,000 ft



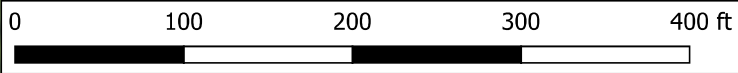
918-0504 AM-04 Mitigation
Aerial Map

Label	lat	long	Pre-FCI	length	Pre-HGM	Post-FCI	Post-HGM
Int 01	36.83992	-84.01702	0.56	444	248.64	0.78	346.32

 918-0504 AM-04 Permit Boundary

 Proposed Mitigation Streams

2022 KY Aerial Imagery



918-0504 AM-04 Mitigation Topo Map

Label	lat	long	Pre-FCI	length	Pre-HGM	Post-FCI	Post-HGM
Int 01	36.83992	-84.01702	0.56	444	248.64	0.78	346.32

 918-0504 AM-04 Permit Boundary

 Proposed Mitigation Streams

USGS Topographic Maps

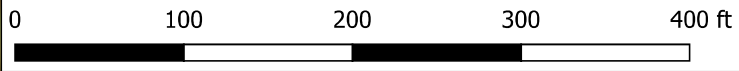


Exhibit 5-1

EXCAVATED SEDIMENT POND, DUGOUT TYPE

Structure Proportioning Computation Sheet

Pond Number **OBP-43**

15

165

SEDIMENT STORAGE REQUIREMENTS

Drainage Area = **106.62**
 Area Disturbed = **25.54**
 Sediment Volume = 0.125 Ac.Ft./Acre times disturbed area controlled by
 Pond Number **OBP-43** = **5.244**
 Sediment Pool Elevation = **8.7**
 Sediment Cleanout Volume = **3.119**
 Sediment Cleanout Stage = **5.7**

 Top of Pond **13** Ft
 = Sediment pool **8.7** Ft
 + ES Depth **4.3** Ft

SEDIMENT POND DIMENSIONS AND VOLUME DETERMINATION

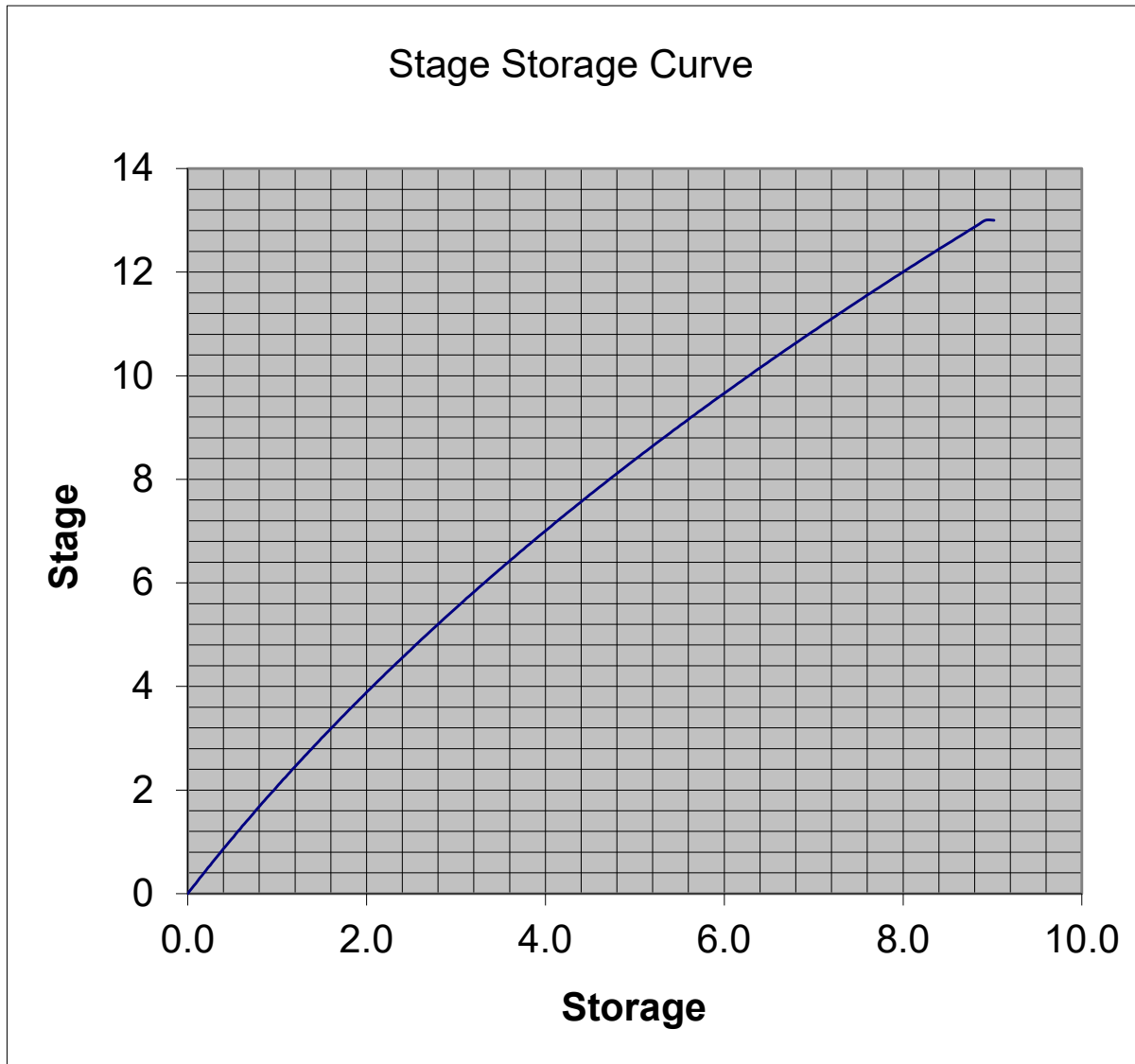
Bottom Length = **300** Ft
 Bottom Width = **65** Ft
 Water Depth = **8.7** Ft
 Side Slopes = **2** H:1V

 Volume = **228,416** Cubic Feet or
 5.244 Acre-feet

The pond is regular shaped & the volumes are calculated using its geometric components.

This form is a facsimile of the West Virginia design form.

POND OBP-43



Feature	Stage	Volume
Bottom	0	0
Cleanout	5.7	3.119
Spillway	8.7	5.244
Top	13	9.015

Exhibit 2-7 *

SURFACE RUNOFF AND PEAK DISCHARGE COMPUTATION SHEET

Type of Structure: **Dugout**

Drainage Area: Number **OBP-43** Acres **106.62**

County: **Whitley** Date: **02/02/26**

Rainfall Frequency (years) **25** Rainfall (Inches): **5.03**

Ave Watershed Slope (%) **30**

Soil Group	Land use	CN	Area	Area X CN
C	Forest	73	65.16	4756.68
C	Mined	86	41.46	3565.56
C	Reclaimed	69	0	0
Totals			106.62	8322.24

Weighted Runoff CN = (Area X CN) / (Area) = **78.1**

q1 for CN = **75** from Ex. 2-4 **243.8** cfs

q2 for CN = **80** from Ex. 2-4 **314.0** cfs

The weighted discharge using straight line interpolation = **286.7** cfs

Slope correction factor for **30** % from Ex. 2.5 = **1.11**

Corrected Q (flow from CN's X Correction factor) = **318.2** cfs

The emergency spillway is designed using the Ky DSMRE's Figure 21 of TRM #13. The following are the ES specifications.

Bottom Width = **6** ft
 Sideslopes = **1** :1
 Depth = **4.3** ft
 Capacity = **251.5** cfs

* This form is a facsimile of the West Virginia design form.

COMPARISON OF PREMINING & DURING MINING DISCHARGE

(This method is presented in Haan & Barfield,

Soil Group	Land use	CN	Area	Area X CN
C	Forest	73	103.82	7578.86
C	Mined	86	2.8	240.8
C	Reclaimed	69	0	0
Totals			106.62	7819.66

$$\text{Weighted Runoff CN} = (\text{Area X CN}) / (\text{Area}) = \underline{\underline{73.3}}$$

$$q_1 \text{ for CN} = \underline{\underline{70}} \quad \text{from Ex. 2-4} \quad \underline{\underline{184.8}}$$

$$q_2 \text{ for CN} = \underline{\underline{75}} \quad \text{from Ex. 2-4} \quad \underline{\underline{243.8}}$$

$$\text{The weighted discharge using straight line interpolation} = \underline{\underline{224.2}}$$

$$\text{Slope correction factor for } \underline{\underline{30}} \% \text{ from Ex. 2.5} = \underline{\underline{1.11}}$$

$$\text{Corrected Premine Q (flow from CN's X Correction factor)} = \underline{\underline{248.9}}$$

$$Q_o \text{ (csm)} = 1494 \quad [\text{Corrected premine } q / (\text{Total acres} * 640 \text{ ac/sq mi})]$$

$$Q_i \text{ (csm)} = 1910 \quad [\text{Corrected during } q / (\text{Total acres} * 640 \text{ ac/sq mi})]$$

$$Q_o/Q_i = 0.78$$

From Haan & Barfield, Figure 4.19

$$V_s/V_r = 0.18$$

$$\text{Runoff (in)} = 2.74 \quad [\text{Runoff from during mining condition using standard SCS CN equation}]$$

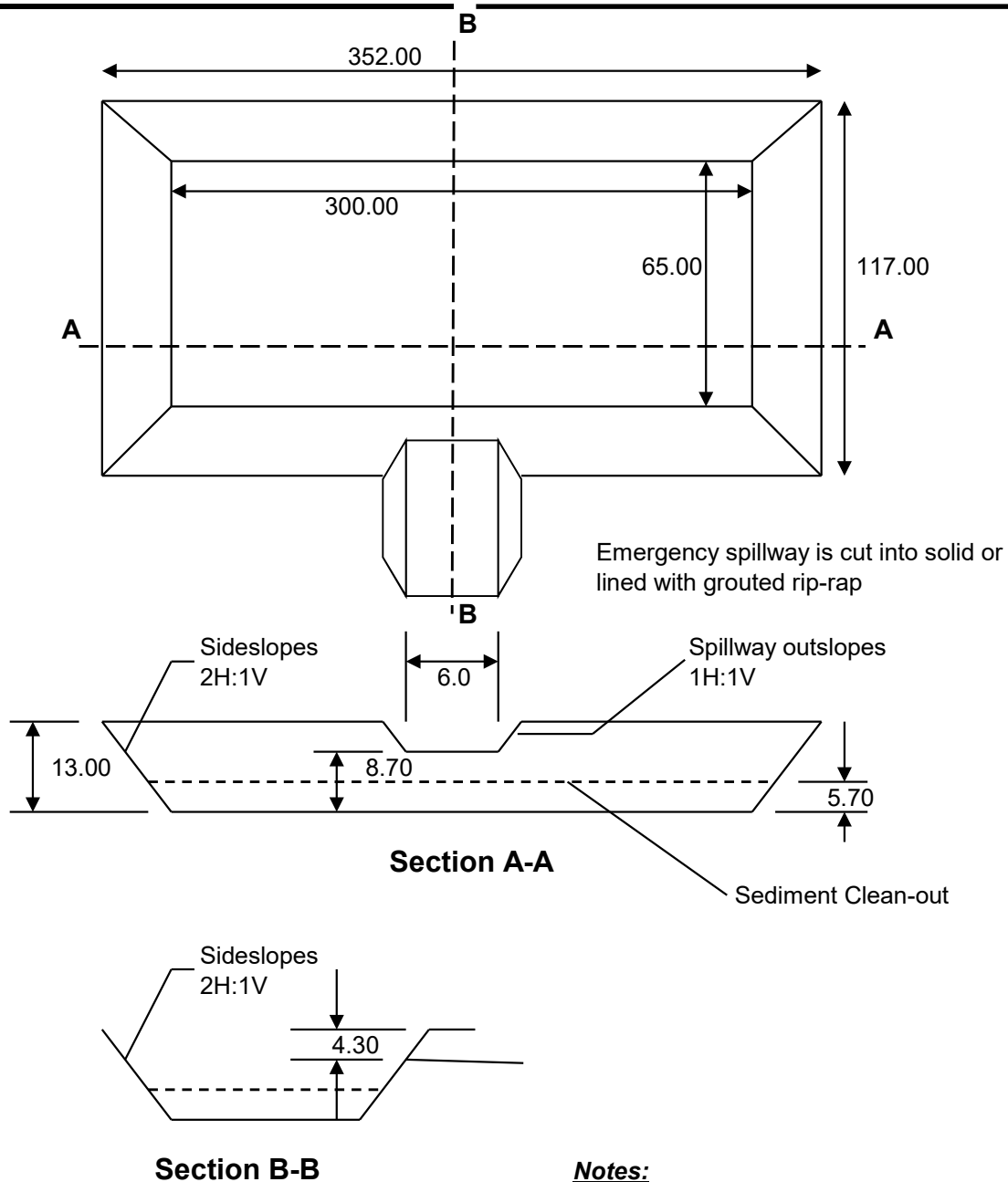
$$\begin{aligned} \text{Storage} &= V_s/V_r (\text{runoff})(\text{area})/12 \\ &= 4.37 \text{ ac-ft} \quad \text{Required to limit discharge to premine Q} \end{aligned}$$

$$\begin{aligned} \text{Provided} &= V_{\text{top}} - V_s \\ &= 3.772 \text{ ac-ft} \quad \text{From stage-storage curve} \end{aligned}$$

$$\text{Provided } V_s/V_r = 0.15$$

$$\text{Estimated } Q_o/Q_i = 0.90 \quad \text{From Haan & Barfield, Figure 4.19}$$

$$\text{During Mining Peak outflow} = \underline{\underline{286.6}} \text{ (cfs)}$$



Notes:

No north arrow is provided on this drawing. The bench pond will be placed at the location shown on the MRP map such that the spillway is perpendicular through the berm.

The design specifies only the stage between various features of the pond. Due to several conditions, such as coal seam rolls, the designs are based on stages and not elevations, therefore no elevations are shown. Approximate elevations can be estimated from the MRP.

PondOBP-43
Design
 Not to Scale

I, _____
 _____,
 hereby certify, to the best of my knowledge and belief, in accordance with 405 KAR 7:040, Section 9, that this document is correct as determined by accepted engineering practices and includes all the information required of it by KRS Chapter 350 and KAR Title 405.

**STREAM AND
WETLAND RESTORATION
Mosley Gap 918-0504 AM 04**

FOR

Ferroglobe USA Mining, LLC

332 W Cumberland Gap Pkwy, Corbin, KY 40701



**Aquatic Resources
Management**

2554 Palumbo Drive
Lexington, KY 40509
(859) 388-9595

November 10, 2025

General Notes

Tree & Shrub Planting

Geomorphology

This stream restoration project has two stream classifications (A4 & B4) utilized in the stream geomorphology natural channel design. Specifically this reach/type of stream will be constructed to meet the classification of the Stream Type. Final structure placement will be determined after the backfill configuration is complete. Log structures can be used in place of rock structures at any interval.

Stream Definitions & Characteristics

Stream orientation and geomorphology will always be constructed in the direction of looking downstream at all times unless other wise directed.

1. **Bankfull Discharge:** The discharge and corresponding stage at the incipient point of flooding begins.
2. **Bankfull Width:** the width of the channel is measured at this elevation. (See Typical)
3. **Bankfull Mean Depth:** The mean depth of flow at the Bankfull stage, determined by the cross-sectional area of the riffle or the pool. (See Typical)
4. **Bankfull Max Depth:** The max depth of flow at the Bankfull stage, determined by the cross-sectional area of the riffle or the pool. (See Typical)
5. **Flood-prone area width:** the width associated with a value of twice the Bankfull depth. it is the area including the flood plain of the stream.
6. **Riffle:** The shallow section of a stream that is characterized by increased velocities and gradients.
8. **Step:** The shallow section of a high gradient stream that is short in length and shallow in depth. Typically the steps are much more narrow than the pools found in a specific reach.
9. **Pool:** The deep section of a stream that is characterized by decreased velocities and gradient.
10. **Low Flow Channel:** A channel created to increase shear stress and enable flows in low periods to transport suspended sediment efficiently.
11. **Thalweg:** The lowest elevation found within the stream channel. This may be the basis for the stream stationing also.
12. **Right Bank:** Looking downstream the bank immediately to the right side.
13. **Left Bank:** Looking downstream the bank immediately to the left side.
14. **Sinuosity:** The ratio of stream length to down valley distance. Sinuosity is the stream length X valley length
15. **Cross-Vane:** The objectives of this structures are to: (1) create in-stream cover/holding water; (2) take excess shear stress away from the "near bank" region and direct the water to the center of the stream to maintain lateral stability; (3) increase stream depth by decreasing width/depth ratio; (4) increase sediment transport capacity; (5) provide a natural sorting of gravel on the up-welling portion on the downstream side of structure for spawning; (6) create grade control to prevent down cutting. Structure Spacing will be determined upon final backfill slopes.
15. **J-Hook:** This structure is designed to re-direct velocity distribution and high velocity gradient in the near-bank region, stabilize stream banks, dissipate energy in deep, wide and long pools created below the structure, create holding cover for fish and spawning habitat in the tail-out of the structure.
16. **Footer Rock:** The rock place on the bottom of the structure underneath the surface rock. This rock shall be larger than surface rocks and flat (not rounded).
17. **Surface Rock:** This rock is placed on top of the footer rock. The rock shall be smaller than the footer rock and flat (not rounded).
18. **Log Weir:** This structure is designed to control grade and decrease velocity on the downstream side by creating a scour pool.

Trees and shrubs should be planted on 12' centers.
Trees and shrubs should be planted with their top major roots even with the soil line.
Trees and shrubs planted at the wrong depth do not develop well and may have shortened life spans. Excess soil should be removed before planting.
Planting will begin at the ordinary high water mark and extend 25' on each side of the restored stream.

The planting Hole:
Dig a pit at least twice the diameter of the root mass and deep enough to place the root flare even with or up to one inch higher than the soil line. Handle the tree or shrub by the root mass and not by the trunk. Ensure the root mass or container is on solid ground to prevent settling.

Backfill Soil:
Make sure the tree or shrub is straight before backfilling. Use the same soil that came out of the pit. Chop the soil and remove any stones or debris. Avoid potting soil, peat moss or other amendments. Fill the hole halfway, watering thoroughly as you go, then finish backfilling. Work the soil around the ball gently so that no air pockets are left. Firm the soil so the tree is vertical and adequately supported, but do not compact the soil.

Water:
Saturate the entire backfilled soil with water. A slow gently soaking is best. Add more soil if need to compensate for settling.

Stakes:
Stakes may be used to prevent shifting of the root mass. The tree or shrubs shall be allowed to sway six (6) to eight (8) inches. Drive the stakes near the tree or shrub, but not through the roots.

General Construction Sequence

Stream construction should proceed in an upstream to downstream manner to avoid disrupting restored sections. All substrate will be durable, non-toxic, non-acidic, and a minimum of six inches deep.

Whenever possible create the new stream channel via survey in the low/no flow periods or in a newly excavated channel. The dimension, pattern, and profile along with stream structures shall be in place prior to water flow in the newly created channel. If possible the channel should be allowed one (1) growing season prior to water flow.

1. Contractor shall locate and identify the thalweg/centerline via survey prior to excavation of stream channel.
2. Contractor shall identify and locate areas to be utilized as riffles, pools, and structures via survey prior to construction. (See Plan, Grading and Detail sheets)
3. Excavate the riffle Bankfull Channels as indicated on the profile and cross-section. (See Typical)
4. Excavate and place structures within the Bankfull Channel in the appropriate locations located by survey prior to construction. (See Plan View & Grading)
5. Excavate pools within the Bankfull Channel located via survey prior to construction. (See Profile and/or Plan View).
6. Construct the Flood-prone area width while grading the side slopes. (See Typical)
7. Prepare the side slopes for seeding and the riparian vegetation.
8. Seed the riparian area while planting the riparian trees and shrubs. (See Riparian Detail Sheet)

Aquatic Resources
Management

2254 Palumbo Drive
Lexington, KY 40509
(859) 588-5695



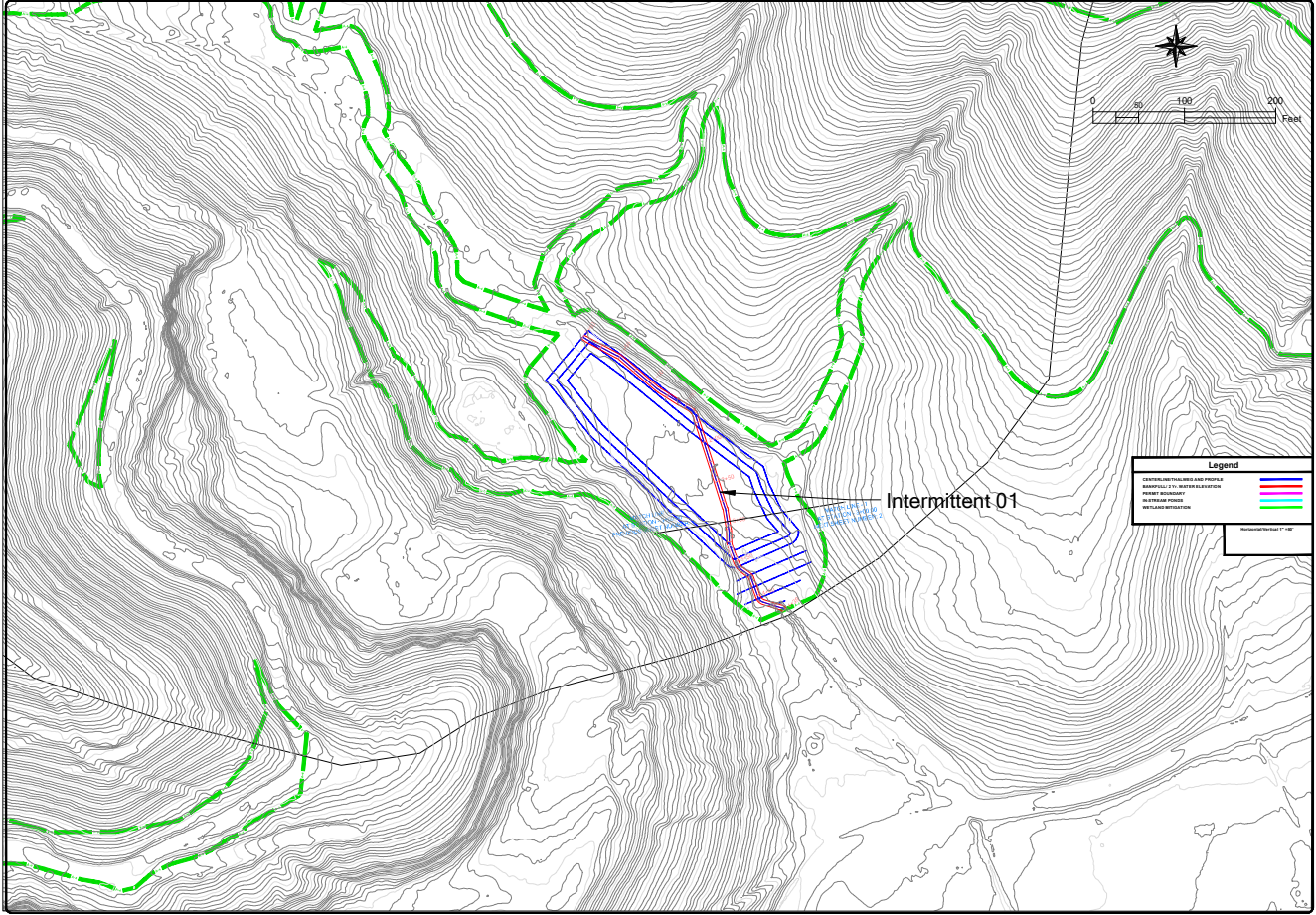
Mosley Gap
Stream and Wetland Restoration

Ferroglobe USA Mining, LLC
332 W. Cumberland Gap Pkwy., Corbin, KY 40701

REVISIONS

DATE
BY
REVISION

SHEET
1



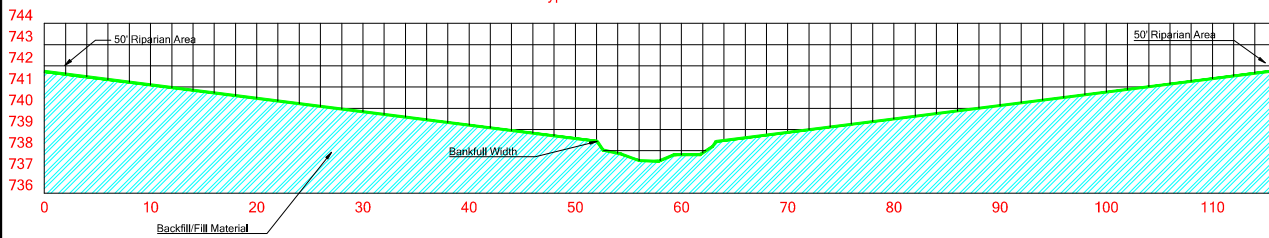
Aquatic Resources Management
 2554 Palumbo Drive
 Louisville, KY 40209
 (502) 588-9595

Mosley Gap Stream and Wetland Restoration
Ferroglobe USA Mining, LLC
 332 W. Cumberland Gap Pkwy Suite 100 Corbin, KY 40703

DATE	BY	REVISIONS

Typical Cross-Sections

Typical Restoration Cross Section



Typical Nested Channel

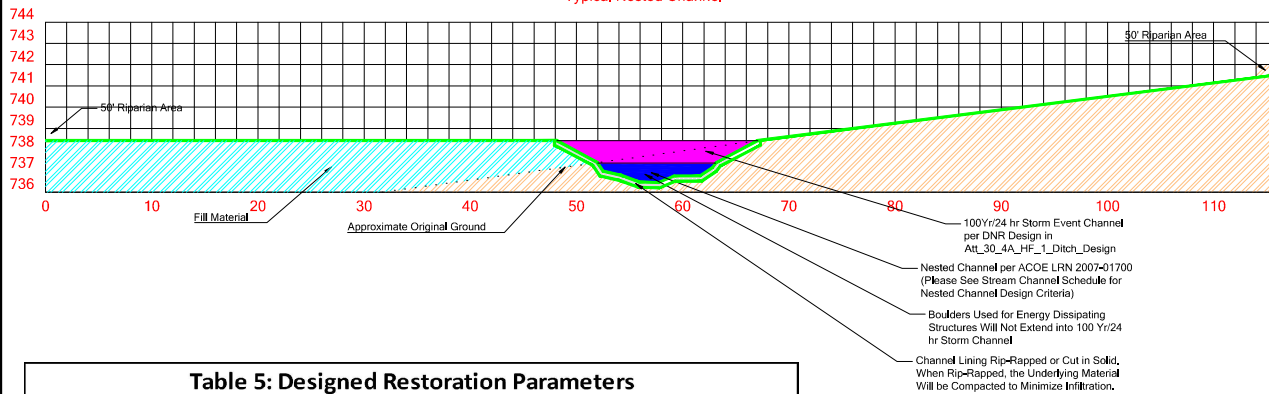


Table 5: Designed Restoration Parameters

Stream	Ac	Sq Mi	Abkf	Qbkf	Wbkf	dbkf
Int. 01	107.1	0.17	2.82	9.48	5.74	0.50

Construction of Streams will range +/-20%

Actual Constructed Dimensions Can Vary by +/- 25%
Channel Slopes will be determined after final backfill and final structure placement and Riffle/Pool Spacing will be determined at that time.

100yr/24hr Channels are Minimum 5' wide and 3' deep, but can be constructed larger to accommodate specific storm events.

Cross-Sections Not to Scale

Aquatic Resources Management
2254 Palumbo Drive
Louisville, KY 40209
(502) 898-5695



Mosley Gap
Stream and Wetland Restoration
Ferroglobe USA Mining, LLC
332 W. Cumberland Gap Pkwy., Corbin, KY 40701

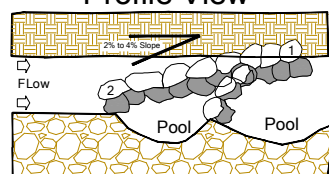
NO.	DATE	BY	REVISIONS
1	11-10-23	WBS	DESIGNED BY
2			CHECKED BY
3			DATE

SHEET
5

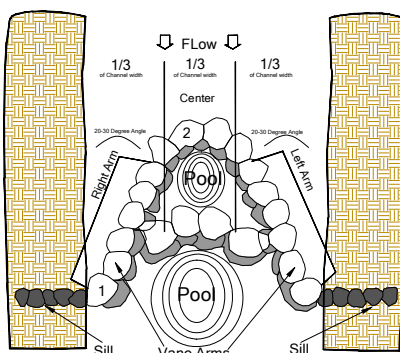
1. All structural material must be obtained prior to excavation of structure.
2. Contractor may, if the stream designer is not present , designate how the available material will be constructed prior to excavation.
3. The Footer Rock(s) in the middle 1/3 (center) of the channel shall be excavated and placed. Check to ensure spacing of Footer Rock(s) does not allow water to flow "under" or "between" the rocks.
4. The Footer Rock(s) of the Vane Arm furthest from the material shall be excavated and placed. Check to ensure arm "angle" and "slope" is within the specifications. Check to ensure spacing of Footer Rock(s) does not allow water to flow "under" or "between" the rocks.
5. The Footer Rock(s) for the Vane Arm closest to the material shall be excavated and placed. Check to ensure arm "angle" and "slope" is within the specifications. Check to ensure spacing of Footer Rock(s) does not allow water to flow "under" or "between" the rocks.
6. Place the Surface Rock(s) in the middle 1/3 (center) of the channel on top of the Footer Rock(s). Check to ensure there is no "pooling" of water behind the Surface Rock(s). Check to ensure spacing of Surface Rock(s) does not allow water to flow "under" or "between" Surface Rock(s). Check to ensure 1/4 of the Footer Rock(s) is exposed on the downstream end of the Surface Rock(s).
7. Place Surface Rock(s) on the Vane Arm Footer Rock(s) furthest from the material. Check to ensure spacing of Surface Rock(s) does not allow water to flow "under" or "between" Surface Rock(s). Check to ensure 1/4 of the Footer Rock is exposed on the downstream end of the Surface Rock(s). Surface Rock shall tie into the Bankfull elevation. Place sills into the Bankfull Bench and bury with channel material excavated from the pool.
8. Place Surface Rock(s) on the Vane Arm Footer closest to the material. Check to ensure spacing of Surface Rock(s) does not allow water to flow "under" or "between" Surface Rock(s). Check to ensure 1/4 of the Footer Rock is exposed on the downstream end of the Surface Rock(s). Surface Rock shall tie into the Bankfull elevation. Place sills into the Bankfull Bench and bury with channel material excavated from the pool.
9. Excavate the "pool" area to the specified depth. The deepest section of the pool shall be within the first 15% of the length of the Vane Arm and gradually rising in elevation to the end of the Vane arms. Utilize the excavated material to backfill each Vane arm. The material shall be placed evenly with the Surface Rock and the Bankfull elevation.
10. Contractor or stream designer (if present) shall check water surface elevation to ensure water will be "pooled" to the middle of the Surface Rock(s) located on the middle 1/3 of the channel.

Cross-Vane Details

Profile View



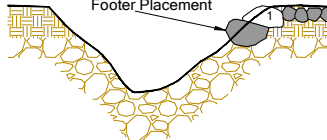
Plan View



Cross-Section



Cross-Section

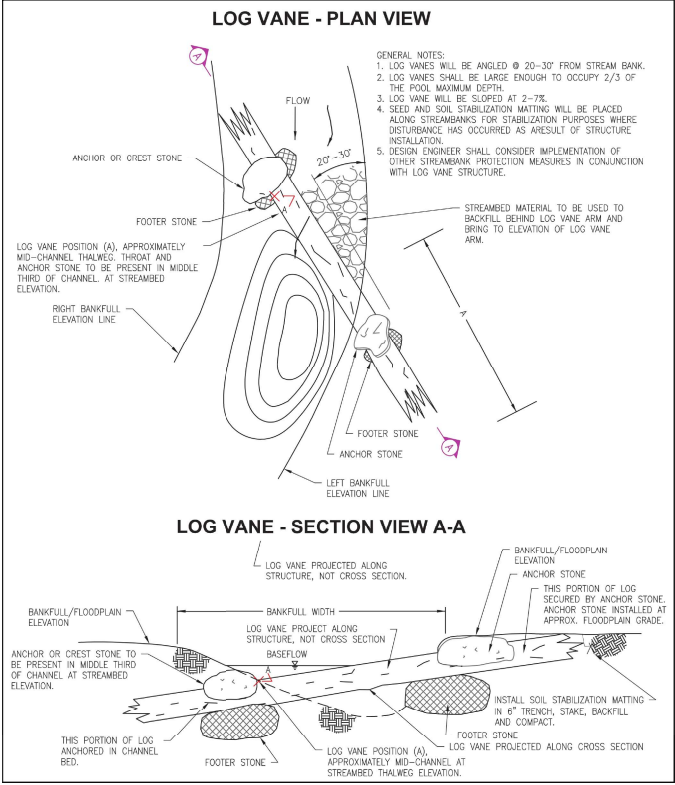


Typical Cross-Vane Specifications and Sizing

Note: All sizes in Feet

Specifications and Sizing			Note: All sizes in Feet
Location:	See Plan View		
Width=W	Thickness=T	Length=L	
Center Footer Rock	Min 2.0/0.825	Max 2.5/1.0/3.0	Length of Center
	Min 2.0/0.5/2.0	Max 2.5/0.825/2.5	
Center Surface Rock	Min 2.0/0.5/2.0	Max 2.5/0.825/2.5	Length of Center
	Min 2.0/0.825	Max 2.5/1.0/3.0	
Left or Right Arm Footer Rock	Min 2.0/0.825	Max 2.5/1.0/3.0	Length of Arm
	Min 2.0/0.5/2.0	Max 2.5/0.825/2.5	
Left or Right Arm Surface Rock	Min 2.0/0.5/2.0	Max 2.5/0.825/2.5	Length of Arm
	Min 0.5/0.30/8	Max 0.8/0.5/1.0	
Left & Right Arm Sill			Length of Sill
Left & Right Arm Slope	2% to 4%		

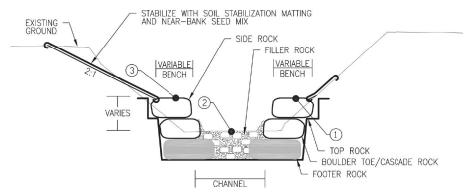




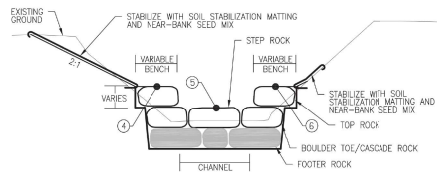
- GENERAL NOTES:
1. LOG VANES WILL BE ANGLED @ 20-30° FROM STREAM BANK.
 2. LOG VANES SHALL BE LARGE ENOUGH TO OCCUPY 2/3 OF THE POOL MAXIMUM DEPTH.
 3. LOG VANE WILL BE SLOPED AT 2-7%.
 4. SEED AND SOIL STABILIZATION MATTING WILL BE PLACED ALONG STREAMBANKS FOR STABILIZATION PURPOSES WHERE DISTURBANCE HAS OCCURRED AS A RESULT OF STRUCTURE INSTALLATION.
 5. DESIGN ENGINEER SHALL CONSIDER IMPLEMENTATION OF OTHER STREAMBANK PROTECTION MEASURES IN CONJUNCTION WITH LOG VANE STRUCTURE.

REVISIONS			
NO.	DATE	BY	DESCRIPTION
1	11-10-20	MM	

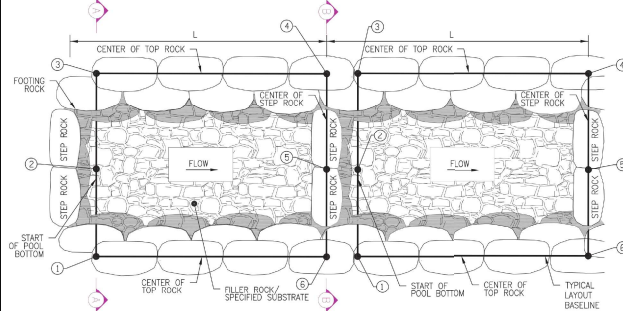
ROCK STEP POOL WITH BOULDER TOE - SECTION VIEW A-A



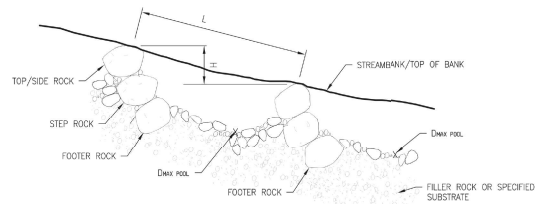
ROCK STEP POOL WITH BOULDER TOE - SECTION VIEW B-B



ROCK STEP POOL WITH BOULDER TOE - PLAN VIEW



ROCK STEP POOL WITH BOULDER TOE - PROFILE VIEW



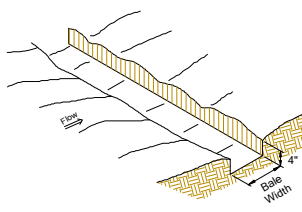
- GENERAL NOTES:**
1. NO GAPS OR VOIDS WILL EXIST BETWEEN FOOTER, CASCADE, AND TOP ROCK.
 2. FOOTER, CASCADE AND SIDE ROCKS EXTEND ALONG STREAMBANK BETWEEN ROCK STEPS TO CREATE A BOULDER TOE WALL ALONG STREAMBANK.
 3. INSTALLATION OF GEOTEXTILE FABRIC MAY NEED TO BE CONSIDERED BASED UPON STREAM SLOPE, WEATHER CONDITIONS, AND OTHER ELEMENTS DETERMINED THROUGH SITE ASSESSMENT.



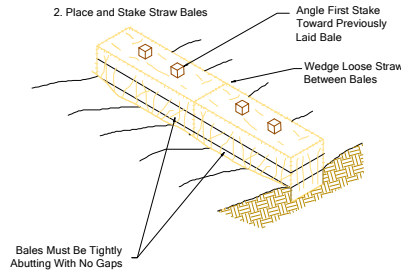
REVISIONS	
NO.	DESCRIPTION
1	ISSUED FOR PERMIT
2	ISSUED FOR CONSTRUCTION
3	ISSUED FOR AS-BUILT
4	ISSUED FOR FINAL
5	ISSUED FOR ARCHIVE
6	ISSUED FOR REVIEW
7	ISSUED FOR APPROVAL
8	ISSUED FOR CLOSURE

Erosion Control

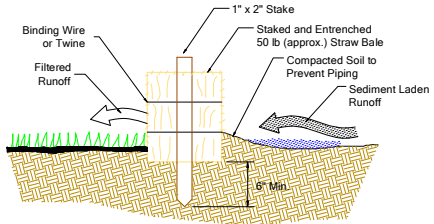
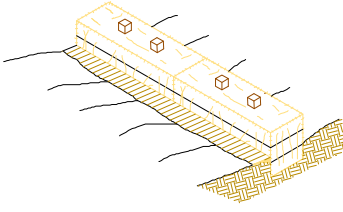
1. Excavate the Trench



2. Place and Stake Straw Bales



3. Backfill and Compact the Excavated Soil



Properly Installed Straw Bale

Aquatic Resources Management
 2254 Palumbo Drive
 Louisville, KY 40209
 (502) 888-5695

Mosley Gap Stream and Wetland Restoration
Ferroglobe USA Mining, LLC
 332 W. Cumberland Gap Pkwy., Corbin, KY 40701

REVISIONS			
NO.	DATE	BY	DESCRIPTION

Typical Stream Riparian Area Tree and Shrub Species to be Planted

Common Name	Species Name	Canopy Location
Common Name	Species Name	Canopy Location
Pawpaw	<i>Asimina triloba</i>	Understory
Pepper Bush	<i>Lindera benzoin</i>	Understory
Umbrella Magnolia	<i>Magnolia tripetala</i>	Understory
Bitternut Hickory	<i>Carya cordiformis</i>	Understory
American Elm	<i>Ulmus americana</i>	Understory
Slippery Elm	<i>Ulmus rubra</i>	Understory
Cucumber tree	<i>Magnolia acuminata</i>	Understory
American Holly	<i>Ilex opaca</i>	Understory
American Hornbeam	<i>Carpinus caroliniana</i>	Midstory
Sourwood	<i>Oxydendron arboreum</i>	Midstory
Sweet Birch	<i>Betula lenta</i>	Midstory
Sandbar Willow	<i>Salix exigua</i>	Midstory
Shortleaf Pine	<i>Pinus echinata</i>	Midstory
Virginia Pine	<i>Pinus virginiana</i>	Midstory
American Beech	<i>Fagus Grandifolia</i>	Overstory
Red Maple	<i>Acer rubrum</i>	Overstory
Tuliptree	<i>Liriodendron tulipifera</i>	Overstory
Sugar Maple	<i>Aceae saccharum</i>	Overstory
Northern Red Oak	<i>Quercus rubra</i>	Overstory
Sweet Gum	<i>Liquidambar styraciflua</i>	Overstory
Sycamore	<i>Platanus occidentalis</i>	Overstory
Black Willow	<i>Salix nigra</i>	Overstory
White Oak	<i>Quercus alba</i>	Overstory
Black Locust	<i>Robinia pseudoacia</i>	Overstory

Aquatic Resources
Management
2254 Palumbo Drive
Lebanon, KY 40039
(859) 938-5695



Mosley Gap
Stream and Wetland Restoration
Ferroglobe USA Mining, LLC
332 W. Cumberland Gap Pkwy., Corbin, KY 40701

DATE	BY	REVISIONS
2012	AS	1
2012	AS	2
2012	AS	3
2012	AS	4
2012	AS	5
2012	AS	6
2012	AS	7
2012	AS	8
2012	AS	9
2012	AS	10

SHEET
10

Bare Root Tree Planting Specifications

Correct and Incorrect Planting Depths



CORRECT At the same depth or 1/2 inch deeper than the seedling grew at the nursery.



INCORRECT Too deep and roots are bent.



INCORRECT Too shallow and roots are exposed.

Mattock Planting



1. Insert the mattock, lift the handle, and pull up.

2. Place the seedling along the straight side at the correct depth.

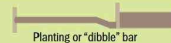
3. Fill in and pack the soil to the bottom.



4. Finish filling in the soil and firm with your heel.

5. Firm around the seedling with your foot.

Dibble Planting



1. Insert the dibble as shown and pull it toward you.

2. Remove the dibble and place the seedling at the correct depth.

3. Insert the dibble 2 inches from the seedling toward you.

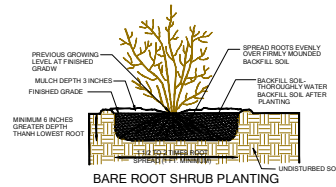
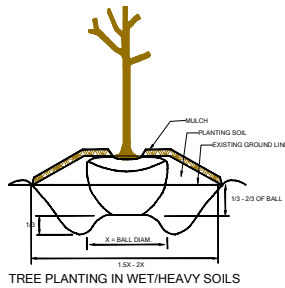
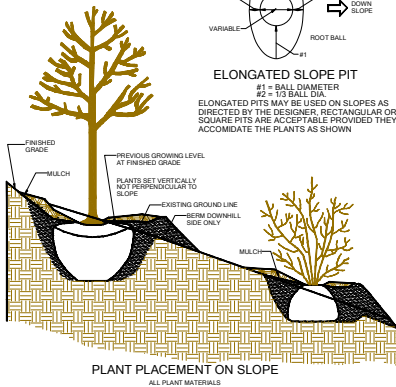
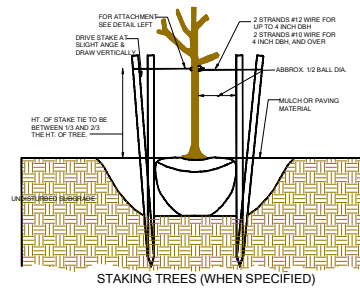
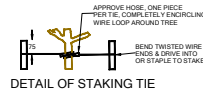
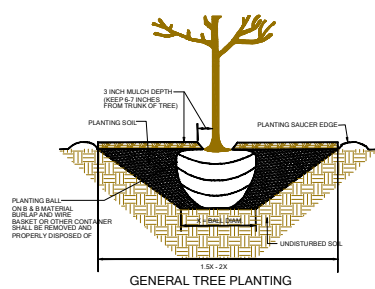


4. Pull the handle of the dibble toward you, firming the soil at the bottom of the roots.

5. Push the handle of the dibble away from you, firming the soil at the top of the roots.

6. Firm the soil around the seedling with your foot.

Container Tree Planting Specifications



Aquatic Resources Management
2254 Palumbo Drive
Lexington, KY 40509
(859) 298-5695



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Ferroglobe USA Mining, LLC
332 W. Cumberland Gap Pkwy., Corbin, KY 40701

DATE	BY	REVISIONS
11-15-23	1	1

SHEET 12

Typical Pavement Analysis

