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Bureau of Abandoned Mine Reclamation

Assessment of Fluvial Geomorphology Projects at Abandoned Mine Sites in the Anthracite Region of Pennsylvania

Presented at the

2014 OSM National Technical Forum:
Advances in Geomorphic Reclamation
on Mined Land

May 20-22, 2014

Albuquerque, New Mexico

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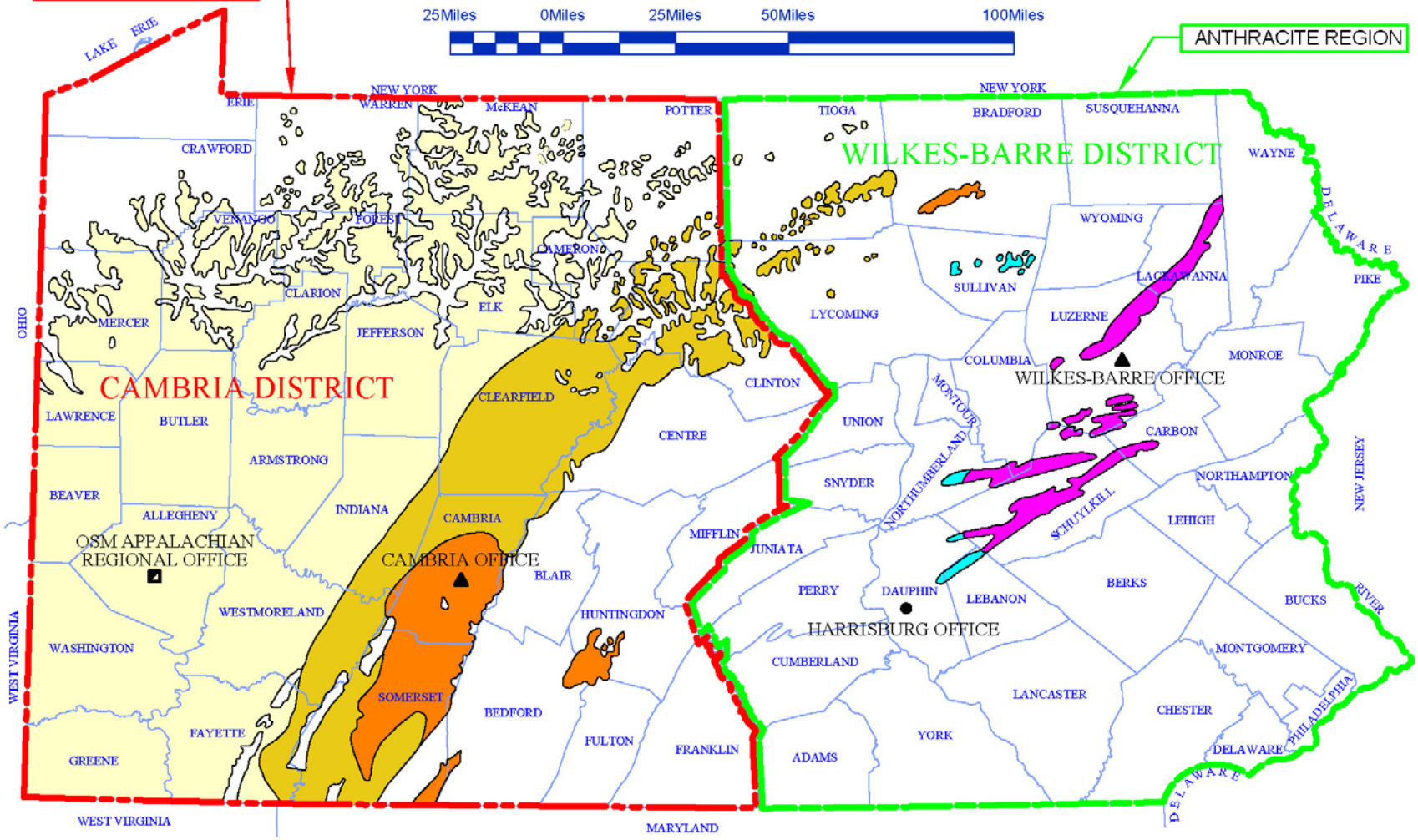
BUREAU OF ABANDONED MINE RECLAMATION

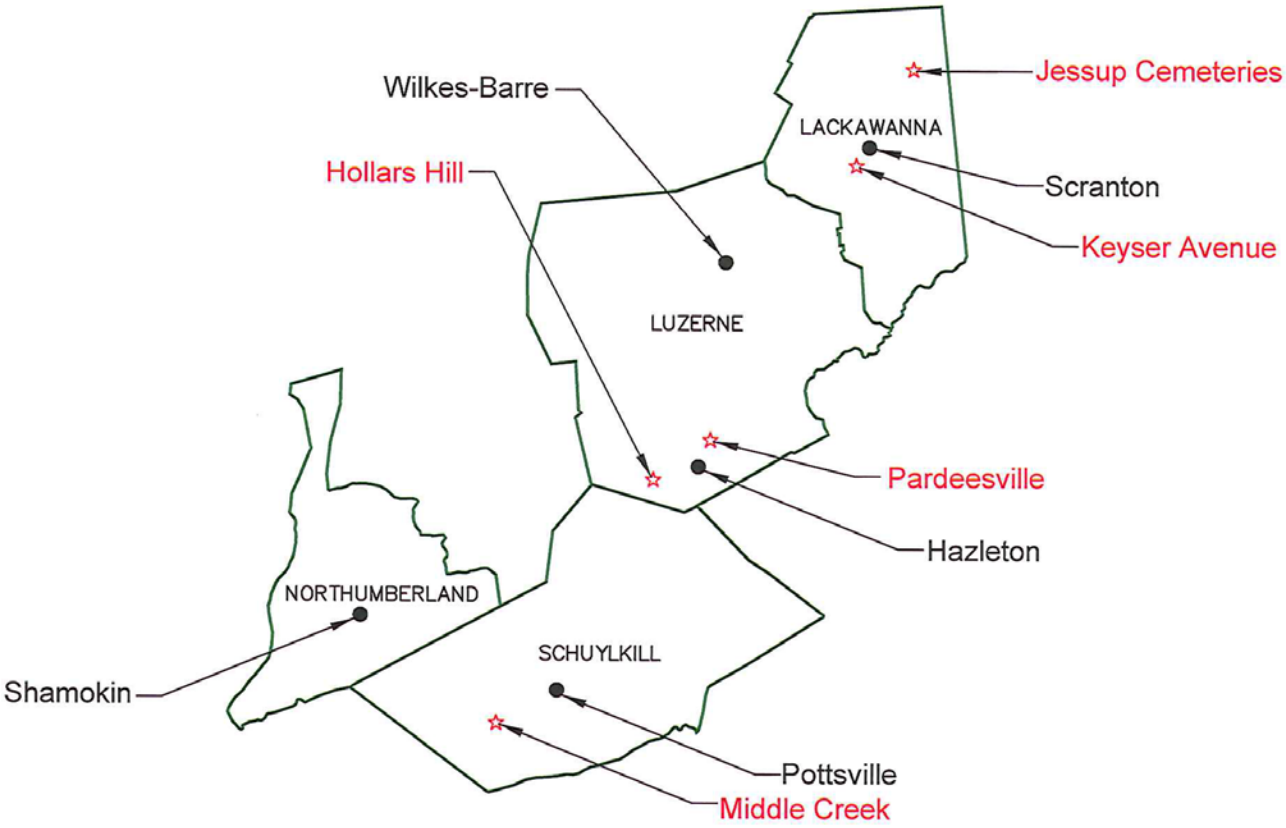
BAMR DISTRICT BOUNDARIES

DISTRIBUTION OF PENNSYLVANIA COALS



Adapted from Commonwealth of Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey Map11

PROJECTS IN NORTHEASTERN PENNSYLVANIA



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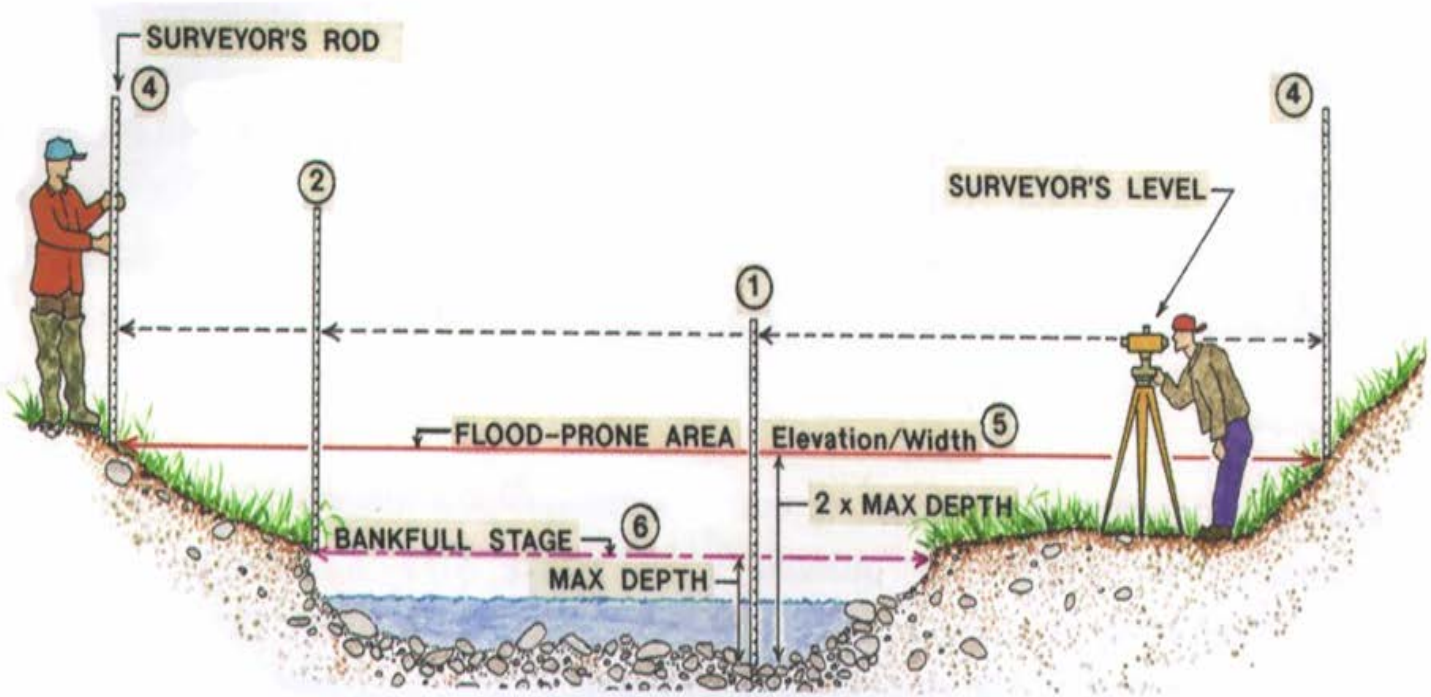
Design Criteria



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Rosgen Classification Criteria

- 1) Entrenchment Ratio (ER) - W_{fpa} / W_{bkf}
- 2) Width/Depth Ratio - W_{bkf} / d_{bkf}
- 3) Sinuosity (K) - SL / VL
- 4) Channel Materials (pebble count) – Gravel, Cobbles, Bedrock, etc.
- 5) Slope (S) – Channel Slope

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Rosgen Stream Classification

	Single-Thread Channels																Multiple Chan
Entrenchment Ratio	Entrenched (Ratio: <1.4)						Moderately Entrenched (1.4-2.2)			Slightly Entrenched (> 2.2)							
Width/Depth Ratio	LOW Width/Depth Ratio (< 12)				Moderate to HIGH W/D (> 12)		MODERATE Width/Depth Ratio (> 12)			VERY LOW Width/Depth (< 12)		Moderate to HIGH Width/Depth (> 12)			Very HIGH Width/Depth (> 40)		
Sinuosity	LOW Sinuosity (< 1.2)		MODERATE Sinuosity (> 1.2)		MODERATE Sinuosity (> 1.2)		MODERATE Sinuosity (> 1.2)			VERY HIGH Sinuosity (> 1.5)		HIGH Sinuosity (> 1.2)			LOW Sinuosity (< 1.2)		
Stream Type	**A**		**G**		**F**		**B**			**E**		**C**			**D**		
Slope	Slope Range		Slope Range		Slope Range		Slope Range			Slope Range		Slope Range			Slope Range		
	> 0.10	0.04-0.099	0.02-0.039	< 0.02	0.02-0.039	< 0.02	0.04-0.099	0.02-0.039	< 0.02	0.02-0.039	< 0.02	0.02-0.039	0.001-0.020	< 0.001	0.02-0.039	0.001-0.020	< 0.001
CHANNEL MATERIAL																	
Bedrock	A1a+	A1	G1	G1c	F1b	F1	B1a	B1	B1c			C1b	C1	C1c-			
Boulders	A2a+	A2	G2	G2c	F2b	F2	B2a	B2	B2c			C2b	C2	C2c-			
Cobble	A3a+	A3	G3	G3c	F3b	F3	B3a	B3	B3c	E3b	E3	C3b	C3	C3c-	D3b	D3	
Gravel	A4a+	A4	G4	G4c	F4b	F4	B4a	B4	B4c	E4b	E4	C4b	C4	C4c-	D4b	D4	D4c-
Sand	A5a+	A5	G5	G5c	F5b	F5	B5a	B5	B5c	E5b	E5	C5b	C5	C5c-	D5b	D5	D5c-
Silt/Clay	A6a+	A6	G6	G6c	F6b	F6	B6a	B6	B6c	E6b	E6	C6b	C6	C6c-	D6b	D6	D6c-

Pardeesville Project

Pardeesville Project

- Bankfull Discharge – 30 cfs
- W_{bkf} – 10 ft.
- d_{bkf} – 1.5 ft.
- ER – 13.5
- W/D – 6.7
- K – 1.2
- S – 0.008 ft/ft
- C3/E3 classification

Construction Fall 1998

Construction Fall 1998

Construction Fall 1998

May 1999

June 1999

July 1999

July 1999

July 1999

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Spring 2000

Fall 2000

Harvesting Live Willow Stakes November 2000

Live Willow Stakes 11-2000

Spring 2001

Summer 2001

Summer 2001

April 2008

April 2008

August 2013

Keyser Avenue Project

Keyser Avenue Project

- Bankfull Discharge – 60 cfs
- W_{bkf} – 16 ft.
- d_{bkf} – 2.5 ft.
- ER – 1
- W/D – 6.4
- K – 1.2
- S – 0.086 ft/ft Step 18%, Pool 1%
- A2 classification

Summer 2000

Summer 2000

Fall 2000

December 2000

December 2000

May 2002

May 2002

May 2002

July 2006

Fall 2006

November 2006

Upper Reach - November 2006

November 2006 (above project)

April 2008

Before and After

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Before and After

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August 2013

May 2014

May 2014

Middle Creek Project

Middle Creek Project

- Bankfull Discharge – 115 cfs
- W_{bkf} – 22 ft.
- d_{bkf} – 1.5 ft.
- ER – 3.2
- W/D – 14.7
- K – 1.15
- S – 0.06 ft/ft
- B3a classification

Middle Creek Before

May 2003

June 2003

June 2003

July 2003

June 2004

December 2004

December 2004

December 2004

April 2008

April 2008

August 2013

Jessup Cemeteries Project

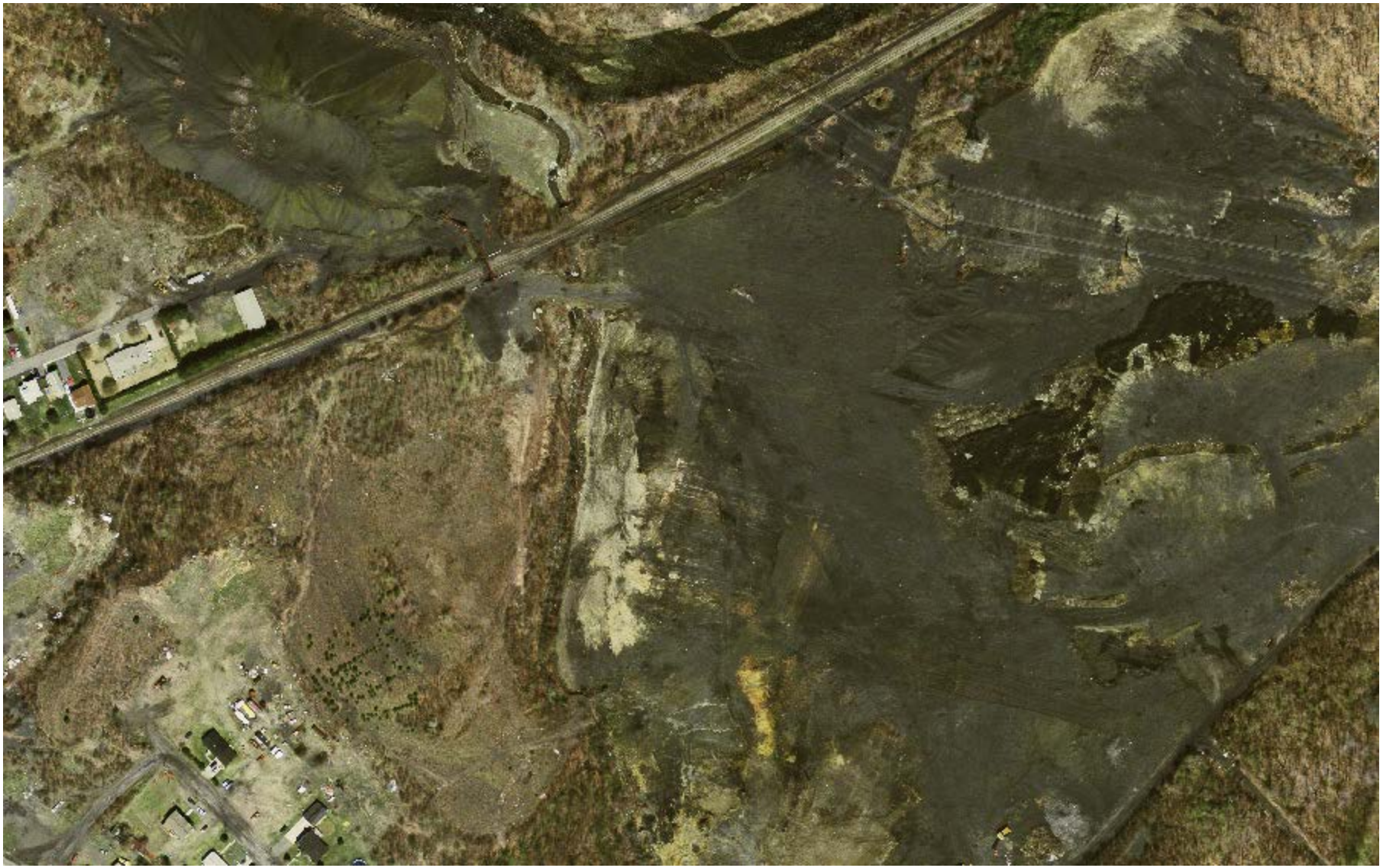
Jessup Cemeteries Project

- Bankfull Discharge – 190 cfs
- W_{bkf} – 28 ft.
- d_{bkf} – 2.0 ft.
- ER – 3.6
- W/D – 14
- K – 1.2
- S – 0.03 ft/ft (B3), 0.02 ft/ft (C3b)
- B3 and C3b classifications

Before

Grassy Island Creek - Before

Aerial Photo Before



Aerial Photo After

Construction 2004

Temporary Diversion Channel

August 2004

2005 Corrections to Floodplain

Remedial Work 2005

April 2008

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April 2008

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March 2011

New Construction - December 2012

“O” Vane Construction - 2012

Erosion Control Matting - 2012

June 2013 – 5” Rainfall

June 2013

June 2013

June 2013

August 2013

Hollars Hill Project

Hollars Hill Project

- Bankfull Discharge – 250 cfs
- W_{bkf} – 30 ft.
- d_{bkf} – 2.5 ft.
- ER – 6
- W/D – 12
- K – 1.5
- S – 0.02 ft/ft
- C4 classification

Aerial Photo Before

Aerial Photo After

Construction 2007

Construction without PVC Liner

PVC Liner vs. No PVC Liner

December 2008

October 2010

August 2013

August 2013

Observations

- 1) Proper Construction Methods
- 2) Vegetation – Quick as Possible
- 3) PVC Liner – No!
- 4) Repair Damaged Structures ASAP
- 5) Design – Should Include 100 yr. or Greater Storm Events
- 6) Floodplain – Proper Elevs. Essential
- 7) Steep Channel Design – C and E held up better than A or B

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Dennis M. Palladino. P.E.

Pennsylvania Department of Environmental Protection

Bureau of Abandoned Mine Reclamation, Wilkes-Barre, PA

dpalladino@pa.gov