Ohio EPA
Division of Surface Water

STREAM MITIGATION WORK GROUP

OCTOBER 16, 2007

Evaluation of Metrics and Scoring

TODAY'S AGENDA

- Review of past progress
- Overview of today's discussion
- Morning session:
  - Tiered mitigation approach (review)
  - Floodplain metrics, buffer requirements
  - Stream condition metrics (habitat and geomorphology)
- Lunch

TODAY'S AGENDA

- Afternoon Session:
  - Impact category metric
  - Control Metric
  - Implementation Schedule Metric
  - Supplemental Water Quality Activities Credit
- Summary and Next Steps

RECAP AND SUMMARY

VISION STATEMENT

To develop a scientifically sound and predictable methodology for assessing impacts to stream ecosystems and associated compensatory mitigation proposals under review by Ohio EPA through the 401 Water Quality Certification Program.

GOALS FOR PROTOCOL DEVELOPMENT

- Protocol should be incorporated by reference into a stream mitigation rule promulgated in the OAC.
- Protocol must be able to account for varying types of stream impacts with respect to existing stream uses as well as the range of potential mitigation projects that may be proposed to compensate for these impacts.

GOALS FOR PROTOCOL DEVELOPMENT

- Protocol should provide predictability and uniformity to the 401 Water quality certification process.
- Protocol should emphasize the development of mitigation proposals which are scientifically sound and durable.
- Approved stream mitigation plans developed under the protocol must be adequate to compensate for lost or impaired in-stream uses.

- **Impact Assessment**
  - Six criteria, variable weighting factor scores
  - Analysis based upon proposed project and site-specific conditions.
  - Weighting factor scores are summed and multiplied by the linear feet of impact to determine the number of debits for which mitigation is required.

Ohio EPA 401 Water Quality Certification
FORM A. ADVERSE IMPACT WEIGHTING TABLE FOR STREAM IMPACTS

Project Name:_____ Page____of ____

Stream Segment:_____Use Designation: _____

Impact Summary:_____

Circle appropriate response for each of the factors listed below and enter the numerical value in the column on the right.

Impact Factors	Options						Impact Factor Value
Existing Aquatic Life Use **Section 5.2.1**	LRW Class I PHWH Protection of Downstream Uses; skip remaining analysis	MWH Class II PHWH Enter **3.0** for (I) in Box 1 below, calculate mitigation credits needed	WWH **1.5**	EWH **2.5**	CWH Class III PHWH **3.0**	SSH Add **0.2** to score for June-September Aquatic life Use	
Existing Habitat Quality **Section 5.2.2**	Analysis for these weighting factors is not necessary for default procedures (see Section 2.1.3.2)		Poor **0.2**	Fair **0.8**	Good **1.0**	Excellent **1.5**	
Priority Area **Section 5.2.3**			Tertiary **0.1**	Secondary **0.5**	Primary **1.0**		
Existing Geo-morphic Integrity **Section 5.2.4**			Poor **0.2**	Fair **0.5**	Good **1.0**	Excellent **1.5**	
Existing Flood Plain Quality **Section 5.2.5.1**			Poor **0.2**	Fair **0.8**	Good **1.0**	Excellent **1.5**	
Impact Category **Section 5.2.6**			Minimal **0.2**	Moderate **1.0**	High **1.5**	Severe **2.0**	
To Calculate the mitigation credits required, sum all Impact Factor row values and enter the result in Box 1.			**Box 1.**	**Sum of Impact Factors (I) =**			
Enter the proposed length of stream to be impacted into Box 2.			**Box 2.**	**Length of Impact (D) =**			
Multiply the values of Box 1 and Box 2 and enter the result in Box 3. **The value of Box 3 equals the total number of stream impact debits for the assessed impacts.**			**Box 3.**	**Total Stream Impact Debits (I x D) =**			

WEIGHTING FACTOR ASSESSMENT

WEIGHTING FACTOR ASSESSMENT

- Impact Assessment (cont.)
  - Impact weighting factors:
    - Existing Aquatic Life Use (1.5 – 3.2 pts)
    - Existing Habitat Quality (0.2 – 1.5 pts)
    - Priority Area (0.1 – 1.0 pts)
    - Existing Geomorphic Integrity (0.2 – 1.5 pts)
    - Existing Flood Plain Quality (0.2 – 1.5 pts)
    - Impact Category (0.2 – 2.0 pts)
  - Debit Scoring Range: 1.5 – 12.2

WEIGHTING FACTOR ASSESSMENT

- **Stream Mitigation Assessment**
  - 12 weighting factors used to score proposed stream mitigation projects.
  - Individual weighting factors may not apply in all cases (e.g. projects which involve only stream preservation get no “stream restoration” credit).
  - Weighting factors designed to encourage and reward excellent projects, avoidance of the export of resource integrity, and the improvement of water quality.

Ohio EPA 401 Water Quality Certification
Form B. STREAM MITIGATION WEIGHTING FACTORS

Project Name: _____ Page: ___ of ___

Stream Segment: _____ Use Designation: _____

Project Summary: _____

Circle appropriate response for each of the factors listed below and enter the numerical value in the column on the right.

Mitigation Factors	Options					Mitigation Factor Value
Stream Restoration/ Relocation Design (Section 5.2.7)	None (Preservation Only Projects) 0.0	Minimal (Relocation Projects Only) 0.5	Moderate 1.0	Good 2.0	Excellent 3.0	
Riparian/ Floodplain Preservation (Section 5.2.5)	Minimal (Relocation Projects Only) 0.0	Low 0.2	Moderate 0.4	Good 0.7	Excellent 1.0	
Riparian Restoration and Enhancement (Section 5.2.8)	None 0.0	Minimal 0.2	Moderate 0.4	Good 0.7	Excellent 1.0	
Resulting Aquatic Life Use (Section 5.2.1)	MWH or Class II PHWH 0.1		WWH 0.6	EWH 0.8	CWH or Class III PHWH 1.0	
Resulting Habitat Quality (Section 5.2.2)	Fair (Relocation Projects Only) 0.1		Good 0.5		Excellent 1.0	
Priority Area (Section 5.2.3)	Tertiary 0.0		Secondary 0.1		Primary 0.5	
Watershed Location (Section 5.2.9)	Outside Watershed 0.0	Within HUC 8 Digit Watershed 0.3	Within HUC 11 Digit Watershed 0.5	Within HUC 14 Digit Watershed 0.8	Onsite 1.0	
Control (Section 5.2.10)	Deed Restriction 0.0		Conservation Easement 0.3		Fee Simple 0.5	
Impact/ Mitigation Relationship (Section 5.2.11)	Out-of-Kind 0.1			In-Kind 0.5		
Implementation Schedule (Section 5.2.12)	Schedule 5 -0.1	Schedule 4 0.0	Schedule 3 0.1	Schedule 2 0.2	Schedule 1 0.3	
Supplemental Water Quality Activities (Section 5.2.13)	None 0.0	Moderate 0.1	Good 0.2		Excellent 0.3	
Threat to Stream Segment (section 5.2.14)	NA or Low 0.0	Moderate 0.1	High 0.2		Very High 0.3	

To calculate the preservation credits allocated, add all mitigation factor values in the right-hand column and enter the result in Box 1.
Enter the proposed length to be preserved into Box 2.
Multiply the values of Box 1 and Box 2 and enter the result in Box 3. The value in Box 3 equals the mitigation credits allocated for the assessed project. (Note: Preservation Credits can only equal 70% of the total mitigation credits required after the requirements of OAC 3745-1-05 are met.)

Box 1. Sum of Factor Values (F) =	
Box 2. Mitigation Length (D) =	
Box 3. Mitigation Credits (F x D) =	

WEIGHTING FACTOR ASSESSMENT

- Stream Mitigation Assessment (cont.)
  - Mitigation Weighting Factors
    - Stream Restoration/Relocation Design (0.0 – 3.0)
    - Riparian/Floodplain Preservation (0.0 – 1.0)
    - Riparian Restoration and Enhancement (0.0 – 1.0)
    - Resulting Aquatic Life Use (0.1 – 1.0)
    - Resulting Habitat Quality (0.1 – 1.0)
    - Priority Area (0.0 – 0.5)
    - Watershed Location (0.0 – 1.0)

WEIGHTING FACTOR ASSESSMENT

- Stream Mitigation Assessment (cont.)
  - Mitigation Weighting Factors (cont.)
    - Control (0.0 – 0.5)
    - Impact/Mitigation Relationship (0.1 - 0.5)
    - Implementation Schedule (-0.1 – 0.3)
    - Supplemental Water Quality Activities (0.0 – 0.3)
    - Threat to Stream Segment (0.0 – 0.3)

WEIGHTING FACTOR ASSESSMENT

- **Stream Mitigation Assessment (cont.)**
  - **Credit Scoring Ranges:**
    - Preservation: 1.3-7.4
    - Relocation: 0.7-10.1
    - Restoration: 2.3-10.4

PREVIOUS STAKEHOLDER MEETINGS

- November 2006: Introduction and Overview
  - Ground Rules established
  - Summary of Comments received during public comment period
  - Discussion of goals in rulemaking process

PREVIOUS STAKEHOLDER MEETINGS

- February 2007: Future WQS rule changes and tiered mitigation approach
  - WQS rule changes: where do streams begin? natural vs highly modified or artificial channels
  - Tiered mitigation approach based on antidegration categories and existing use

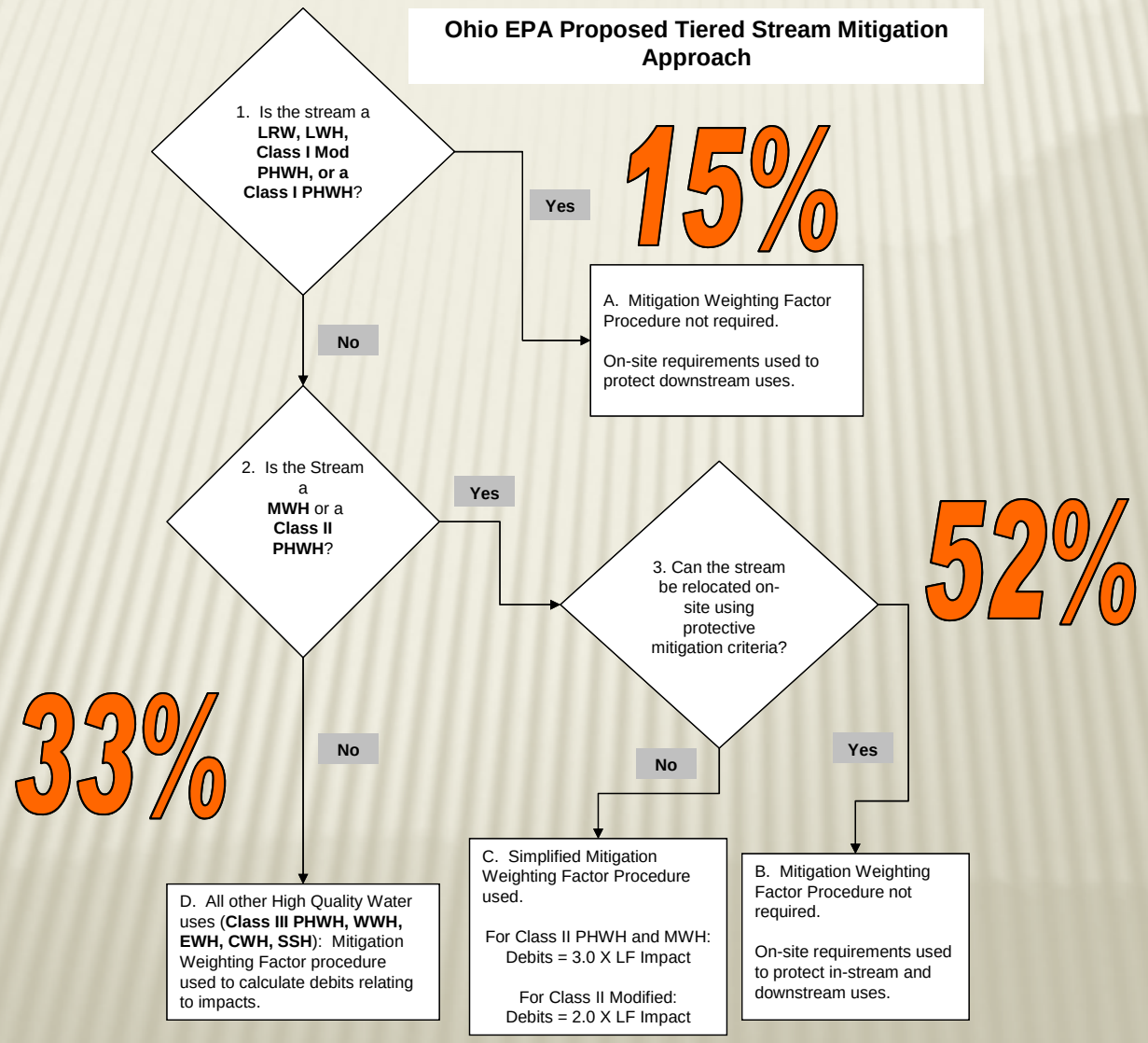
PREVIOUS STAKEHOLDER MEETINGS

- April 2007: Water quality standard basics, proposed tiered mitigation approach
  - Antidegradation
  - Beneficial uses
  - Data regarding 401 impacts and mitigation
  - Tiered approach to mitigation
    - Antidegration categories and aquatic life uses

PREVIOUS STAKEHOLDER MEETINGS

- June 2007: Primary Headwater Habitat streams, watershed protection aspects of mitigation rule
  - Background and proposal for PHWH aquatic life uses
  - Discussion topics regarding mitigation protocol
    - Definitions
    - Restoration vs preservation
    - Metrics: In Kind vs Out of Kind, Priority Areas, Watershed Location, and Threat metrics
    - Cumulative Impacts

TIERED MITIGATION APPROACH



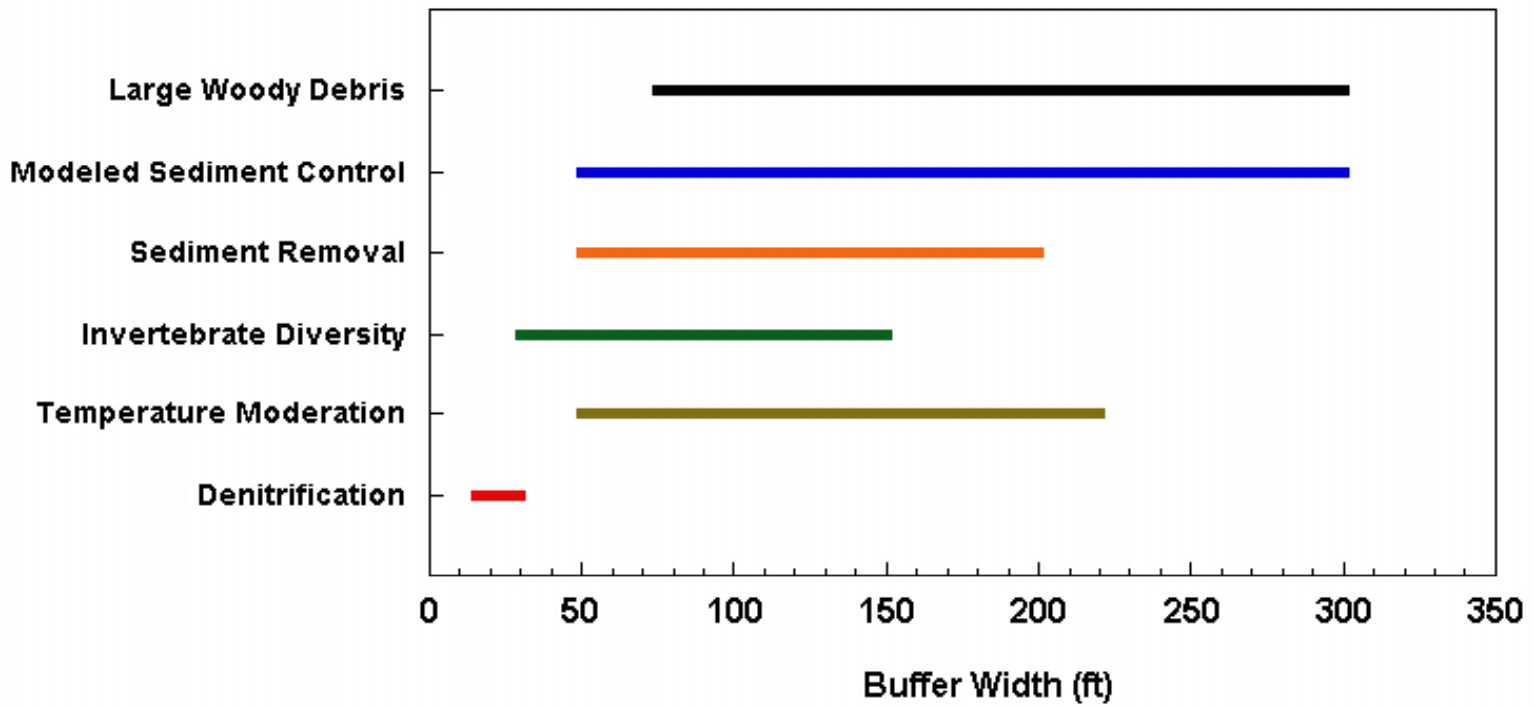
RIPARIAN AND FLOODPLAIN METRICS

RIPARIAN AND FLOODPLAIN – CURRENT DRAFT

- Minimum buffers of 25 ft per bank (8 m) for headwater streams (<20 mi^2) and 50 ft per bank for larger drainages.
- Maximum credits for preservation to the "streamway" boundary.
- Table to categorize categories for widths less than the "streamway" provided
  - Matrix based upon buffer width vs. acres of active floodplain preserved or impacted.

RIPARIAN AND FLOODPLAIN – LITERATURE REVIEW

- Very large body of literature.
  - Site specific data overwhelms experimental data. Correlations derived from body of knowledge.
- One example: Broadmeadow and Nesbit, 2004:
  - Comparison of studies related to various riparian functions with respect to water quality factors.
  - Similar patterns of effective buffer ranges emerge.
  - No normalization by stream drainage.



Broadmeadow and Nisbet, 2004

RIPARIAN AND FLOODPLAIN – LITERATURE REVIEW

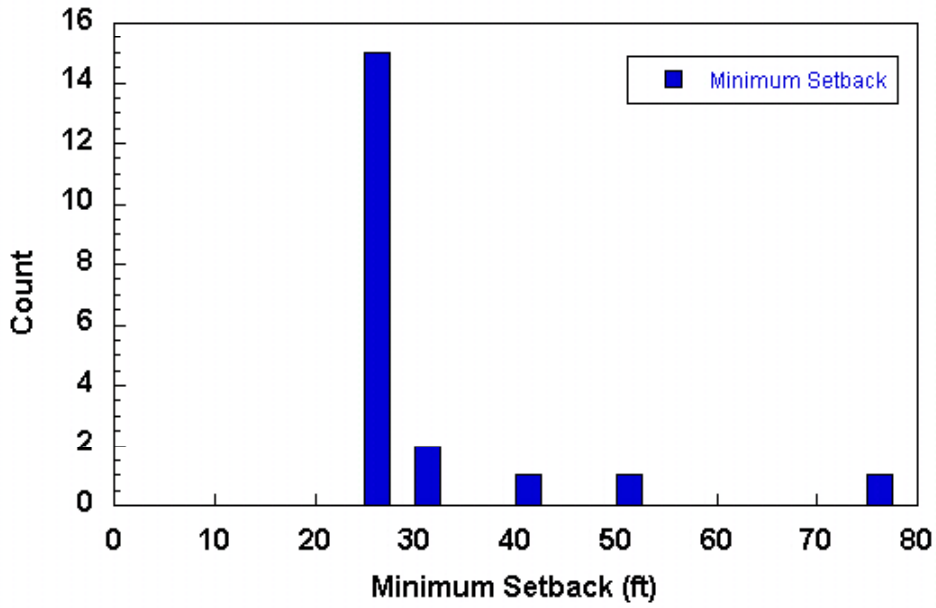
NUTRIENTS: Non-linear regression model predicted buffer widths necessary (in meters) to achieve set Nitrogen removal efficiencies (%) (Mayer et al., 2005).

Riparian Type	50%	75%	90%	n=	r^2
Grass	16	47	90	22	0.277
Forest + Grass	5	20	47	8	0.407
Pooled	3	28	112	66	0.137

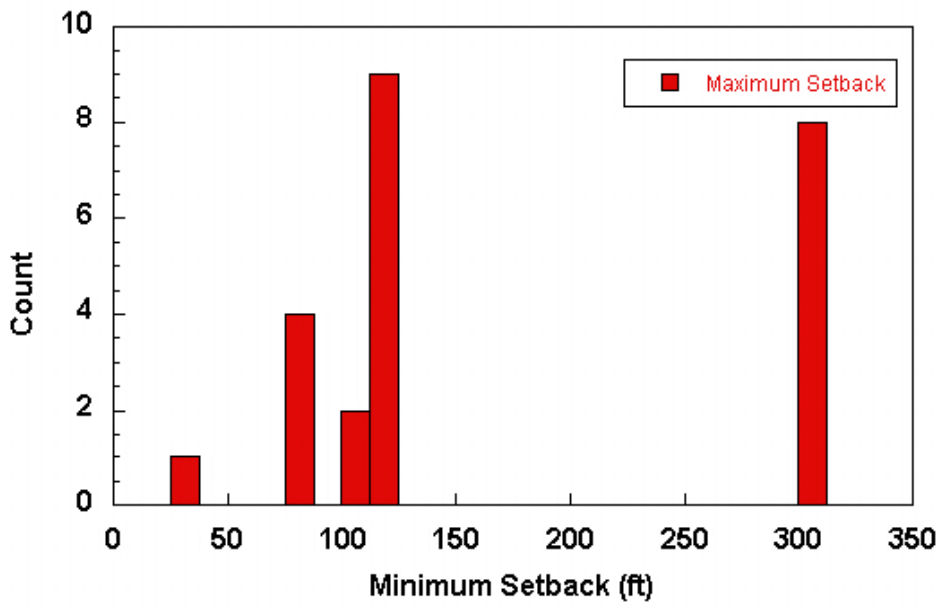
- Literature review and analysis of 66 studies relating to Nitrogen removal within riparian zones.
- Variability relating to stream size was not accounted for.
- Narrow buffers provide some benefit for nutrient removal, but best performance when widths >50 m.
- Most denitrification occurs within the root zone.
- Slope within the riparian has significant effects on transport time and infiltration rates.
- Grass riparian as effective for N removal as forest, but forest has significantly greater effectiveness for phosphorus and carbon removal.

MINIMUM BUFFER REQUIREMENTS
(N=20)

MAXIMUM BUFFER REQUIREMENTS
(N=24)



(Source: CRWP, 2006)



(Source: CRWP, 2006)

RIPARIAN SETBACK ORDINANCES IN OHIO

DATA COMPILED BY CRWP (2006)

RIPARIAN AND FLOODPLAIN – BASIC PRINCIPLES

- Under the antidegration rule, mitigated areas are provided to replace loss of function (beneficial uses) resulting from permitted activities.
- Wooded riparian buffer is critical to support the aquatic life beneficial uses (significant body of literature).
  - Rule will likely require wooded riparian for Class III PHWH and WWH and above aquatic life uses.
  - For Class II PHWH and MWH, grasses may be acceptable if they provide sufficient stability to protect channel integrity (Ward and Mecklenburg).

RIPARIAN AND FLOODPLAIN – BASIC PRINCIPLES

- Sizing of buffers by drainage area is supported by the literature and present practices for non-point pollution control programs and local riparian ordinances.
- Other factors also play an important role in buffer effectiveness to protect water quality.
  - Slope (extensive literature, silviculture BMP's, local riparian ordinances)
  - Wetlands (beneficial use protection)

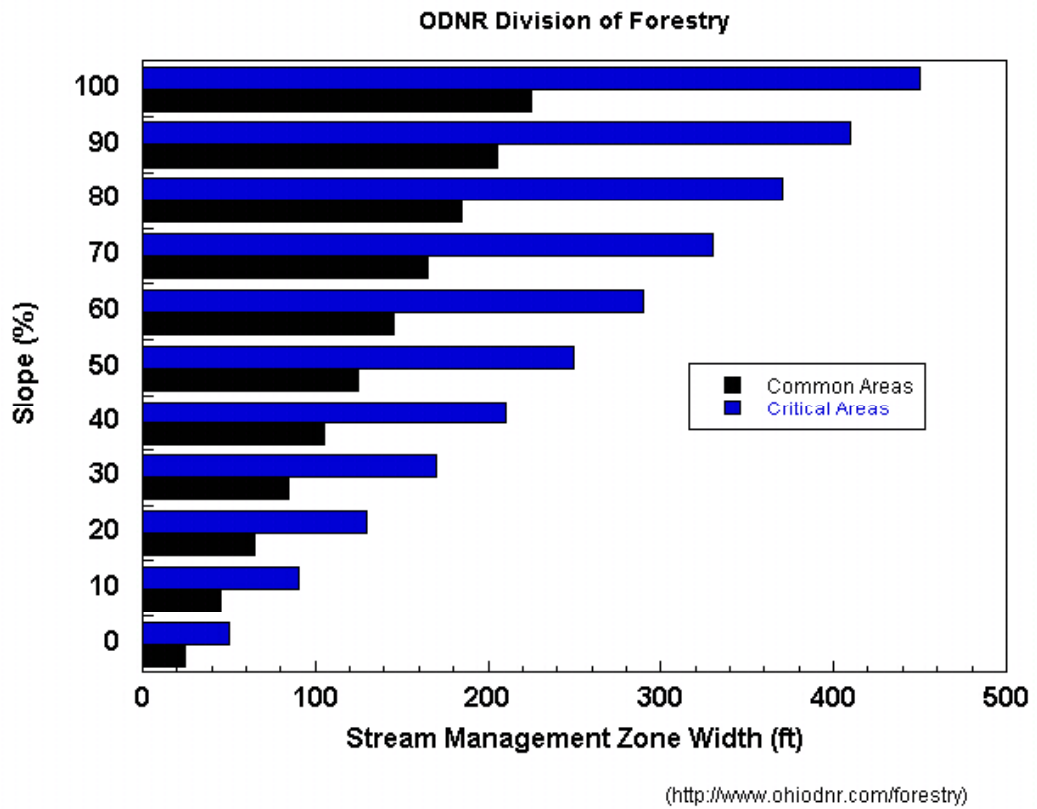
STEEP SLOPES

- Activities within steep slope areas (>15% slope) increases risk of water quality impairment.
  - Increases erosion
  - Slump failure
  - Reduced pollutant assimilation
  - Impacts on riparian vegetation

STEEP SLOPES – SILVICULTURE EXAMPLE

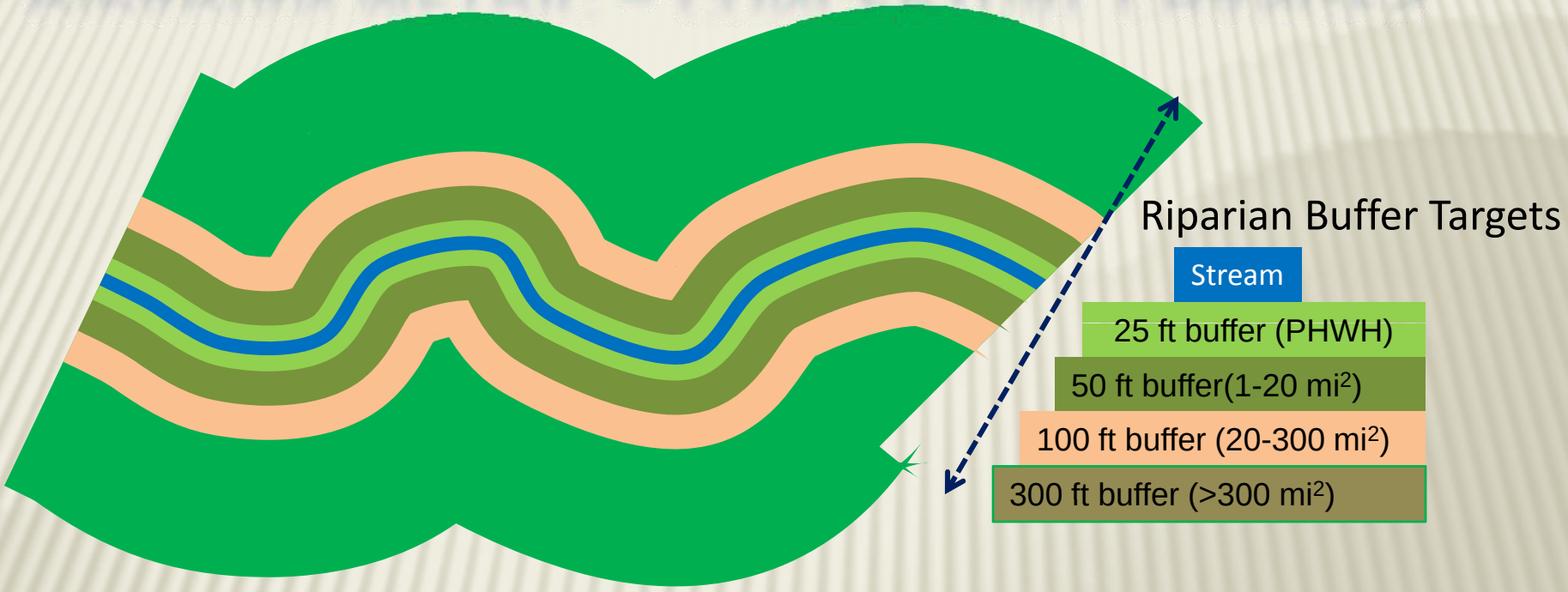
- Review of requirements for riparian protection in U.S. and Canada by Lee, et al. (2004).
  - Buffer width requirement statistics (in meters):
    - Intermittent - 15.1 ± 1.7
    - Small Perennial - 21.8 ± 1.7
    - Large Perennial – 28.1 ± 2.7
- ~50% of jurisdictions modified base buffer requirements for steep slopes.
  - Increased minimum buffer by an average of 0.79 ± 0.08 m per 1% increase in slope.
  - Jurisdictions with no slope modifications had significantly higher base buffer width requirements.

SILVICULTURE – OHIO REQUIREMENTS



- Stream Management Zones (SMZ's) used for erosion and water quality control
  - 15 ft unimpacted along stream for maintaining shade.
  - Varies in width dependent on slope and stream quality (2-4 ft per 1% increase).
  - SMZ range 25 ft -450 ft
  - Selective cutting allowed in rest of SMZ – machinery excluded

RIPARIAN METRIC – CONCEPTUAL CHANGES



Stream Size	Minimum Buffer	Target Buffer Width (each bank)	Relative Credits/Debits (Scaling Factor)	Weighting Factor Range
<1.0 mi^2 (PHWH)	15 ft	25 ft	0.125	0.075 - 0.125
≥1.0 – 20 mi^2	25 ft	50 ft	0.250	0.125 - 0.250
>20 – 300 mi^2	50 ft	100 ft	0.750	0.250 - 0.500
>300 mi^2	75 ft	300 ft	1.500	0.375 - 1.500

RIPARIAN/FLOODPLAIN METRIC

- Weighting Factor (WF) calculation
  - Scaling factor (SF) reflective of relative land areas of minimum riparian buffer along stream segment. Used to provide credit for additional preservation required.
  - Weighting factor adjusted to reflect the ratio of the actual buffer (B) along the stream segment to the target buffer width (B^*)
  - Resulting equation: $WF = SF \times B/B^*$

RIPARIAN/FLOODPLAIN METRIC

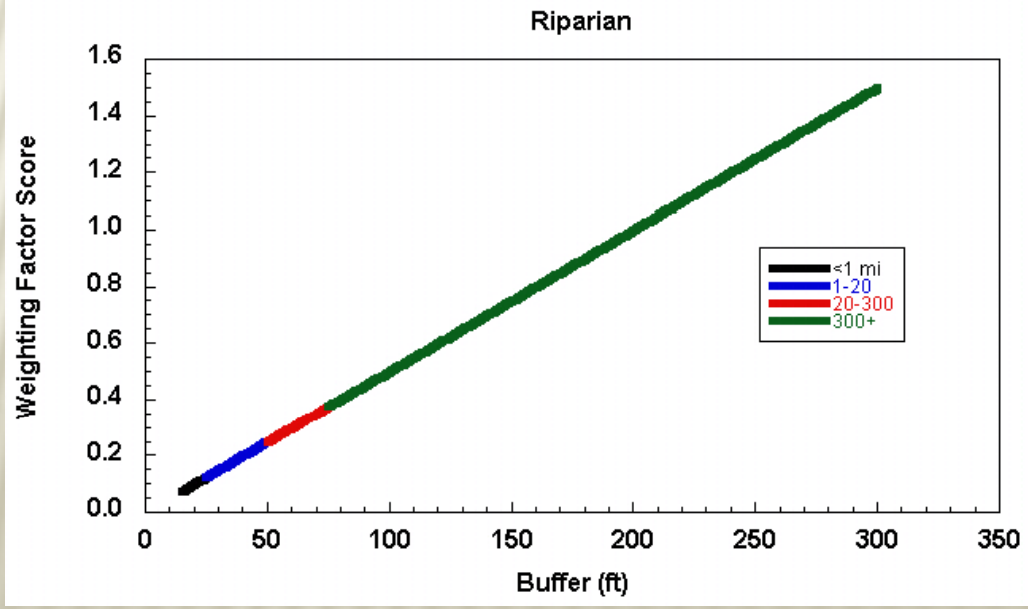
- Example 1: impact
  - 30 mi^2 watershed
  - 500 ft impacted
  - 100 ft riparian on river right, 30 ft riparian on river left:
    - mean = 65 ft = B
  - Scaling Factor (SF) = 0.75
  - Target Buffer = B^* = 100 ft
  - Weighting Factor Calculation:
    - WF = SF x B/B^* = 0.75 x (65 ÷ 100) = 0.4875
  - $Debits_{(riparian)}$ = 0.4875 x 500 ft = 243.75

RIPARIAN/FLOODPLAIN METRIC

- Example 2: mitigation
  - 400 mi^2 watershed
  - 1,275 ft preservation
  - 450 ft riparian on river right, 100 ft riparian on river left:
    - mean = 190 ft = B
      - (note: only credited with 300 ft on right bank)
  - Scaling Factor (SF) = 1.50
  - Target Buffer = B^* = 300 ft
  - Weighting Factor Calculation:
    - WF = SF x B/B^* = 1.50 x (190 ÷ 300) = 0.95
  - $Credits_{(riparian)}$ = 0.95 x 1,275 ft = 1,211

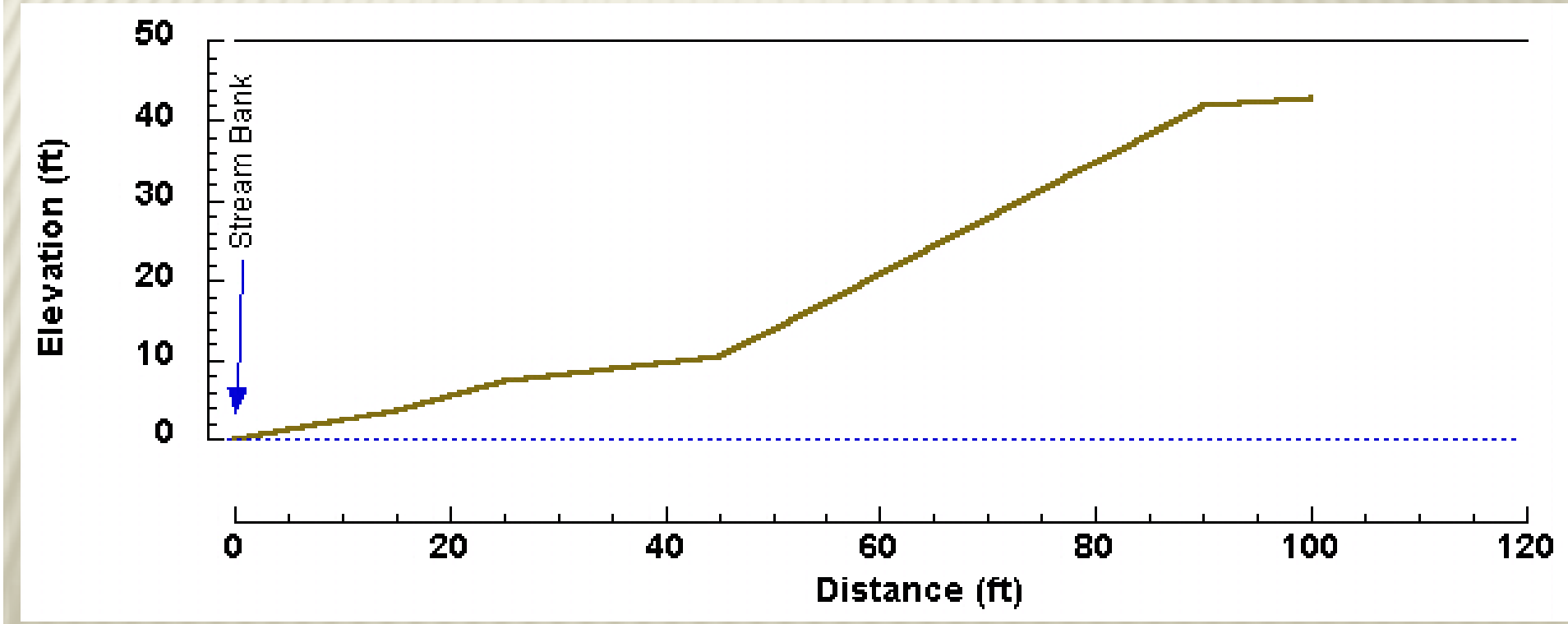
RIPARIAN/FLOODPLAIN METRIC

- Notes on new concept:
  - Weighting factor linear across buffer widths
  - Scoring the same for both impact and mitigation weighting factors for riparian buffer
  - Riparian enhancement WF scoring and criteria likely to be adjusted



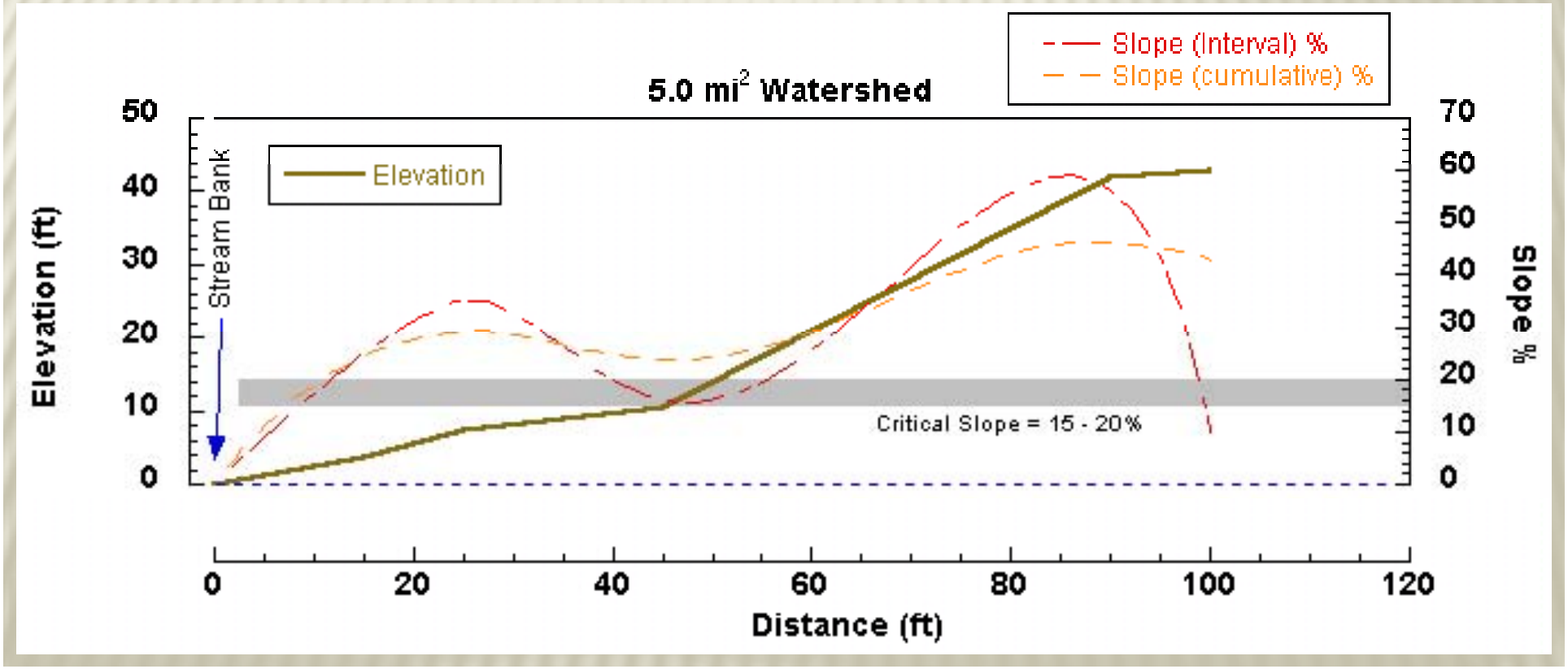
MODIFIER – STEEP SLOPES

- Discussion Example:
  - 5.0 mi^2 watershed mitigation site
    - Elevation cross section



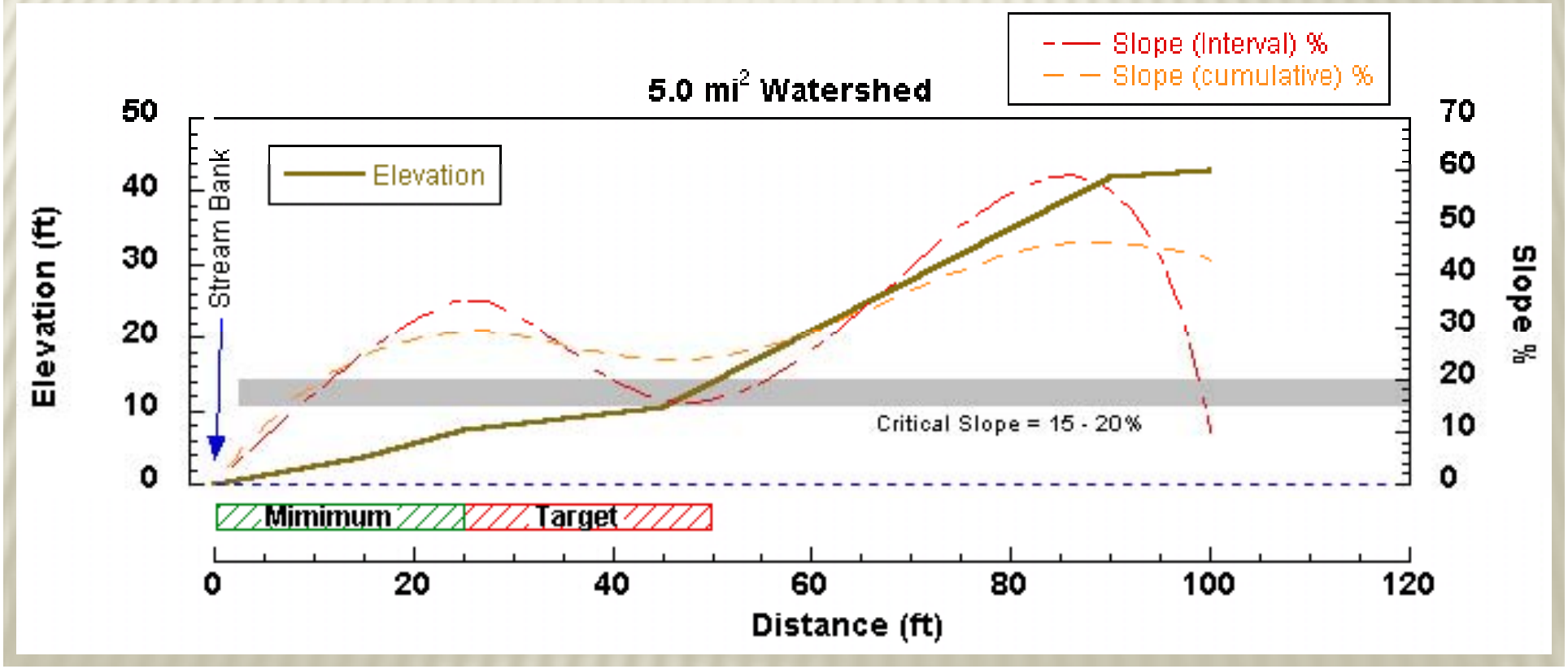
MODIFIER – STEEP SLOPES

- Slope of the riparian area indicates that water quality problems may result from disturbance if proper buffer not provided.



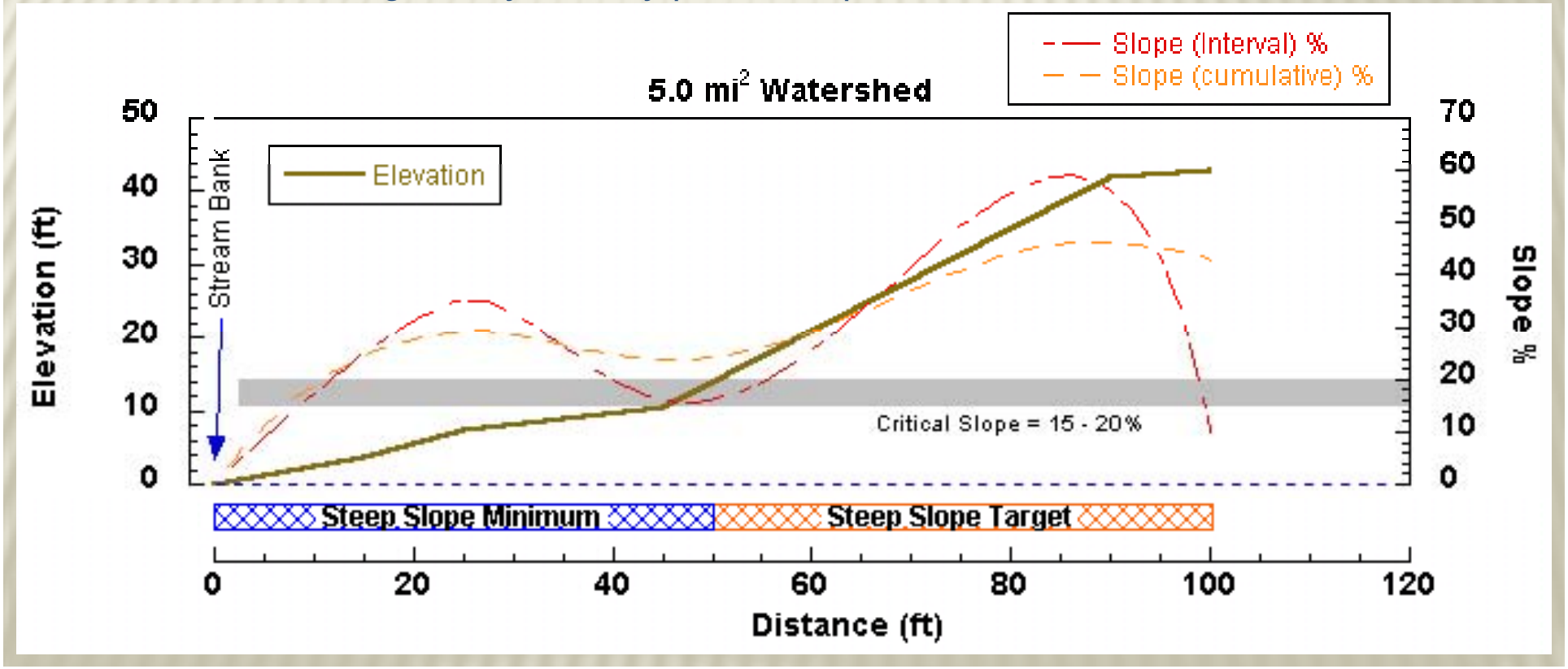
MODIFIER – STEEP SLOPES

- Application of standard buffer minimums and targets may not provide sufficient water quality protection.



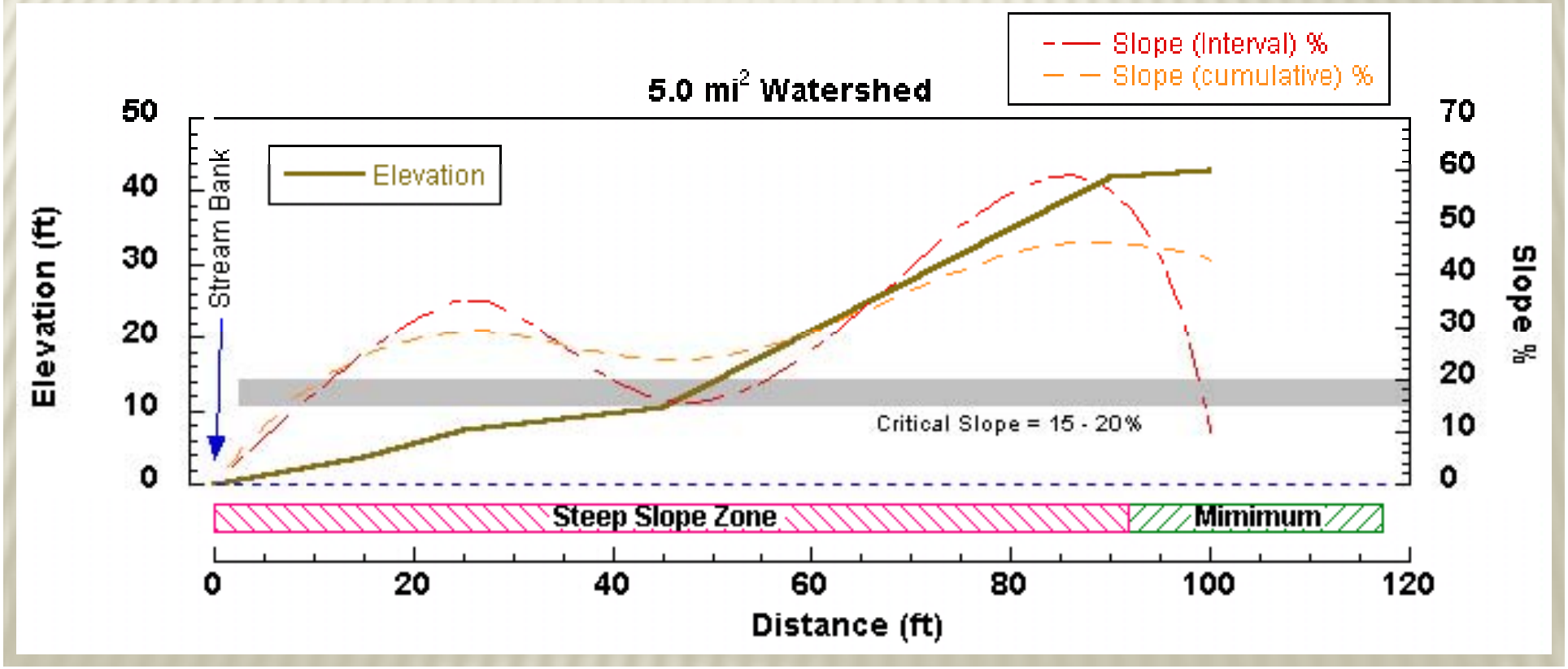
MODIFIER – STEEP SLOPES

- Option 1: increase minimum and target buffer requirements based on slope.
  - This example: widths doubled, could also use a formula based on slope (ODNR example would increase by 2-4 ft per 1% of slope).
  - Buffers > base target credited at 100% of scaling factor.
  - Disadvantage: may not fully protect slope.



MODIFIER – STEEP SLOPES

- Option 2: Steep slope zone that does not count toward minimum buffer.
  - Minimum buffer required at top of slope where angle falls below critical value.
  - Buffers > base target credited at 100% of scaling factor for total buffer > standard target buffer.
  - Advantage: fully protects slope.



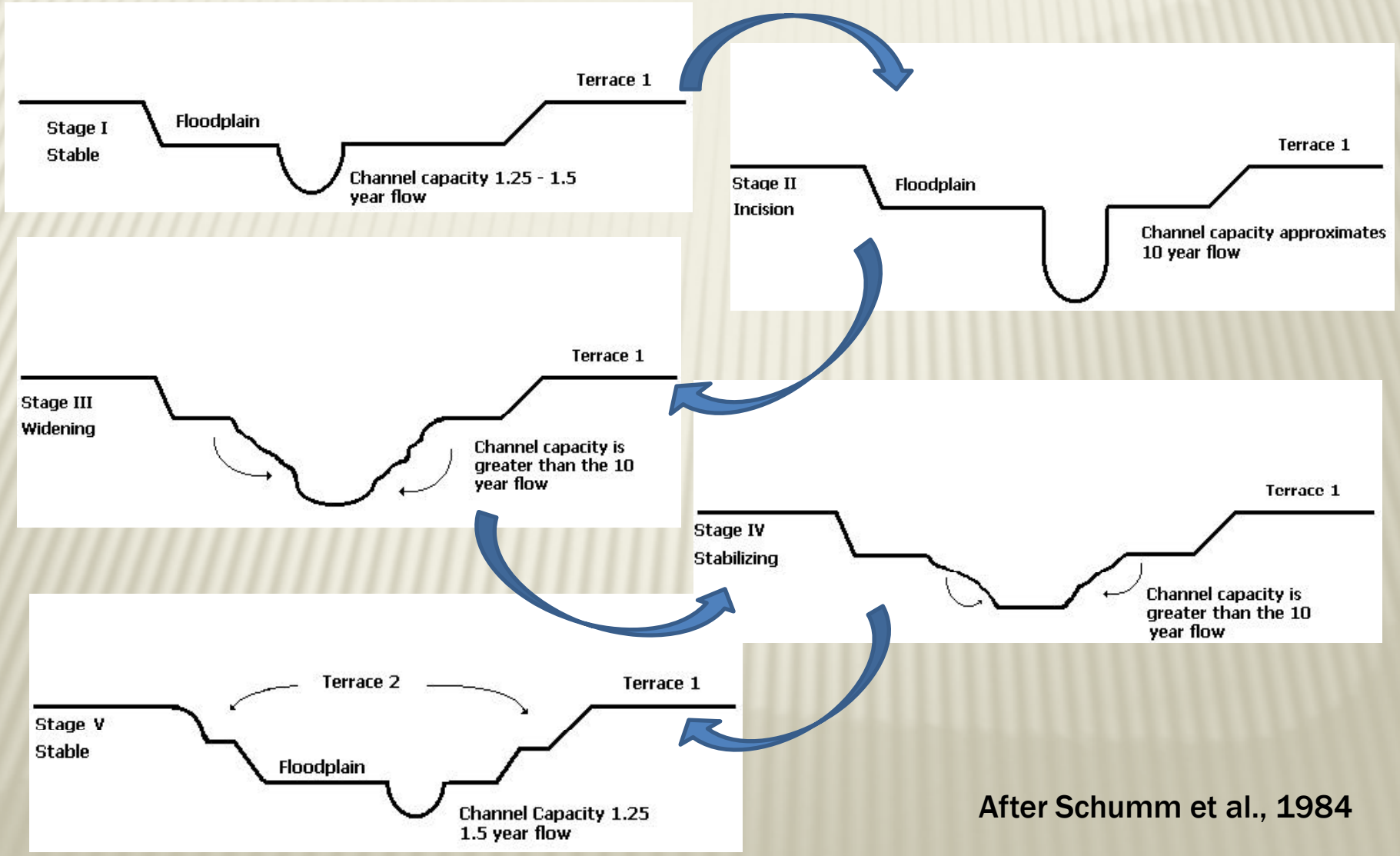
RIPARIAN DISCUSSION

GEOMORPHIC INTEGRITY WEIGHTING FACTOR

GEOMORPHIC INTEGRITY WEIGHTING FACTOR

- Existing approach:
  - Narrative description of quality factors
    - Incorporates assessment of channel entrenchment, floodplain integrity, channel evolution features, and cumulative effects of culverts, pipes, impoundments, etc.
  - Mitigation credits for restoration dependent upon changes to geomorphic integrity class
  - Additional data requirements for assessment.
  - Expertise needed to properly assess the metric.

CHANNEL EVOLUTION MODEL



After Schumm et al., 1984

QHEI & CHANNEL CONDITION

Qualitative Habitat Evaluation Index Field Sheet QHEI Score:

River Code: RM: Stream:

Date: Location:

Scorers Full Name: Affiliation:

1) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present

TYPE — POOL RIFFLE

- -BOULDER [9]
- -COBBLE [8]
- HARDPAN [4]
- MUCK [2]
- SILT [2]
- -GRAVEL [7]
- -SAND [6]
- BEDROCK[5]
- DETRITUS[2]
- ARTIFICIAL[0] NOTE: Ignore Sludge Originating From Point Sources

SUBSTRATE ORIGIN — POOL RIFFLE — Check ONE (OR 2 & AVERAGE)

- -LIMESTONE [1] SILT
- -TILLS [1]
- -WETLANDS[0]
- -HARDPAN [0]
- -SANDSTONE [0]
- -RIP/RAP [0]
- -LACUSTRINE [0]
- -SHALE [-1]
- -COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)

- - SILT HEAVY [-3]
- -SILT MODERATE [-1]
- -SILT NORMAL [0]
- -SILT FREE [1]

EMBEDDEDNESS

- -EXTENSIVE [-2]
- -MODERATE [-1]
- -NORMAL [0]
- -NONE [1]

Substrate — Max 20

NUMBER OF SUBSTRATE TYPES: 4 or More [2] / 3 or Less [0] (High Quality Only, Score 5 or +)

COMMENTS

2) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure) TYPE: Score All That Occur

- UNDERCUT BANKS [1]
- OVERHANGING VEGETATION [1]
- SHALLOWS (IN SLOW WATER) [1]
- ROOTMATS [1]
- POOLS 70 cm [2]
- ROOTWADS [1]
- BOULDERS [1]
- DEBRIS, BACKWATERS [1]
- AQUATIC MACROPHYTES [1]
- LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT (Check ONLY One or check 2 and AVERAGE)

- EXTENSIVE > 75% [11]
- MODERATE 25-75% [7]
- SPARSE 5-25% [3]
- NEARLY ABSENT < 5% [1]

Cover — Max 20

3) CHANNEL MORPHOLOGY (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY

- HIGH [4]
- MODERATE [3]
- LOW [2]
- NONE [1]

DEVELOPMENT

- EXCELLENT [7]
- GOOD [5]
- FAIR [3]
- POOR [1]

CHANNELIZATION

- NONE [6]
- RECOVERED [4]
- RECOVERING [3]
- RECENT OR NO RECOVERY [1]

STABILITY

- HIGH [3]
- MODERATE [2]
- LOW [1]

MODIFICATIONS/OTHER

- SNAGGING
- RELOCATION
- CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATIONS
- IMPOUND.
- ISLANDS
- LEVEES
- BANK SHAPING

Channel — Max 20

COMMENTS:

4) RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH — L R (Per Bank)

- WIDE > 50m [4]
- MODERATE 10-50m [3]
- NARROW 5-10 m [2]
- VERY NARROW <5 m[1]
- NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) — L R (Most Predominant Per Bank)

- FOREST, SWAMP [3]
- SHRUB OR OLD FIELD [2]
- RESIDENTIAL, PARK, NEW FIELD [1]
- FENCED PASTURE [1]
- CONSERVATION TILLAGE [1]
- URBAN OR INDUSTRIAL [0]
- OPEN PASTURE, ROWCROP [0]
- MINING/ CONSTRUCTION [0]

BANK EROSION — L R (Per Bank)

- NONE/LITTLE [3]
- MODERATE [2]
- HEAVY/SEVERE[1]

Riparian — Max 10

COMMENTS:

5) POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)

- >1m [6]
- 0.7-1m [4]
- 0.4-0.7m [2]
- 0.2-0.4m [1]
- <0.2m [POOL=0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)

- POOL WIDTH > RIFFLE WIDTH [2]
- POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH < RIFFLE W. [0]

CURRENT VELOCITY (POOLS & RIFFLES) (Check All That Apply)

- EDDIES[1]
- FAST[1]
- MODERATE [1]
- SLOW [1]
- TORRENTIAL[-1]
- INTERSTITIAL[-1]
- INTERMITTENT[-2]
- VERY FAST[1]

Pool Current — Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH

- Best Areas > 10 cm [2]
- Best Areas 5-10 cm[1]
- Best Areas < 5 cm [RIFFLE=0]

RUN DEPTH

- MAX > 50 [2]
- MAX < 50[1]

RIFFLE/RUN SUBSTRATE

- STABLE (e.g.,Cobble, Boulder) [2]
- MOD. STABLE (e.g.,Large Gravel) [1]
- UNSTABLE (Fine Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS

- NONE [2]
- LOW [1]
- MODERATE [0]
- EXTENSIVE [-1]

Riffle/Run — Max 8

COMMENTS: - NO RIFFLE [Metric=0]

Gradient — Max 10

6) GRADIENT (ft/mi) DRAINAGE AREA (sq.mi.)

%POOL: %GLIDE:

%RIFFLE: %RUN:

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RECOVERING CHANNEL

SOUTH FORK SUGAR CREEK RM 21.1, QHEI = 34.5

RECOVERED CHANNEL

MIDDLE FORK SUGAR CREEK RM 10.3, QHEI = 46.5

CHANNEL CONDITION METRIC

QHEI ATTRIBUTE ANALYSIS

QHEI table for sites on the Ashtabula River, sampled in 2007 by NEDO.

Key QHEI Components

			WWH Attributes											MWH Attributes															
														High Influence					*Moderate Influence*										
River Mile	QHEI	Gradient (ft/mile)	No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max Depth > 40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth < 40 cm (WD, HW)	**Total H.I. MWH Attributes**	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent and Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	**Total M.I. MWH Attributes**	**(MWH H.I.+1)/(WWH+1) Ratio**	**(MWH M.I.+1)/(WWH+1) Ratio**
(07-001) Ashtabula River																																			
Year: 2007																																			
20.5	66.5	5.32	■	■						■	■	■	■	6				◆		1		●			●	●				●		4	0.29	0.86
19.0	78.5	9.43	■	■		■	■	■	■			■	■	8				◆		1		●			●				●		●	4	0.22	0.67
13.9	71.0	10.75	■				■	■	■	■	■	■	■	7				◆		1		●			●							2	0.25	0.50

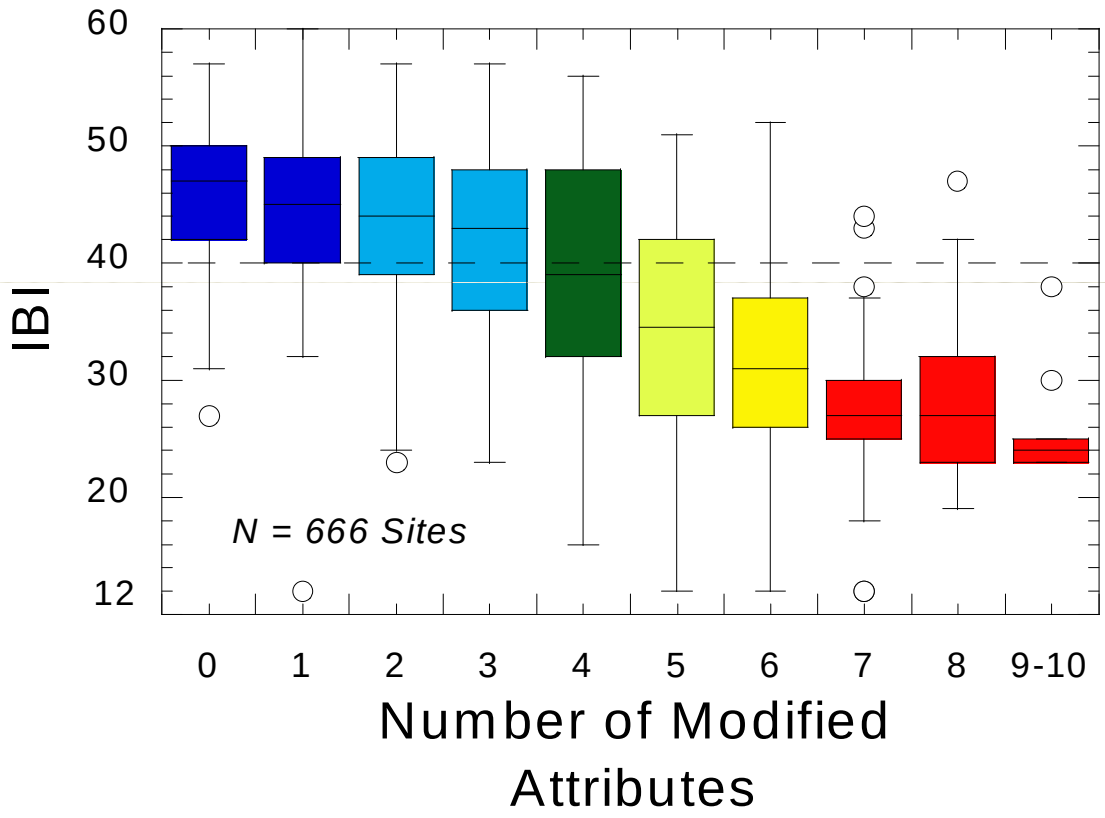
WARMWATER HABITAT ATTRIBUTES

- No channelization
- Boulder/Cobble/ Gravel Substrates
- Silt free
- Good/Excellent Development
- Moderate/High Sinuosity
- Extensive/Moderate Cover
- Fast Current/Eddies
- Low (No) – Normal Embeddedness
  - Overall
  - Riffles
- Maximum Depth ≥ 40 cm

MODIFIED WARMWATER HABITAT ATTRIBUTES – MODERATE INFLUENCE

- Recovering Channel
- Heavy/Moderate Silt Cover
- Sand Substrates (boat sites)
- Hardpan Substrate Origin
- Fair/Poor Development
- Low Sinuosity
- Only 1-2 Cover Types

MWH ATTRIBUTES – MODERATE INFLUENCE



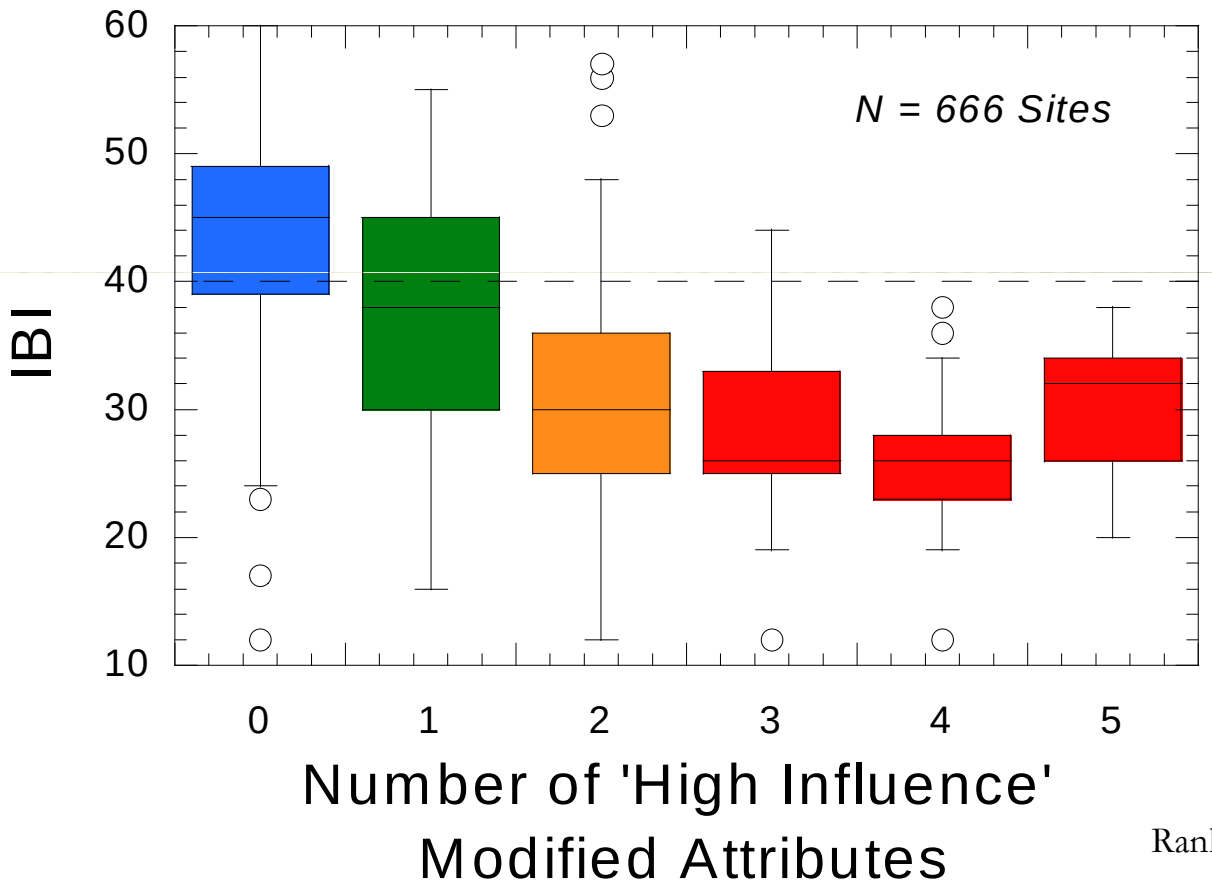
Rankin, 1989

Significant decrease in IBI when MWH attributes > 4

MODIFIED WARMWATER HABITAT ATTRIBUTES – HIGH INFLUENCE

- Channelized or No Recovery
- Silt/Muck Substrates
- No Sinuosity
- Sparse/No Cover
- Maximum Depth <40 cm

MWH ATTRIBUTES – HIGH INFLUENCE



Rankin, 1989

Significant decrease in IBI when HI MWH attributes > 1

CHANNEL CONDITION METRIC (SITES>1.0 MI^2)

- **Poor:** ≥ 2 High Influence MWH Attributes
- **Fair:** Number of High Influence + Moderate Influence MWH Attributes > 4
- **Good:** No High Influence MWH Attributes, 3-4 Moderate Influence MWH Attributes
- **Excellent:** No High Influence MWH Attributes, < 2 Moderate Influence MWH Attributes

RECOVERING CHANNEL

SOUTH FORK SUGAR CREEK RM 21.1
QHEI = 34.5
WWH ATTRIBUTES = 2
H.I. MWH ATTRIBUTES = 4
M.I. MWH ATTRIBUTES = 9
ATTAINMENT: IBI = 20 – PARTIAL ATTAINMENT

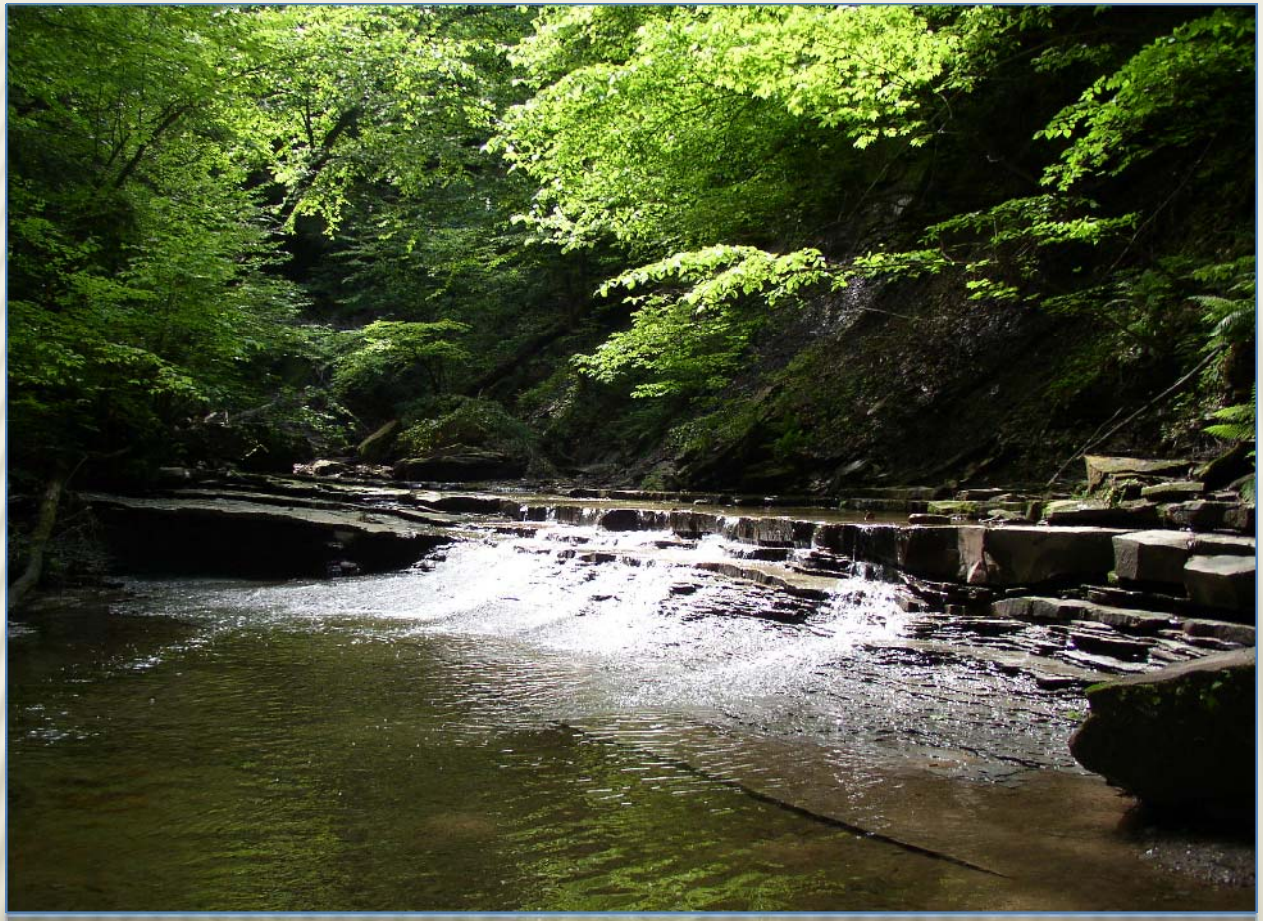
Metric = POOR

RECOVERED CHANNEL

MIDDLE FORK SUGAR CREEK RM 10.3
QHEI = 46.5
WWH ATTRIBUTES = 4
H.I. MWH ATTRIBUTES = 1
M.I. MWH ATTRIBUTES =7
ATTAINMENT: IBI = 44 – FULL ATTAINMENT

Metric = FAIR

CHANNEL CONDITION METRIC



CHANNEL CONDITION METRIC DISCUSSION

TODAY'S AGENDA

- Afternoon Session:
  - Impact category metric
  - Control Metric
  - Implementation Schedule Metric
  - Supplemental Water Quality Activities Credit
- Summary and Next Steps

IMPACT CATEGORIES

Table 4. Impact weighting factor categorization table (see Section 5.2.6).

Minimal Impact WF=0.2	**Moderate Impact WF=1.0**	**High Impact WF=1.5**	**Severe Impact WF=2.0**
Road Crossing: Enhanced Culvert <150 feet	Road Crossing: Enhanced Culvert 150-300 feet	Road Crossing: Enhanced Culvert >300 feet (only applicable if fish passage possible)	- - -
- - -	Road Crossing: Standard Culvert <50 feet	Road Crossing: Standard Culvert 50-150 feet	Road Crossing: Standard Culvert >150 feet
- - -	Fill/Relocation <50 feet	Fill/Relocation 50-150 feet	Fill/Relocation >150 feet
Impoundment Temporary: <150 feet, <6 months duration	Impoundment Temporary: <150 feet, 6-12 months duration or >150 feet, < 6 month duration	Impoundment Permanent: Impounded areas <300 feet and fish passage possible	Impoundment Permanent: Impounded areas ≥300 feet or fish passage impossible
- - -	Morphological Alteration <150 feet	Morphological Alteration 150-300 feet	Morphological Alteration >300 feet
Armor <50 feet	Armor 50-150 feet	Armor 150-300 feet	Armor >300 feet
Shading/Clearing <300 feet	Shading/Clearing 300-600 feet	Shading/Clearing >600 feet	- - -
Utility Crossing <150 feet	Utility Crossing 150-300 feet	Utility Crossing >300 feet or Multiple Crossings >300 feet	- - -
Other Temporary Impacts <300 feet, <6 months duration	Other Temporary Impacts <300 feet, 6-12 months duration or >300 feet, < 6 month duration	Other Temporary Impacts > 300 feet, 6-12 months duration	

CONTROL MITIGATION METRIC

- Perpetual control required
- Fee Simple (WF = 0.5)
- Conservation Easement (WF = 0.3)
  - Environmental Covenant will be added to this category, likely limited use.
- Deed Restriction (WF = 0.0)

IMPLEMENTATION SCHEDULE

- Where possible, mitigation should be implemented before or concurrent with the impacts
- Five categories – WF range 0.3 to -0.1
  - Schedule 1 (0.3) - all mitigation prior to impact
  - Schedule 2 (0.2) - ≥ 60% prior to impact
  - Schedule 3 (0.1) - ≥ 60% concurrent with impact
  - Schedule 4 (0.0) - ≥ 60% 3-6 months after impact
  - Schedule 5 (-0.1) - mitigation > 6 months after impact

SUPPLEMENTAL WATER QUALITY

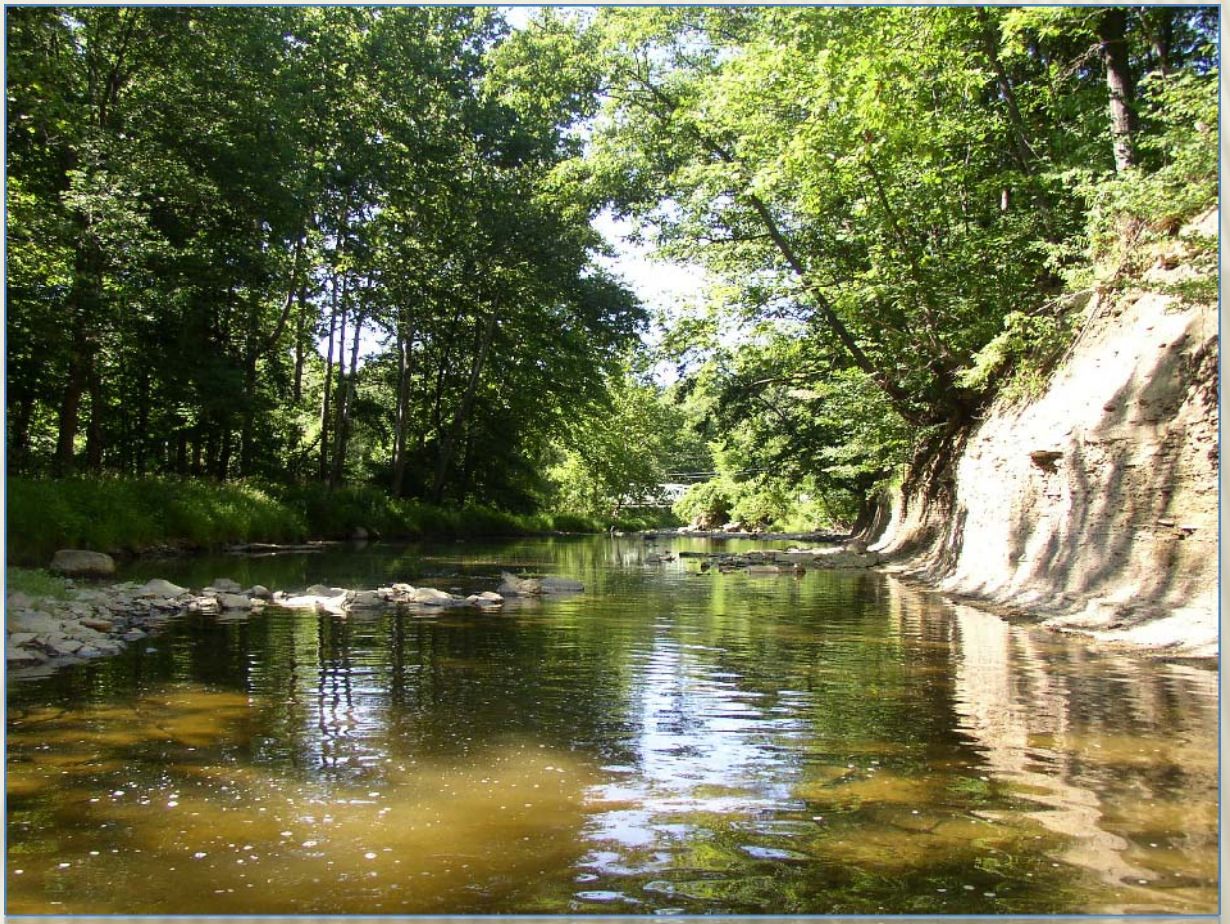
- Excellent Activities
  - Off-channel detention where storm flows documented to cause water quality problems
  - Nutrient reduction and/or sediment control through stream buffering
  - Watershed water quality improvement actions in ONW, OSRW, SHQW, or endangered species habitat
  - Livestock fencing (75’ with crossings, 50’ with no crossings)

SUPPLEMENTAL WATER QUALITY

- Good Activities
  - Non-point pollution reduction through methods other than buffering
  - Watershed water quality improvement actions in GHQW, or in Federal Species of Management Concern or declining aquatic species habitat
  - Livestock fencing (50’ with crossings, 25’ with no crossings)

SUPPLEMENTAL WATER QUALITY

- Moderate Activities
  - Livestock fencing 25’ on both banks(crossings OK) or 75’ on one side (no crossings)
  - Livestock fencing 75’ on one side (crossings OK) or 50’on one side (no crossings)



THE END – THANK YOU!