

# WV Stream and Wetland Valuation Metric (SWVM) Development

Appalachian Stream Mitigation Workshop

April 11-15, 2011

Lexington, KY

Presented by the WV IRT:

Michael Hatten – USACE (Acting IRT Chair)

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Dennis Stottlemeyer – WVDEP



US Army Corps of Engineers  
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# Key Points

- IRT development of SWVM appropriate with progression of Best Available Science in WV
- Compliant with Final Rule
- Integrates individual (established) assessments and key parameters for chemical, physical and biological components
- Consistent unit-based (debit/credit) plane for assessing impacts and mitigation while preserving a rapid approach



# Best Available Science

- National Interagency Implementation Team-NAP Adopt HGM Approach
  - ▶ **August 1996 (FR 1997)**
- USEPA – RBPs for Wadeable Streams
  - ▶ **July 1999 (second addition)**
- USEPA/WVDEP – WVSCI
  - ▶ **March 2000 (Revised July 2000)**



# Best Available Science (cont'd)

- USACE – ERDC IFAA
  - ▶ Rapid Assessment to use during completion of a comprehensive methodology (HGM)
  - ▶ **August 2007**
- Final Rule on Compensatory Mitigation
  - ▶ Encourages the use of an appropriate assessment method (e.g. hydrogeomorphic approach to wetlands functional assessment, index of biological integrity) or “**other suitable metric**”
  - ▶ **June 2008**



# Best Available Science (cont'd)

- WV SWVM v1.0 released by IRT via PN
  - Presented as “a tool”, not “the tool”
  - **February 2010**



U S Army Corps  
of Engineers  
Huntington District  
Regulatory Branch

## Public Notice

In reply refer to Public Notice No.	Issuance Date:
<b>LRH-2009-WV IRT INITIATIVES</b>	<b>February 1, 2010</b>
Stream:	Closing Date:
<b>WV Streams and Wetlands</b>	<b>March 3, 2010</b>

Please address any inquiries to:

U.S. Army Corps of Engineers, Huntington District  
ATTN: CELRH-OR-F Public Notice No. (reference above)  
502 Eighth Street  
Huntington, West Virginia 25701-2070

Phone: (304) 399-5710

### GUIDANCE ON THE WEST VIRGINIA INTERAGENCY REVIEW TEAM INITIATIVES ADMINISTERED IN ACCORDANCE WITH THE 2008 FINAL RULE ON COMPENSATORY MITIGATION FOR LOSSES OF AQUATIC RESOURCES WITHIN THE U.S. ARMY CORPS OF ENGINEERS, HUNTINGTON AND PITTSBURGH DISTRICTS

**Joint Public Notice:** This joint public notice is distributed on behalf of the West Virginia Interagency Review Team (IRT), which consists of the following federal and state resource agencies: U.S. Army Corps of Engineers (USACE) Huntington and Pittsburgh Districts, U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS), West Virginia Department of Environmental Protection (WVDEP) and West Virginia Division of Natural Resources (WVDNR).

**Authority:** The initiatives described below are administered by the IRT in accordance with the mitigation procedures derived from the USACE and USEPA final rule on Compensatory Mitigation for Losses of Aquatic Resources (final rule), published on April 10, 2008 in the Federal Register (Vol. 73, No. 70). The federal regulations associated with this final rule include 33 CFR 325 and 33 CFR 332 (*federal regulations for the USACE*) and 40 CFR 230 (*federal regulations for the USEPA*). The final rule became effective June 9, 2008 and may be referenced in its entirety at [http://www.usace.army.mil/CECW/Pages/final\\_cmr.aspx](http://www.usace.army.mil/CECW/Pages/final_cmr.aspx).

**Purpose:** The purpose of this public notice is to advise applicants, consultants, industry and the general public of the various initiatives currently being administered by the IRT.

\*Note: This public notice is issued for information purposes only and no comments are being requested.

#### INTERAGENCY REVIEW TEAM

As indicated in the USACE's regulations [33 CFR 332.8(b)], the district engineer will establish an IRT to review documentation for the establishment and management of mitigation banks and in-lieu fee programs. The primary role of the IRT is to facilitate the establishment of mitigation

# Best Available Science (cont'd)

- USACE – ERDC HGM
  - ▶ Eph and Int High-gradient streams ( $\geq 4\%$  slope)
  - ▶ Operational Draft Regional Guidebook released
  - ▶ **July 2010**

ERDC/EL TR-10-11

Environmental Laboratory



US Army Corps  
of Engineers®  
Engineer Research and  
Development Center

Wetlands Regulatory Assistance Program

## Operational Draft Regional Guidebook for the Functional Assessment of High-gradient Ephemeral and Intermittent Headwater Streams in Western West Virginia and Eastern Kentucky

U.S. Army Corps of Engineers

July 2010



Approved for public release; distribution is unlimited.

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# Best Available Science (cont'd)

- WV SWVM v2.0 released by IRT via PN
  - ▶ Revisions include
    - Mitigation Site Location Data
    - Integrated HGM
    - Removal of “No Net Loss” Default
    - 10yr Column for Mitigation
    - Extent of Restoration Work Incentive
    - Buffer Zone Width Incentive
  - ▶ **February 2011**



# Pre-SWVM Assessments:

- Assortment of individual conditional or functional assessments
  - ▶ USEPA RBPs
  - ▶ WV SCI (benthics)
  - ▶ pH
  - ▶ Conductivity
  - ▶ BEHI
  - ▶ SMCRA-related
    - Buffer Zone Analysis (BZA)
    - Cumulative Hydrologic Impact Assessment (CHIA)



Overwhelming task for *Reviewer's* to correlate individual assessment findings to form an overall condition in a consistent and timely manner (i.e. BPJ)



# Pre-SWVM Assessments:

- Factors and Values
  - ▶ Temporal loss
  - ▶ Long-term protection (vs. perpetual)
  - ▶ Linear feet-based evaluations
    - Impact
    - Mitigation (min. 1:1 ratio)
  - ▶ Buffers
  - ▶ In-kind and out-of-kind mitigation

*Determined on a  
case-by-case  
basis*



# Agency/IRT Evaluation Needs:

- ▶ Comprehensive metric developed with key physical, chemical and biological parameters
- ▶ Debit/Credit determination system
- ▶ Consistent plane for assessing debits/credits
- ▶ Methodology incorporating factors and values
  - Temporal Loss
  - Risk of Protection
  - Extent of Mitigation
    - ▷ Level of restoration
    - ▷ Buffer widths



# IRT SWVM Development:

- Compliant with 2008 Final Rule on Compensatory Mitigation
  - ▶ “other suitable metric”
- IRT Role: Establishment and Management of Mitigation Banks and In-lieu Fee Programs
  - ▶ IRT Members:
    - WV State Resource Agencies
      - ▷ DNR and DEP
    - Federal Resource Agencies
      - ▷ USFWS, USDA, USEPA and USACE (Chair)

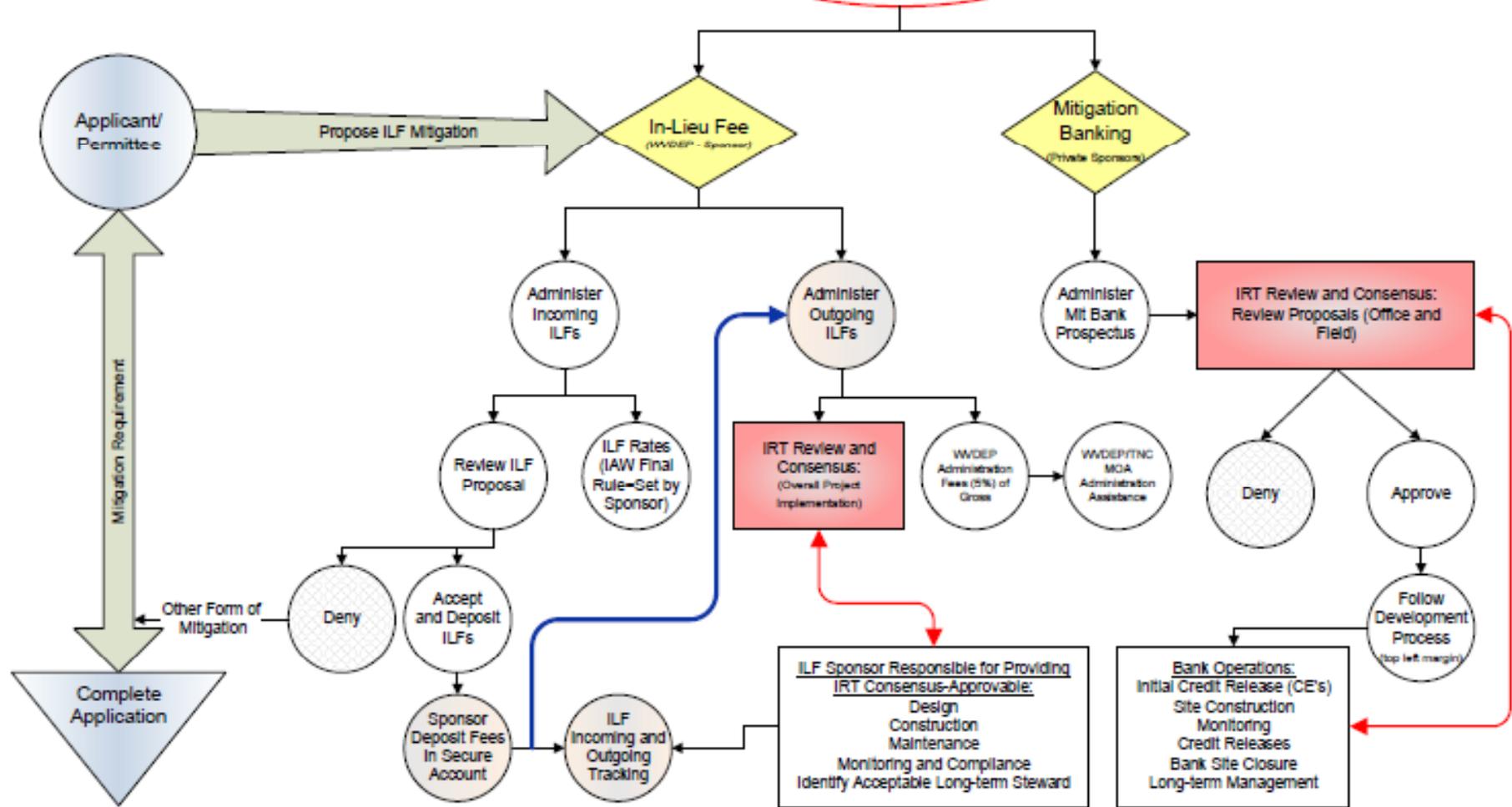


**Development Process for ILF and Bank Instruments:**

- Preapplication and Consultation
  - Compensation Planning Framework
- Draft Prospectus
- Prospectus
  - Public Notice
  - Evaluation of Prospectus
- Draft Instrument
- Final Instrument

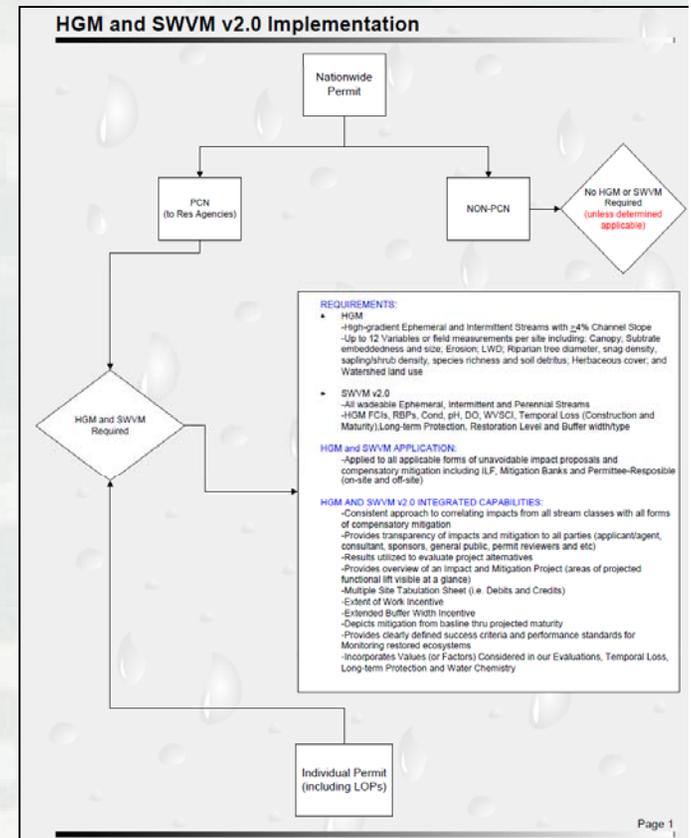
## West Virginia Interagency Review Team (IRT)

(Chaired by USACE)



# SWVM “Highly Recommended” When?

- Impact Thresholds**
- Applications which require one of the following:
    - ▶ PCN to the Resource Agencies (NWP)
    - ▶ Public Notice (IP)
    - ▶ USACE may also require on a case-by-case basis as deemed appropriate
  - Applies to Mitigation Banks, ILF Projects as well as Permittee-Responsible Mitigation



# SWVM (v2.0) Data Entry ~ Stream Parts Tab 1 (Impact and Mitigation Assessment)

## West Virginia Stream and Wetland Valuation Metric

(Stream Valuation Metric - Worksheet 1 of 3)

USACE FILE NO./Project Name:	Reynolds Creek Development (SWVM V2.0 Example)		IMPACT COORDINATES: (In Decimal Degrees)	Lat	-81.8346	Lon	39.1713	WEATHER:	Cloudy, 40 degrees	DATE:	January 28, 2011			
STREAM CLASSIFICATION:	Intermittent		IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (square), watershed or topographic)	Channel Slope 4%, 70 ac Watershed, Un-impacted Forestland				MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (square), watershed or topographic)	Intermittent, Channel Slope 4.5%, 85 ac Watershed, minimal impairments due to gas exploration and logging					
STREAM IMPACT LENGTH:	250	FORM OF MITIGATION:	Permittee Responsible-On-site	MIT COORDINATES: (In Decimal Degrees)	Lat	-81.8213	Lon	39.2314	PRECIPITATION PAST 48 HRS:	0.1	Mitigation Length:	475		
<b>Column No. 1- Impact Existing Condition (Debit)</b>			<b>Column No. 2- Mitigation Existing Condition - Baseline (Credit)</b>			<b>Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)</b>			<b>Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)</b>			<b>Column No. 5- Mitigation Projected At Maturity (Credit)</b>		
<b>HGM Score (attach data forms):</b>			<b>HGM Score (attach data forms):</b>			<b>HGM Score (attach data forms):</b>			<b>HGM Score (attach data forms):</b>			<b>HGM Score (attach data forms):</b>		
Hydrology			Hydrology			Hydrology			Hydrology			Hydrology		
Biogeochemical Cycling			Biogeochemical Cycling			Biogeochemical Cycling			Biogeochemical Cycling			Biogeochemical Cycling		
Habitat			Habitat			Habitat			Habitat			Habitat		
Average			Average			Average			Average			Average		
0.834			0.432			0.715			0.795			0.798		
0.763			0.389			0.692			0.723			0.766		
0.798			0.382			0.783			0.862			0.883		
0.79166667			0.401			0.73			0.79333333			0.8153333		
PART I - Physical, Chemical and Biological Indicators			PART I - Physical, Chemical and Biological Indicators			PART I - Physical, Chemical and Biological Indicators			PART I - Physical, Chemical and Biological Indicators			PART I - Physical, Chemical and Biological Indicators		
Physical Indicator			Physical Indicator			Physical Indicator			Physical Indicator			Physical Indicator		
USEPA RSP (High Gradient Data Sheet)			USEPA RSP (High Gradient Data Sheet)			USEPA RSP (High Gradient Data Sheet)			USEPA RSP (High Gradient Data Sheet)			USEPA RSP (High Gradient Data Sheet)		
1. Epifaunal Substrate Available Cover			1. Epifaunal Substrate Available Cover			1. Epifaunal Substrate Available Cover			1. Epifaunal Substrate Available Cover			1. Epifaunal Substrate Available Cover		
2. Periphyton Density			2. Periphyton Density			2. Periphyton Density			2. Periphyton Density			2. Periphyton Density		
3. Velocity Depth Regime			3. Velocity Depth Regime			3. Velocity Depth Regime			3. Velocity Depth Regime			3. Velocity Depth Regime		
4. Sediment Deposition			4. Sediment Deposition			4. Sediment Deposition			4. Sediment Deposition			4. Sediment Deposition		
5. Channel Flow Status			5. Channel Flow Status			5. Channel Flow Status			5. Channel Flow Status			5. Channel Flow Status		
6. Channel Abandonment			6. Channel Abandonment			6. Channel Abandonment			6. Channel Abandonment			6. Channel Abandonment		
7. Frequency of Riffles (or bands)			7. Frequency of Riffles (or bands)			7. Frequency of Riffles (or bands)			7. Frequency of Riffles (or bands)			7. Frequency of Riffles (or bands)		
8. Bank Stability (L.R. & R.R.)			8. Bank Stability (L.R. & R.R.)			8. Bank Stability (L.R. & R.R.)			8. Bank Stability (L.R. & R.R.)			8. Bank Stability (L.R. & R.R.)		
9. Vegetative Protection (L.S. & R.R.)			9. Vegetative Protection (L.S. & R.R.)			9. Vegetative Protection (L.S. & R.R.)			9. Vegetative Protection (L.S. & R.R.)			9. Vegetative Protection (L.S. & R.R.)		
10. Relative Vegetative Zone Width (L.R. & R.R.)			10. Relative Vegetative Zone Width (L.R. & R.R.)			10. Relative Vegetative Zone Width (L.R. & R.R.)			10. Relative Vegetative Zone Width (L.R. & R.R.)			10. Relative Vegetative Zone Width (L.R. & R.R.)		
Total RSP Score			Total RSP Score			Total RSP Score			Total RSP Score			Total RSP Score		
Sub-Total			Sub-Total			Sub-Total			Sub-Total			Sub-Total		
0.78			0.5			0.7			0.81			0.875		
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)		
WVDEP Water Quality Indicators (General)			WVDEP Water Quality Indicators (General)			WVDEP Water Quality Indicators (General)			WVDEP Water Quality Indicators (General)			WVDEP Water Quality Indicators (General)		
Specific Conductivity			Specific Conductivity			Specific Conductivity			Specific Conductivity			Specific Conductivity		
100-190 = 85 points			100-500 = 50 points			300-390 = 70 points			300-390 = 70 points			300-390 = 70 points		
All			All			All			All			All		
6.0-9.0 = 10 points			4.0-5.5 = 10 points			5.0-6.0 = 45 points			5.0-6.0 = 45 points			5.0-6.0 = 45 points		
DO			DO			DO			DO			DO		
+5.0 = 10 points			+5.0 = 10 points			+5.0 = 30 points			+5.0 = 30 points			+5.0 = 30 points		
Sub-Total			Sub-Total			Sub-Total			Sub-Total			Sub-Total		
0.975			0.35			0.45			0.725			0.725		
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)		
WV Stream Condition Index (WVSCI)			WV Stream Condition Index (WVSCI)			WV Stream Condition Index (WVSCI)			WV Stream Condition Index (WVSCI)			WV Stream Condition Index (WVSCI)		
Good			Gray Zone			Good			Good			Good		
0.100			0.100			0.100			0.100			0.100		
0.1			0.1			0.1			0.1			0.1		
72			63			65			70			72		
Sub-Total			Sub-Total			Sub-Total			Sub-Total			Sub-Total		
0.72			0.63			0.65			0.7			0.72		
PART II - Index and Unit Score			PART II - Index and Unit Score			PART II - Index and Unit Score			PART II - Index and Unit Score			PART II - Index and Unit Score		
Index			Index			Index			Index			Index		
Linear Feet			Linear Feet			Linear Feet			Linear Feet			Linear Feet		
Unit Score			Unit Score			Unit Score			Unit Score			Unit Score		
0.808333333			0.447166667			0.665			0.769166667			0.794333333		
250			475			475			475			475		
262.063333			212.40417			315.875			365.354167			377.30633		

Impact

Baseline Mitigation

Mitigation Projected at 5 yrs

Mitigation Projected at 10 yrs

Mitigation Projected Maturity

# SWVM (v2.0) Data Entry ~ Stream Parts Tab 1

Column No. 1- Impact Existing Condition (Debit)			
HGM Score (attach data forms):			Average
Hydrology	0.824	0.79166667	
Biogeochemical Cycling	0.753		
Habitat	0.798		
PART I - Physical, Chemical and Biological Indicators			
			Points Scale Range Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	16
2. Embeddedness	0-20		16
3. Velocity/ Depth Regime	0-20		16
4. Sediment Deposition	0-20		16
5. Channel Flow Status	0-20		16
6. Channel Alteration	0-20		16
7. Frequency of Riffles (or bends)	0-20		14
8. Bank Stability (LB & RB)	0-20		14
9. Vegetative Protection (LB & RB)	0-20		14
10. Riparian Vegetative Zone Width (LB & RB)	0-20		18
Total RBP Score	Suboptimal		156
Sub-Total			0.78
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
100-199 = 85 points	0-90	0-1	100
pH			
6.0-8.0 = 80 points	0-80		6.2
DO			
<5.0 = 10 points	10-30		12
Sub-Total			0.975
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	72
Sub-Total			0.72

Column No. 2- Mitigation Existing Condition - Baseline (Credit)			
HGM Score (attach data forms):			Average
Hydrology	0.432	0.401	
Biogeochemical Cycling	0.389		
Habitat	0.382		
PART I - Physical, Chemical and Biological Indicators			
			Points Scale Range Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	8
2. Embeddedness	0-20		8
3. Velocity/ Depth Regime	0-20		8
4. Sediment Deposition	0-20		8
5. Channel Flow Status	0-20		8
6. Channel Alteration	0-20		12
7. Frequency of Riffles (or bends)	0-20		12
8. Bank Stability (LB & RB)	0-20		12
9. Vegetative Protection (LB & RB)	0-20		12
10. Riparian Vegetative Zone Width (LB & RB)	0-20		12
Total RBP Score	Marginal		100
Sub-Total			0.5
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
500-599 = 50 points	0-90	0-1	500
pH			
4.6-5.5 = 10 points	5-90		5.3
DO			
<5.0 = 10 points	10-30		4
Sub-Total			0.35
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Grey Zone	0-100	0-1	63
Sub-Total			0.63

# A Breakdown of SWVM Baseline Components

- HGM
- Physical
  - ▶ USEPA RBPs
- Chemical
  - ▶ Conductivity, pH and DO
- Biological
  - ▶ WVSCI

Each of the four  
Sections have been  
Scaled from:  
0 (poor) to 1.0 (best)



# A Breakdown of SWVM Baseline Components (cont'd)

- Agency/IRT consensus on scales and weighting approach

Score	Range	Default Values	Score	Individual Percentages	Overall Percentage			
<b>HGM (Operational Draft Regional Guidebook July 2010)</b>								
Hydrology	0-1.0	NA	Avg of FCI Scores		50%			
Biogeochemical Cycling	0-1.0							
Habitat	0-1.0							
<b>Physical Indicator</b>								
1. Epifaunal Substrate/Available Cover	0-20	NA	0-200		33%			
2. Pool Substrate Characterization	0-20							
3. Pool Variability	0-20							
4. Sediment Deposition	0-20							
5. Channel Flow Status	0-20							
6. Channel Alteration	0-20							
7. Channel Sinuosity	0-20							
8. Bank Stability (LB & RB)	0-20							
9. Vegetative Protection (LB & RB)	0-20							
10. Riparian Vegetative Zone Width (LB and RB)	0-20							
<b>Chemical Indicator</b>								
<b>DO</b>								
>5	30	Default	30	15%	33%			
0-5	10							
<b>Specific Conductivity</b>								
0-99	90	Default	85	45%				
100-199	85							
200-299	80							
300-399	70							
400-499	60							
500-599	50							
600-749	40							
750-999	30							
1000-1499	20							
1500-2500	10							
<b>pH</b>								
0-3.5	0	Default	45	40%				
3.6-4.5	5							
4.6-5.5	10							
5.6-5.9	45							
6.0-8.0	80							
8.1-9.0	45							
9.1-11	10							
<b>Biological Indicator</b>								
100-86	1					1	33%	
60.6-86	x/100					x/100		
20-60.5	(x-10)/100		(x-10)/100					
<20	0		0					

# SWVM (v2.0) Data Entry ~ Stream Parts Tab 2

## (Impact and Mitigation Assessment)

### West Virginia Stream and Wetland Valuation Metric

(Stream Valuation Metric - Worksheet 2 of 3)

PART III - Impact Factors (See instruction page to insert default values for MITIGATION BANKING and ILF)			
<b>Temporal Loss-Construction</b>		<b>Long-term Protection</b>	
<i>*Note: Reflects duration of aquatic functional loss between the time of an impact (debit) and completion of compensatory mitigation (credit).</i>		% Add. Mitigation and Monitoring Period	Long-Term Protection (Years)
Years	4		
Sub-Total	0.097	0 = 5/10 Year Monitoring	101
<b>Temporal Loss-Maturity</b>		Sub-Total	0
<i>*Note: Period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. maturity of tree stratum to provide organic matter and detritus within riparian stream or wetland buffer corridor).</i>		<b>PART IV - Index to Unit Score Conversion</b>	
% Add. Mitigation	Temporal Loss-Maturity (Years)	Final Index Score (Debit)	Linear Feet
		Unit Score (Debit)	ILF Costs (Offsetting Debit Units)
30%	30	1.235333333	250
Sub-Total	0.33	308.8333333	\$247,066.67

PART V - Comparison of Unit Scores and Projected Balance									
Final Unit Score (Debit) [No Net Loss Value]	308.8333333	Mitigation Existing Condition - Baseline (Credit)	212.4041667	Mitigation Projected at Five Years Post Completion (Credit)	315.875	Mitigation Projected at Ten Years Post Completion (Credit)	365.3541667	Mitigation Projected At Maturity (Credit)	377.3083333
<b>FINAL PROJECTED NET BALANCE</b>					103.4708333		152.95		164.9041667

Part VI - Mitigation Considerations (Incentives)			
<b>Extent of Stream Restoration</b>		<b>Extended Upland Buffer Zone</b>	
<i>*Note1: Reference the instructional handout to determine the correct Restoration Levels (below) for your project</i>		<i>*Note1: Reference instructional handout for the definitions of the Buffer Zone Mitigation Extents and Types (below)</i>	
<i>*Note2: Place an "X" in the appropriate category (only select one).</i>		<i>*Note2: Enter the buffer width for each channel side (Left Bank and Right Bank)</i>	
Level I Restoration		<i>*Note3: Select the appropriate mitigation type</i>	
Level II Restoration		<b>Buffer Width</b>	<b>Left Bank</b>
Level III Restoration	x	150	0-50 51-150
			Preservation and Re-vegetation Preservation
		<b>Buffer Width</b>	<b>Right Bank</b>
		130	0-50 51-150
			Preservation and Re-vegetation Preservation
		<b>Average Buffer Width/Side</b>	140

Site	Impact Unit Yield (Debit)	Mitigation Unit Yield (Credit)
Reynolds Crk Stream 1 - Segment A	308.8333333	312.4933958

# Factors and Value Components

- ▶ Temporal Loss
- ▶ Long-term Protection
- ▶ Extent of Restoration Work Incentive
- ▶ Extended Buffer Zone Width Incentive

Temporal Loss-Construction (period between impact and completion of mitigation)	
Year(s)	% Additional Mitigation (figure added to total debit)
≤ 1	0
2	6
3	9
4	12
5	15
6	18
7	21
8	24
9	27
10	30
11	33
12	36
13	39
14	42
15	45
16	48
17	51
18	54
19	57
≥ 20	60

Long-term Protection	
Year(s)	% Additional Mitigation
0-20	50% + 20 yr Monitoring
21-30	40% + 15 yr Monitoring
31-40	30% + 10 yr Monitoring
41-50	20% + 5/10 yr Monitoring
51-100	10% + 5/10 yr Monitoring
Perpetual	0% + 5/10 yr Monitoring

Temporal Loss-Maturity (period between mitigation completion and maturity)	
Year(s)	% Additional Mitigation (figure added to total debit)
<5	0%
5.1-10	10%
10.1-15	20%
15.1-19	30%

Extent of Stream Restoration - Incentive (% multiplied by projected lift and added to total)	
Level I Restoration	100%
Level II Restoration	75%
Level III Restoration	50%

Extended Buffer Zone Width - Incentive (% multiplied by projected lift and added to total)	
Inner Buffer 0-100' (or 0-50'/bank)	Preservation 10%
	Preservation and Supplemental 20%
	Preservation and Revegetation 35%
Outer Buffer 101-300' (or 51-150'/bank)	Preservation 5%
	Preservation and Supplemental 10%
	Preservation and Revegetation 17.5%

# Extent of Restoration

Restoration Incentive Levels	Applicable Stream Classification	Activity Types	Corresponding Priority Level	Incentive Amount
Level I	Moderate and Low-gradient (Perennial and Intermittent )	Full-extent Channel/ Habitat Restoration, Floodplain Restoration and Bank Stability	Priority 1 and Priority 2 (as deemed applicable based upon a case-by-case review)	100%
Level II	Moderate and Low-gradient (Perennial and Intermittent)	Significant Floodplain Re-establishment, Habitat Improvement & Bank Stability	Priority 2	75%
Level III	High, Moderate and Low-gradient (Perennial, Intermittent and Ephemeral)	Intensive Channel Restoration, Habitat Restoration & Bank Stability	Priority 3	50%

Caveat: A Watershed Approach (or a Watershed Plan) shall be provided to qualify for the above incentives .



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# Extent of Restoration (cont'd)

United States  
Department of  
Agriculture

Natural  
Resources  
Conservation  
Service

Part 654 Stream Restoration Design  
National Engineering Handbook

Chapter 11

Rosgen Geomorphic  
Channel Design



- ▶ Level 1  
(Priority 1 & 2)
- ***Full-extent  
Channel/ Habitat  
Restoration,  
Floodplain  
Restoration and  
Bank Stability***



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# Extent of Restoration (cont'd)

Table 11-14 Morphological characteristics of the existing and proposed channel with gage station and reference reach data

Restoration site (name of stream and location):

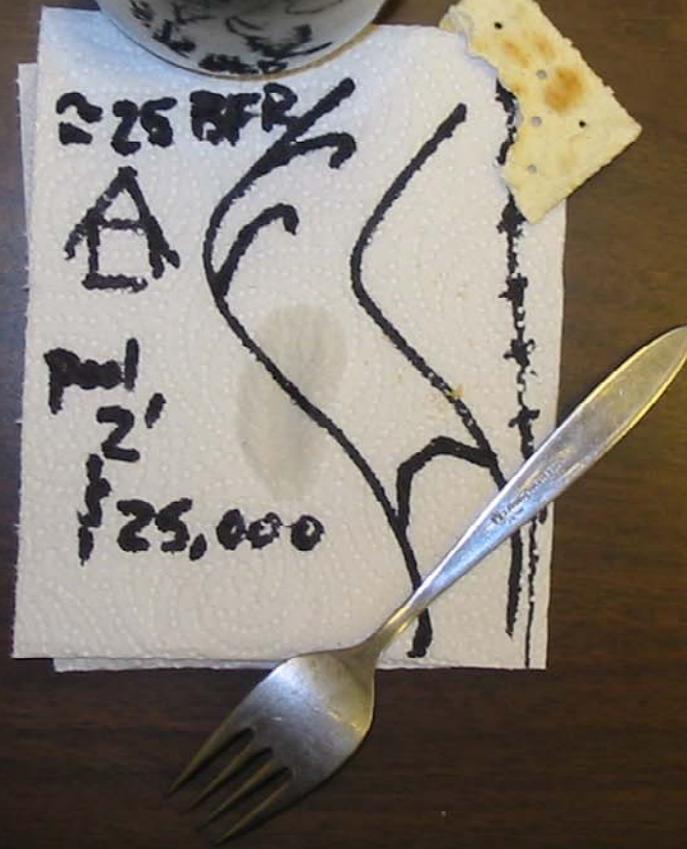
Reference reach (name of stream and location):

Variables	Existing channel	Proposed reach	USGS station	Reference reach
1 Stream type				
2 Drainage area, mi <sup>2</sup>				
3 Mean riffle depth, ft ( $d_{bkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
4 Riffle width, ft ( $W_{bkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
5 Width-to-depth ratio ( $W_{bkr}/d_{bkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
6 Riffle cross-sectional area, ft <sup>2</sup> ( $A_{bkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
7 Max riffle depth ( $d_{mbkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
8 Max riffle depth/mean riffle depth ( $d_{mbkr}/d_{bkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
9 Mean pool depth, ft ( $d_{bkp}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
10 Mean pool depth/mean riffle depth	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
11 Pool width, ft ( $W_{bkp}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
12 Pool width/riffle width	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
13 Pool cross-sectional area, ft <sup>2</sup> ( $A_{bkp}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
14 Pool area/riffle area	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
15 Max pool depth ( $d_{mbkp}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:
16 Max pool depth/mean riffle depth ( $d_{mbkp}/d_{bkr}$ )	Mean:	Mean:	Mean:	Mean:
	Range:	Range:	Range:	Range:

# 53 Variables



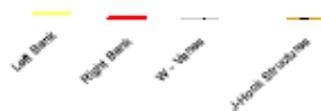
**This is not an acceptable plan**



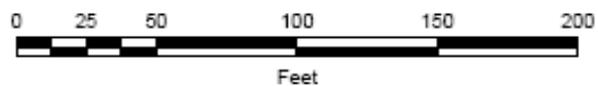
# Extent of Restoration (cont'd)



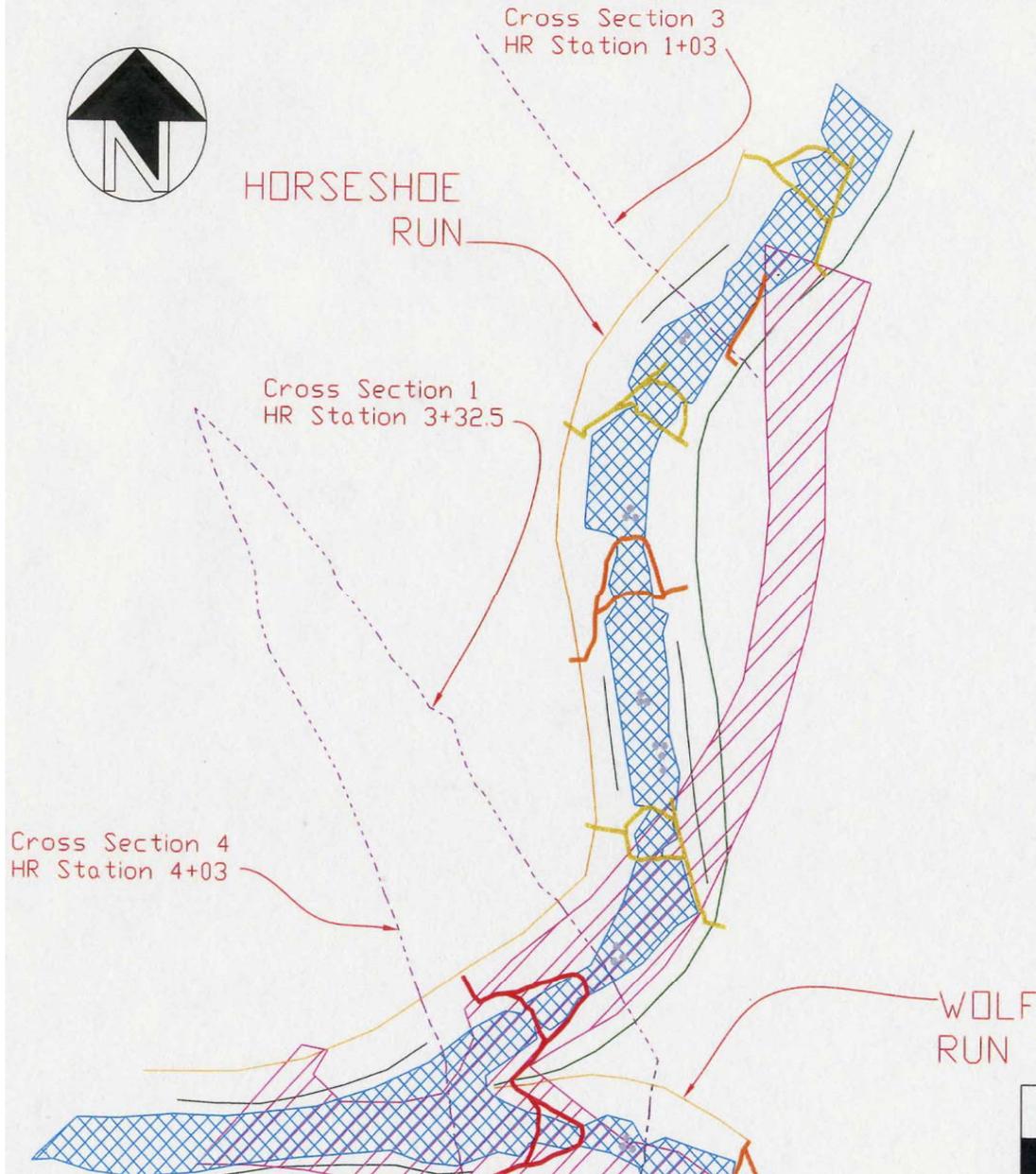
**Legend**



**Phase I Modification - Hockman**



# Extent of Restoration (cont'd)



## NOTES

Construction Completion Date: 7-31-2007

As-built Survey Date: June 2007

Surveyed By: Abby McQueen, Ed Watson,  
Will Postlethwait

## LEGEND

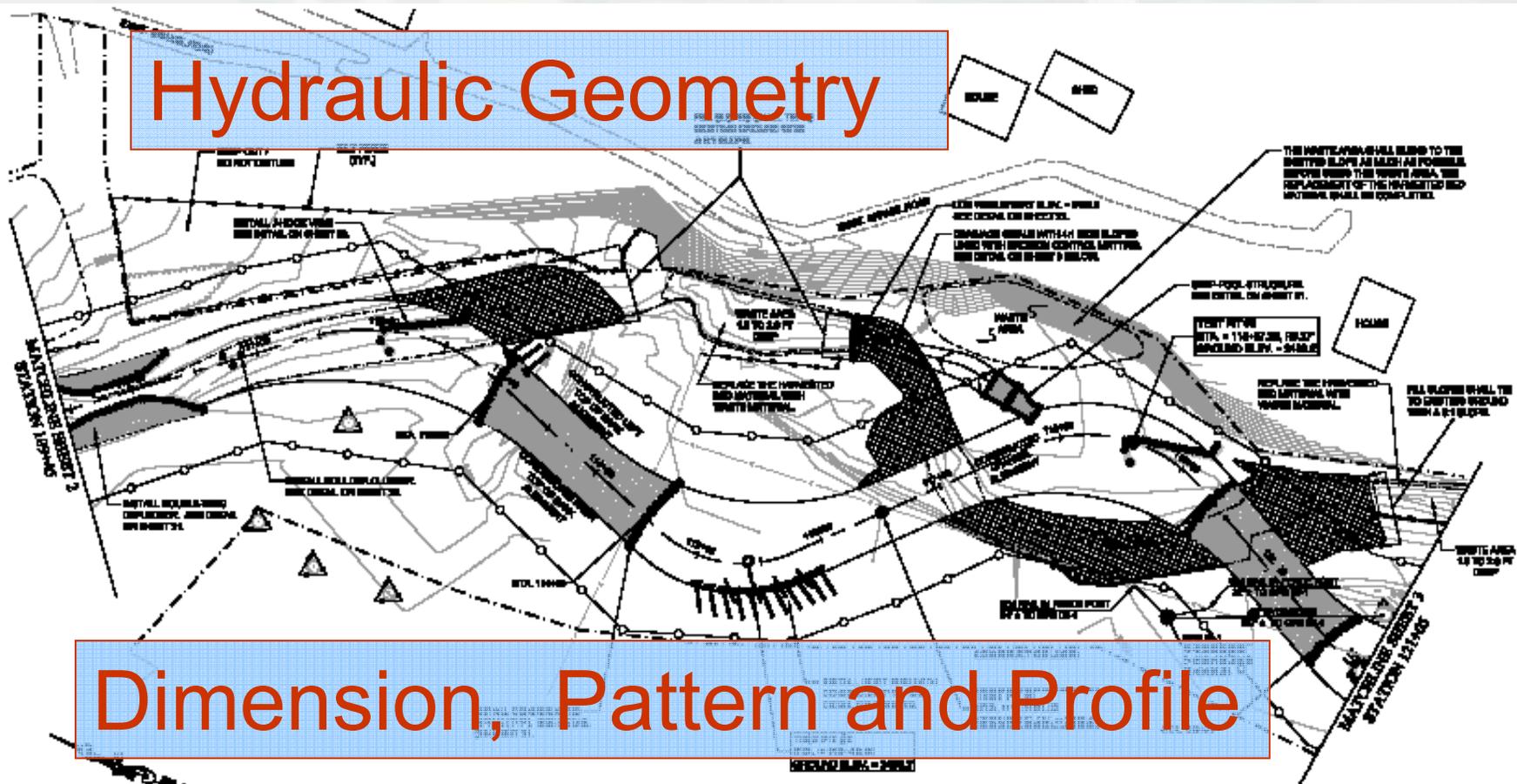
NAME	SYMBOL
As-Built Right Bankfull	
AB Left Bankfull	
AB Inner Berm	
AB Habitat Rock	
AB Boulder Cross Vane	
AB Boulder J-Hook w/ Step	
AB Combination Structure	
AB Rock Vane	
AB Thalweg Channel	
Original Thalweg Channel	

**"AS BUILT"**  
Date of Completion: 7-31-2007



# Extent of Restoration (cont'd)

## Hydraulic Geometry



## Dimension, Pattern and Profile



CONTRACTOR SHALL MAINTAIN EXISTING CHANNEL WITH 1:1H:1VH SLOPES UNLESS OTHERWISE NOTED. CONTRACTOR SHALL MAINTAIN EXISTING CHANNEL WITH 1:1H:1VH SLOPES UNLESS OTHERWISE NOTED.

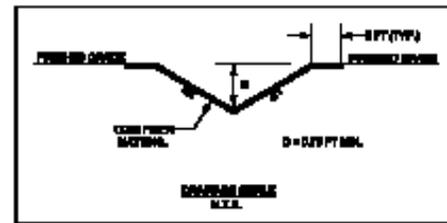
ALL WORK SHALL BE CONFORMED TO THE DIMENSION, PATTERN AND PROFILE INDICATED IN THE FIELD. CONTRACTOR SHALL MAINTAIN EXISTING CHANNEL WITH 1:1H:1VH SLOPES UNLESS OTHERWISE NOTED.

PERMANENT RESTORATION SHALL BE ESTABLISHED ALONG THE CHANNEL. WHICH SHALL BE MAINTAINED FOR AN 80% FLOOD CAPACITY. CONTRACTOR SHALL MAINTAIN EXISTING CHANNEL WITH 1:1H:1VH SLOPES UNLESS OTHERWISE NOTED.

THE CONTRACTOR SHALL BE REQUIRED TO INSTALL AND MAINTAIN TEMPORARY FENCES TO INCLUDE CATTLE FENCE TO BE CONSTRUCTION SITE FOR 12 MONTHS OF THE CONTRACT. TEMPORARY FENCES SHOULD BE LOCATED AT THE CONSTRUCTION LINE.

### LEGEND

- |  |                                  |  |                            |
|--|----------------------------------|--|----------------------------|
|  | EXISTING CHANNEL                 |  | J-HOOK WEIR                |
|  | EXISTING POWER POLE              |  | ROCK LINE ALIGNMENT        |
|  | EXISTING CHANNEL                 |  |                            |
|  | CONTRACTED TOP OF BANK ALIGNMENT |  | COVER LOG                  |
|  | EXISTING BANK OF CHANNEL PROFILE |  | FILL IN EXISTING CHANNEL   |
|  | EXISTING BANK CENTERLINE         |  | CONSTRUCTION LANE          |
|  | EXISTING BANK CENTERLINE         |  | TREE REMOVAL               |
|  | EXISTING TREE                    |  | TEMPORARY FENCE            |
|  | EXISTING TREE LINE               |  | PERMANENT STRUCTURE (POLE) |
|  | EXISTING POWER POLE              |  | EXISTING ROCK BENCH        |
|  | EXISTING OVERBANK POTENTIAL      |  |                            |
|  | PERMANENT STRUCTURE (POLE)       |  |                            |
|  | EXISTING ROCK BENCH              |  |                            |



Project Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Scale: \_\_\_\_\_  
 Drawing No: \_\_\_\_\_

**BUCK**  
 CONSULTING ENGINEERS  
 1000 N. 10th St., Suite 100  
 Fargo, ND 58102  
 Phone: (701) 785-1111  
 Fax: (701) 785-1112

UNIVERSITY OF NORTH DAKOTA  
 RESTORATION PROJECT OF  
 WATERSHED COLLEGE, WEST WYOMING

PROJECT PLAN MAP

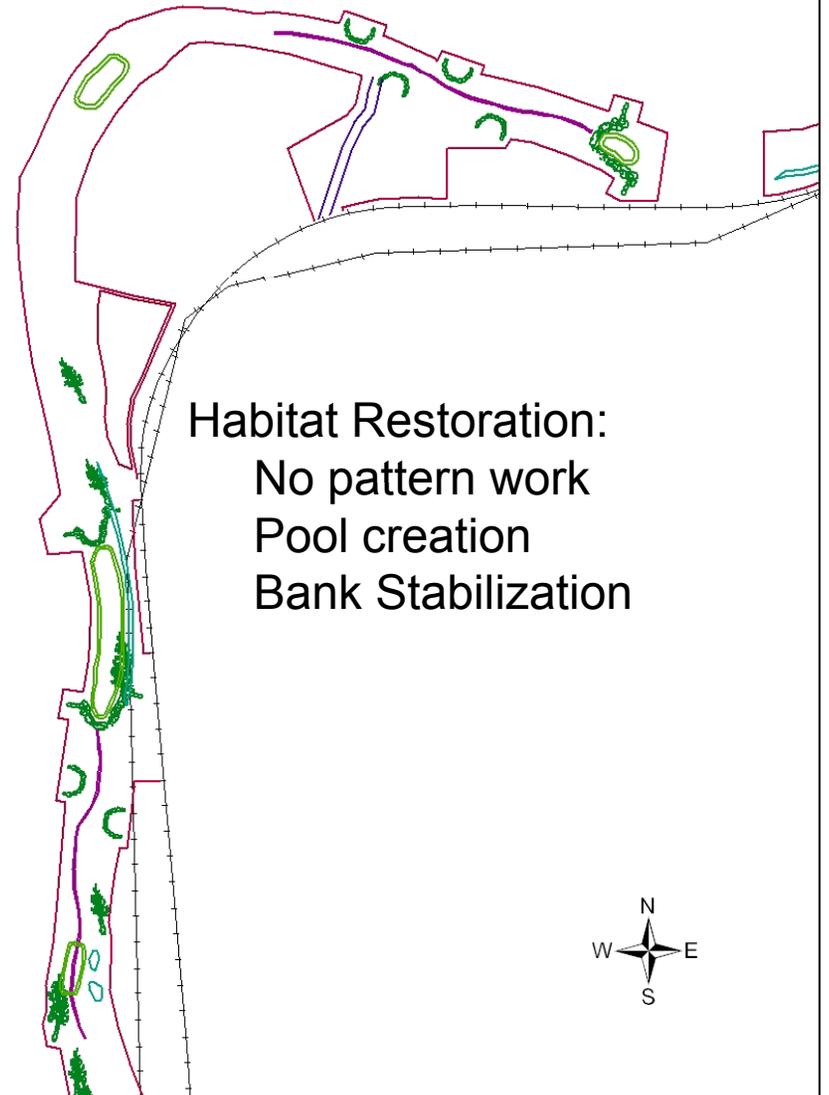
USDA NRCS  
 NATIONAL RESTORATION SERVICE

# Extent of Restoration (cont'd)

- ▶ Level 2
- ***Significant Floodplain Re-establishment, Habitat Improvement & Bank Stability***



Upper Shavers Habitat Restoration Project



# Extent of Restoration (cont'd)



- ▶ Level 3
- ***Intensive Channel Restoration, Habitat Restoration & Bank Stability***



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# Extent of Restoration (cont'd)





# SWVM Application

- Pro's [What it can do...]
  - ▶ HGM and SWVM integrated approach
  - ▶ Impact and mitigation assessments (baseline and projected)
  - ▶ Utilize to evaluate project alternatives
  - ▶ Monitor the performance of restored ecosystems (Mitigation)
  - ▶ Transparency of impacts and mitigation to all parties including: Applicant, Agent/ Consultant, Sponsors (Mit. Banks), General Public, Permit Reviewers



# SWVM Application

- Pro's [What it can do...] (cont'd)
  - ▶ Correlates impacts of all (wadeable) stream classes (Eph, Int and Per) with similar forms of stream compensatory mitigation
  - ▶ Provides overview of an impact and mitigation project (areas of projected functional lift visible at a glance)
  - ▶ Multiple Site Tabulation Sheet (i.e. Debits and Credits)
  - ▶ Incorporates factors and values considered in our evaluations
    - ▷ Temporal Loss
    - ▷ Long-term Protection
    - ▷ Water Chemistry  
*(if lights are "ON" we want somebody to be home...)*
    - ▷ Extent of Work Incentive
    - ▷ Extended Buffer Width Incentive



# SWVM Application

- Con's [What it does not do...]
  - ▶ Not functional assessment
    - IRT designed the foundation to be composed of widely-accepted individual assessments and key parameters used to correlate condition
  - ▶ Not peer-reviewed
    - HGM, a component of the SWVM v2.0, is under Peer-Review and Validation. The final HGM may replace the SWVM by incorporating similar factors and value components



# The “Future”

- HGM (Eph & Int Streams)
  - ▶ Under concurrent use and 2 year validation process
  - ▶ Revisions or tweaks implemented as necessary during/after validation process
  - ▶ Potentially calibrated for adjacent USACE Districts
- HGM (Perennial Streams)
  - ▶ Initial data collection effort completed
  - ▶ Additional data collection and validation
- WV SWVM
  - ▶ Expand for fishery IBI (perennial low-gradient stream impacts and mitigation)



# The “Dream Machine”

- HGM Post Validation

- ▶ **Component A** – HGM Guidebook for High-gradient Streams

- Eph and Int Streams
    - Perennial Streams

- ▶ **Component B** – Factors and Value Components

- Temporal Loss
    - Long-term Protection
    - Water Chemistry (i.e. IBI’s)
    - Mitigation Work Extent Incentive
    - Extended Buffer Incentive





Thank You...

# WV IRT

Powerpoint by: Michael Hatten

Acting IRT Chair/Team Leader, South Regulatory Section

[michael.e.hatten@usace.army.mil](mailto:michael.e.hatten@usace.army.mil)

The WV SWVM and Instructions are available at:

<https://www.lrh.usace.army.mil/permits/>



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