Ohio EPA
Stream Mitigation Rule Update

Stakeholder Group meeting
September 1, 2009

Acknowledgements

- This work could not have been completed without the untiring help received from the following colleagues:
  - Dan Mecklenburg, ODNR-DSWC
  - Randy Keitz, ODNR-DMR
  - Laura Fay, ODNR-DSWC
  - Steve Tuckerman, Ohio EPA
  - Roger Thoma
- The following people also provide valuable assistance in the development of this model:
  - Dr. Robert Davic, Tom Harcarik, Joe Loucek, Erin Sherer, and Mike Smith
- The valuable input of all of those who have participated in the series of stakeholder meetings is also gratefully acknowledged

What have we been doing? (a little history)

- Draft rules and mitigation protocol circulated for "interested party" review – Spring 2006
  - Several workshops held state-wide during the comment period.
  - Over 100 sets of comments received
- Stakeholder group formed in 2007 to receive further input. Seven meetings held, average attendance ~30.
- PHWH use designations added to the WQS rule package in 2008.
- Collaboration with Ohio EPA DSW staff and ODNR DSWC staff has resulted in an updated approach.

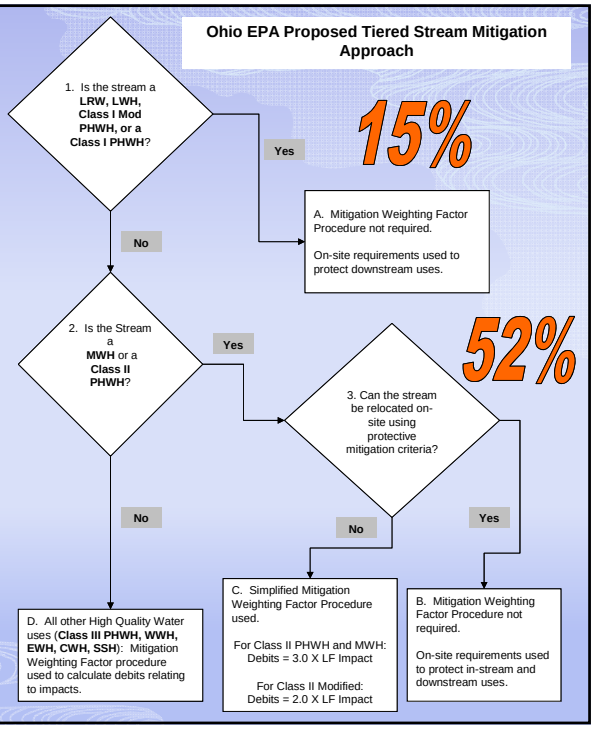
Outcome of the Stakeholder Process

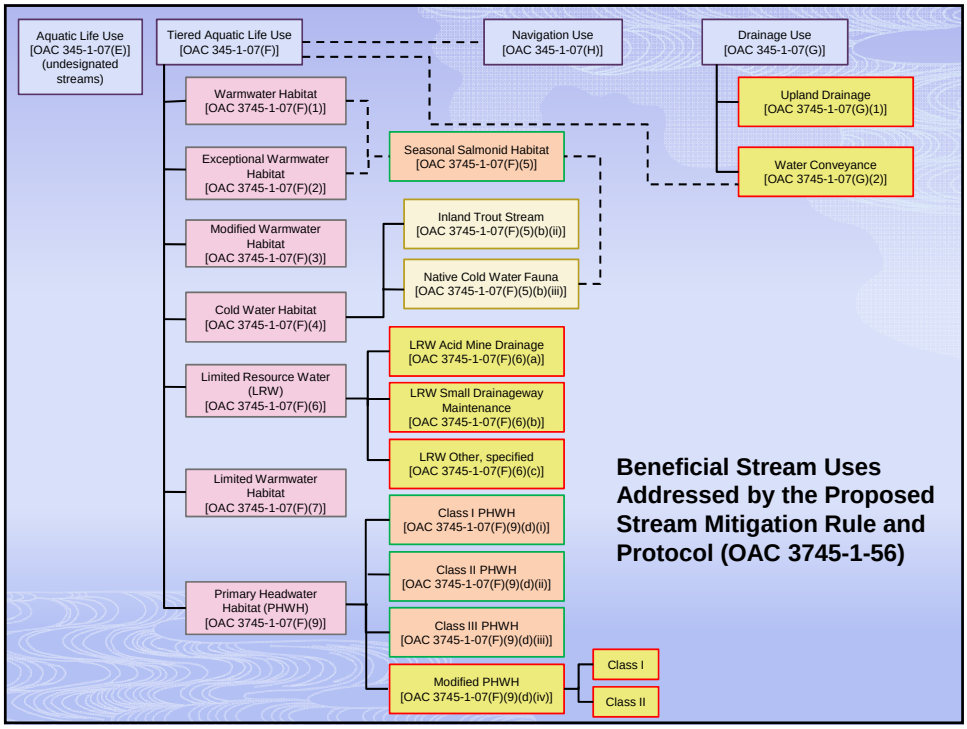
- Tiered mitigation approach refined
  - Two priorities: protection of in-stream and downstream beneficial uses.
  - Water quality functions vary dependent on stream size and beneficial uses.
    - For limited quality waters, protection of downstream uses is the goal.
    - For high quality waters, in-stream beneficial uses must be protected.
  - Mitigation requirements should be designed to meet the goals for water quality protection.
  - General agreement regarding tiered approach.
- Recommendations to reduce the number of metrics used for debits and credits.

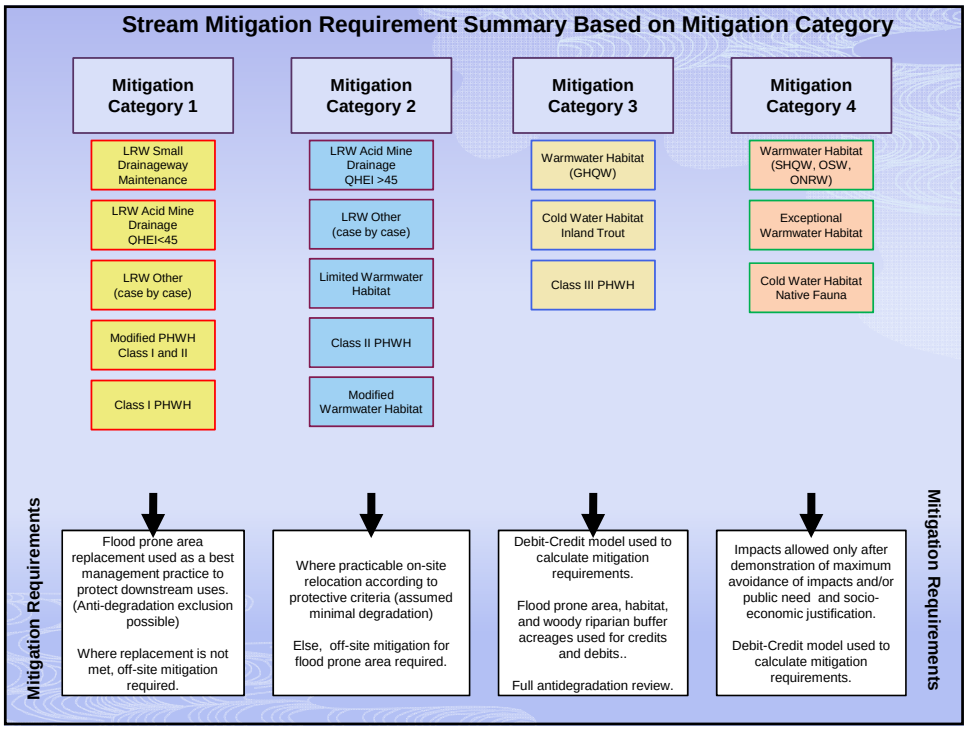
TIERED MITIGATION APPROACH

Tiered Mitigation Approach:

Stakeholder Group Results




Aquatic Life Use [OAC 345-1-07(E)] (undesignated streams)
Tiered Aquatic Life Use [OAC 345-1-07(F)]
Navigation Use [OAC 345-1-07(H)]
Drainage Use [OAC 345-1-07(G)]
Upland Drainage [OAC 3745-1-07(G)(1)]
Water Conveyance [OAC 3745-1-07(G)(2)]
Warmwater Habitat [OAC 3745-1-07(F)(1)]
Exceptional Warmwater Habitat [OAC 3745-1-07(F)(2)]
Seasonal Salmonid Habitat [OAC 3745-1-07(F)(5)]
Modified Warmwater Habitat [OAC 3745-1-07(F)(3)]
Inland Trout Stream [OAC 3745-1-07(F)(5)(b)(ii)]
Native Cold Water Fauna [OAC 3745-1-07(F)(5)(b)(iii)]
Cold Water Habitat [OAC 3745-1-07(F)(4)]
LRW Acid Mine Drainage [OAC 3745-1-07(F)(6)(a)]
Limited Resource Water (LRW) [OAC 3745-1-07(F)(6)]
LRW Small Drainageway Maintenance [OAC 3745-1-07(F)(6)(b)]
LRW Other, specified [OAC 3745-1-07(F)(6)(c)]
Limited Warmwater Habitat [OAC 3745-1-07(F)(7)]
Class I PHWH [OAC 3745-1-07(F)(9)(d)(i)]
Class II PHWH [OAC 3745-1-07(F)(9)(d)(ii)]
Primary Headwater Habitat (PHWH) [OAC 3745-1-07(F)(9)]
Class III PHWH [OAC 3745-1-07(F)(9)(d)(iii)]
Modified PHWH [OAC 3745-1-07(F)(9)(d)(iv)]
Class I
Class II
Beneficial Stream Uses Addressed by the Proposed Stream Mitigation Rule and Protocol (OAC 3745-1-56)


Stream Mitigation Requirement Summary Based on Mitigation Category
Mitigation Category 1
LRW Small Drainageway Maintenance
LRW Acid Mine Drainage QHEI<45
LRW Other (case by case)
Modified PHWH Class I and II
Class I PHWH
Mitigation Category 2
LRW Acid Mine Drainage QHEI >45
LRW Other (case by case)
Limited Warmwater Habitat
Class II PHWH
Modified Warmwater Habitat
Mitigation Category 3
Warmwater Habitat (GHQW)
Cold Water Habitat Inland Trout
Class III PHWH
Mitigation Category 4
Warmwater Habitat (SHQW, OSW, ONRW)
Exceptional Warmwater Habitat
Cold Water Habitat Native Fauna
Mitigation Requirements
Flood prone area replacement used as a best management practice to protect downstream uses. (Anti-degradation exclusion possible)
Where replacement is not met, off-site mitigation required.
Where practicable on-site relocation according to protective criteria (assumed minimal degradation)
Else, off-site mitigation for flood prone area required.
Debit-Credit model used to calculate mitigation requirements.
Flood prone area, habitat, and woody riparian buffer acreages used for credits and debits..
Full antidegradation review.
Impacts allowed only after demonstration of maximum avoidance of impacts and/or public need and socio-economic justification.
Debit-Credit model used to calculate mitigation requirements.
Mitigation Requirements

Mitigation Design

- Premise: The ecological integrity of a stream will be maximized in its natural state; when best fit to its existing conditions.
- Design Objective: Minimize the deviation of the new stream from its natural condition.

Mitigation Design

- General Design Goals: To protect existing and downstream uses the goals are tiered based on the mitigation category:
  - Category Four: maintain biota, habitat, form, and function
  - Category Three: maintain habitat, form, and function
  - Category Two: maintain form, function
  - Category One: maintain function

Version 5, Ohio EPA Stream Mitigation Protocol

TIERED MITIGATION REQUIREMENTS

Mitigation Protocol: Important Definitions

- Bankfull Stage: the water elevation at the 1.5 – 2.0 year recurrence interval peak discharge
  - Area inundated or saturated at bankfull stage is most critical
- Flood Prone Area: area inundated or saturated at 2 times the maximum depth as measured in a riffle at the bankfull stage
- Targets (based upon Eastern U.S. stream data):
  - Low gradient streams [stream slope < 2%]
    - Target Streamway Width (ft)
      $= 12.6 * DA^{0.38}$
  - High gradient streams [stream slope ≥ 2%]
    - Target replacement channel width (ft)
      $= 2.58 * DA^{0.38}$
  - Where:
    - DA = upstream drainage area in acres

Mitigation Protocol: Important Definitions

- Antidegradation exclusion [OAC 3745-1-05 (D)(1)(a):
  - exclusion from submittal requirements for non-degradation, minimal degradation, and mitigative projects, requirements for socio-economic justification, and review of local conservation efforts.
  - Only allowed when downstream water quality is protected.
- Minimal Degradation Alternative: "means an alternative … including pollution prevention alternatives, that would result in a lesser lowering of water quality."
  [OAC 3745-1-05 (A)(14)

Mitigation Category 1

Goal: Replace Function and Protect Downstream Water Quality

Mitigation Category 1

- Stream Uses:
  - LRW (3 classes)
  - Class I PHWH
  - Modified PHWH
- Goal is replacement of stream function to protect downstream water quality
- Director may upgrade to a higher mitigation category where site specific data indicates need to protect downstream water quality
- Simplified antidegradation approach warranted
- Requirements can be tailored for setting:
  - Surface mining
  - Linear transportation and utilities
  - Drainage use
  - Development
- Use or adaptation of successful existing methodologies encouraged

Example: Ephemeral Channels

- At the very top of the watershed.
- Often dry
- Existing Uses:
  - Moderates flow
  - Nutrient dynamics
  - Sediment transport
  - CPOM – stream energy
  - Limited or no aquatic life

Mitigation Category 1

- Goal is to protect existing stream functions within the watershed
- Caution needed – approaches should be chosen with the downstream use in mind
- Protection of groundwater recharge and discharge may be needed where downstream use is EWH, CWH or Class III PHWH

Mitigation Category 1 Stream Replacement Criteria

Mitigation target =

on-site replacement of services. Options:

1. Meet Mitigation Category 2 channel relocation criteria
   - This option must be used for high gradient streams (slope ≥ 2%)
     - no linear foot replacement requirement
   - Antidegradation exclusion applies if design criteria are met
2. Meet flood prone area replacement criteria (replacement of channel corridor services)
3. Other alternatives require:
   - Full antidegradation review
   - Off-site mitigation

Mitigation Category 1 Stream Replacement Criteria

- For streams with gradient <2%
  - Flood prone area replacement is the main design parameter - channel reconstruction (Mitigation Category 2 criteria) is not required
  - Applicant must ensure that the design is vertically stable: where necessary, appropriate grade control structures must be installed
    - No requirements for ecological function considerations in grade control design
  - Monitoring requirements relate to physical stability and conformance to design requirements

Mitigation Category 1 Stream Replacement Criteria

Design criteria (<2% slope):

- Functional flood prone area must be replaced at the greater of:
  - Existing flood prone area; or
  - Flood prone area ≥ 30% of the calculated streamway target
- Flood prone area ≥ 50% of the target (or greater) may be required where necessary to protect downstream uses
  - Mitigation Category 4 streams or other site-specific conditions
- Antidegradation exclusion does not apply when the design does not meet these criteria
  - Full antidegradation review
  - Additional mitigation for flood prone area loss

Mitigation Category 1 Stream Replacement Criteria

Quality Factor (scoring value)	Permeability (µm/sec)	Permeability (inches/hr)	Percent Organic Matter
Excellent (1.2)	≥ 9.2	≥ 1.3	≥ 3%
Good (1.0)	5.6 - <9.2	0.8 - <1.3	2% - <3%
Fair (0.8)	3.5 - <5.6	0.5 - <0.8	1% - <2%
Poor (0.4)	<3.5	<0.5	<1%

Design criteria (<2% slope):

- Soils should be suitable for establishment of native Ohio flora and floodplain function
  - Where there is a significant reduction in soil quality associated with stream replacement or relocation, antidegradation exclusions, etc. may not apply, and/or mitigation credits may be significantly reduced
- The highest quality factor for either permeability or percent organic matter is used for determining the soils quality factor

Mitigation Category 1 Stream Replacement Criteria

Design criteria (<2% slope):

- The flood prone area must have stable banks and shall be vegetated with suitable native vegetation.
  - Periodic maintenance to exclude woody vegetation or invasive species is acceptable.
  - Where the downstream use is mitigation category 4, measures may be required to protect against downstream temperature increase.
    - Appropriate controls, including provision of shaded riparian corridor or other BMP's may be necessary.

Mitigation Category 2

Goal: Replace Function, Maintain Channel and Floodplain Form

Mitigation Category 2

- Roughly 50% of the 401 applications received are for small intermittent or perennial streams:
  - Class II PHWH
  - MWH
- On-site relocation is often approved in these circumstances as a minimal degradation alternative
- Mitigation Category 2 would formalize use of on-site relocation as a minimal degradation alternative for the following stream categories:
  - Class II PHWH
  - MWH
  - Certain LRW streams
  - LWH Streams
- Standards to be met for stream relocation design would be set in protocol
- In cases where relocation is impossible but impacts are approvable under antidegration, mitigation required using the debit-credit model

SELF-FORMING CHANNELS

"NATURAL CHANNEL DESIGN"

Mitigation Category 2 Stream Relocation Criteria

- Mitigation target = on-site replacement of stream channel and water quality services
  - Use of design criteria qualifies as a minimal degradation alternative in the antidegradation review process
  - Applicant must ensure that the design is vertically stable. Where necessary, appropriate grade control structures must be installed
  - Stream channel must be provided with length ≥ existing condition appropriate to the setting
    - Self-forming channels
    - Constructed channels

Mitigation Category 2 Stream Relocation Criteria

Design criteria (<2% slope):

- Functional flood prone area must be replaced at the greater of:
  - the existing average flood prone area; or
  - an adjusted flood prone area ≥ 30 percent of the streamway target
- Adjusted flood prone area ≥ 50 and up to 100 percent of the target may be required where necessary to protect sensitive downstream uses
  - Mitigation Category 4 streams or other site-specific concerns

Mitigation Category 2 Stream Relocation Criteria

Design criteria (<2% slope):

- Vertical Stability
  - Grade control structures shall be appropriately sized to maintain integrity under existing and projected watershed conditions
  - Ecological design considerations should be followed in grade control design for Mitigation Category 2 streams where appropriate to meet an ecological goal
    - Class II PHWH
    - MWH
    - LRW AMD with QHEI > 60
  - Self-forming channels appropriate where sufficient water power exists to result in channel recovery during the monitoring period
  - Constructed channels should use suitable natural channel design approaches that result in the appropriate channel dimension, pattern and profile based upon reference reach conditions or suitable watershed-based design considerations

Mitigation Category 2 Stream Relocation Criteria

Design criteria (<2% slope):

- Soils must be suitable for floodplain function and re-vegetation
- The same soils criteria applicable to Mitigation Category 1 streams apply for Mitigation Category 2

Mitigation Category 2 Stream Relocation Criteria

Design criteria (<2% slope):

- The flood prone area must have stable banks and shall be vegetated with suitable native vegetation
  - Maintenance to exclude woody vegetation acceptable except where shading is required to protect against downstream temperature increase
- Where the downstream use is Mitigation Category 4, the applicant must demonstrate that there is no measureable change in downstream temperature
  - Structural temperature moderation may be acceptable in some situations

Mitigation Category 2 Stream Relocation Criteria

Design criteria (<2% slope):

- The flood prone area must have stable banks and shall be vegetated with suitable native vegetation.
  - Maintenance to exclude woody vegetation acceptable except where shading is required to protect against downstream temperature increase.
    - Where the downstream use is Mitigation Category 4, the applicant must demonstrate that there is no measureable change in downstream temperature.
    - Structural temperature moderation may be acceptable in some situations.

High Gradient Channels

- For high gradient streams (slopes greater than 2%), alternative design criteria are allowed:
  - Channels proportioned as follows:
    - Rosgen Type A channels for slopes greater than 4%
    - Rosgen Type B channels for slopes between 2-4%
- A simplified model for use in these situations has been developed by ODNR division of Soil and Water Conservation:
  - A_{25} = is the cross sectional area of the 25 year recurrence interval peak discharge (in ft^2)

Slope	Side Slope	Base Width (ft)	Minimum Channel Depth (ft)
2-4%	4:1	$1.2(A_{25})^{0.5}$	$0.4(A_{25})^{0.5}$
>4%	2:1	$1.0(A_{25})^{0.5}$	$0.5(A_{25})^{0.5}$

Mitigation Categories 3 and 4

Debit – Credit Model

Mitigation Category 3

- WWH – GHQW streams
- Cold Water Habitat – Inland Trout
- Class III PHWH

- Debit-credit model used to assess impacts and mitigation.
- Weighting factors calibrated to the WWH use.

- Streams with larger drainage area
- Impact and mitigation approaches may vary significantly.
- Prescriptive minimal degradation options not used.

Mitigation Category 4

- Sensitive beneficial uses
- Avoidance put at a premium
- Public need and/or social-economic justification required.
- Higher bar for antidegradation review

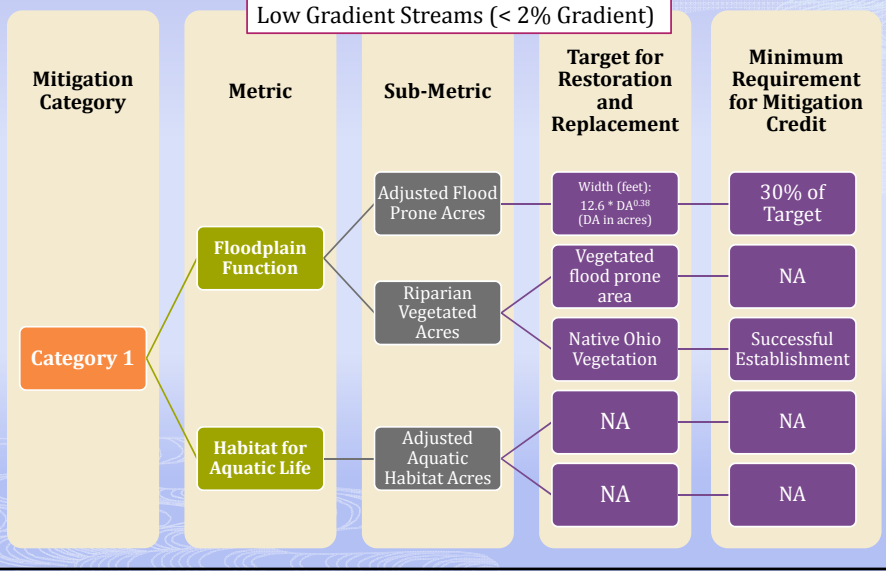
- Requirements for mitigation determined based on debit-credit model.
- Higher debit and credit values for impacts and mitigation.

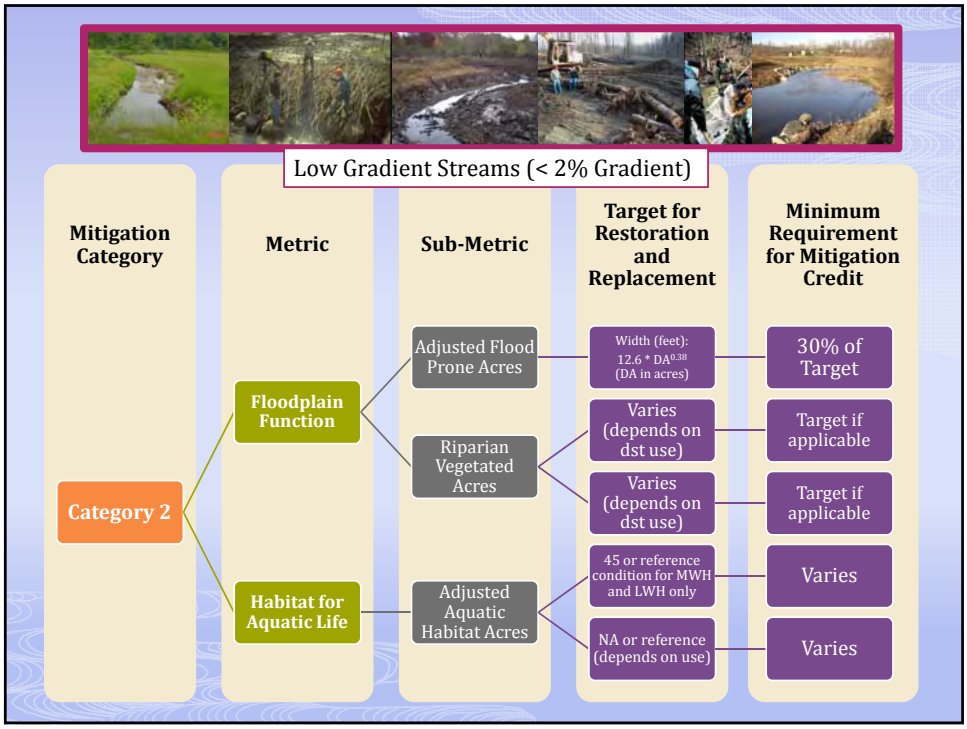
- All SHQW, OSW, ONRW Streams (includes WWH)
- EWH
- CWH – Native Fauna

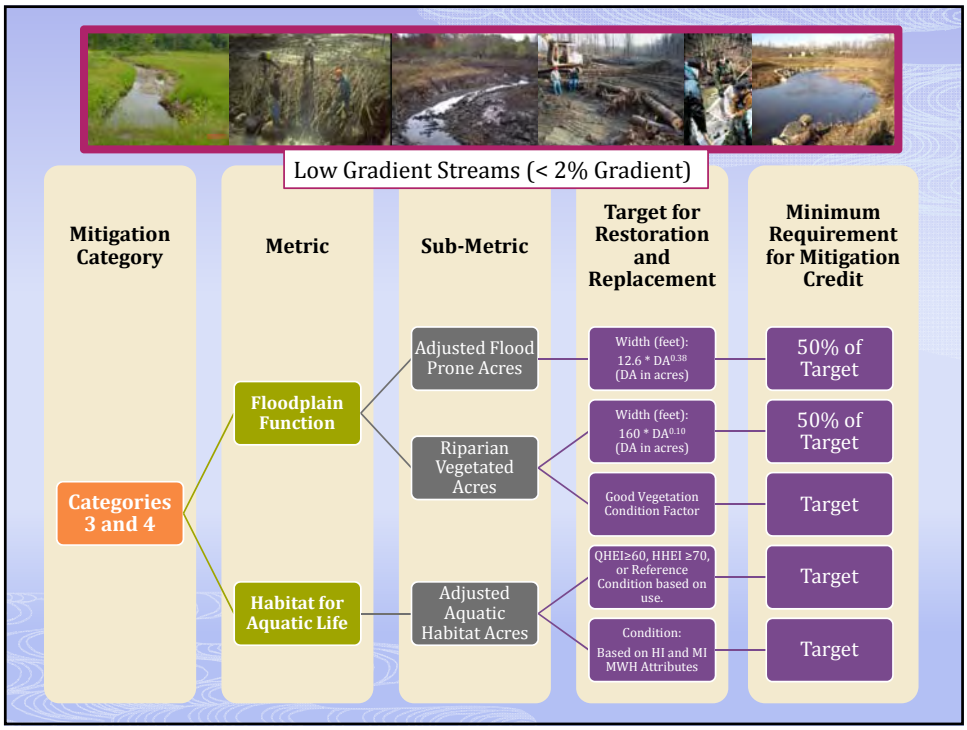
Minimum Mitigation Criteria

		Mitigation Category			
Metric	**Measurement**	**1**	**2**	**3**	**4**
Habitat	Total Score	N/A	Varies	60	75 or Reference
	HI MWH Attributes	N/A	Varies	0	0
	MI MWH Attributes	N/A	Varies	<4	<2
Floodplain (Low Gradient Streams)	Frequently Inundated Area	30% of Target Varies by DA	30-50% of Target Varies by DA	50% of Target Varies by DA	50% of Target Varies by DA
	Soils	Suitable for Ohio native vegetation	Suitable for Ohio native vegetation	≥2% OM or ≥0.8"/hr or reference condition	≥2% OM or ≥0.8"/hr or reference condition
Riparian Buffer	Vegetation Type	Herbaceous Native Maintenance OK	Varies (depends on dst use)	Woody Native	Woody Native
	Buffer Width	Flood Prone Area	Varies (depends on dst use)	Buffer Required Varies by DA	Buffer Required Varies by DA

Low Gradient Streams (< 2% Gradient)




Low Gradient Streams (< 2% Gradient)
Mitigation Category
Metric
Sub-Metric
Target for Restoration and Replacement
Minimum Requirement for Mitigation Credit
Category 2
Floodplain Function
Habitat for Aquatic Life
Adjusted Flood Prone Acres
Riparian Vegetated Acres
Adjusted Aquatic Habitat Acres
Width (feet): 12.6 * DA^0.38 (DA in acres)
Varies (depends on dst use)
Varies (depends on dst use)
45 or reference condition for MWH and LWH only
NA or reference (depends on use)
30% of Target
Target if applicable
Target if applicable
Varies
Varies


Low Gradient Streams (< 2% Gradient)
Mitigation Category
Metric
Sub-Metric
Target for Restoration and Replacement
Minimum Requirement for Mitigation Credit
Categories 3 and 4
Floodplain Function
Habitat for Aquatic Life
Adjusted Flood Prone Acres
Riparian Vegetated Acres
Adjusted Aquatic Habitat Acres
Width (feet): 12.6 * DA^0.38 (DA in acres)
Width (feet): 160 * DA^0.10 (DA in acres)
Good Vegetation Condition Factor
QHEI≥60, HHEI ≥70, or Reference Condition based on use.
Condition: Based on HI and MI MWH Attributes
50% of Target
50% of Target
Target
Target
Target

Questions so far?

"I've watched that stream for three years and it's never flooded yet!"

Mitigation Debit-Credit Model

Scoring Metric Development
Ohio EPA Stream Mitigation Protocol Version 5

2004 Mitigation Protocol

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	CWH Class I (Public) Protection of Ohio water uses, and remaining aquatic	MWH Class II (Public) Enter 0.0 for (1) or Box 3 if some or all adverse mitigation credits needed	WWH 1.5	EWH 2.0	Class III (Public) 2.5	EWH Add 0.2 to score for each Superior Aquatic Use	
Existing Habitat Quality Section 5.2.2	Available for these weighting factors		Poor 0.2	Fair 0.4	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	Submit is not necessary for default procedure.		Poor 0.2	Fair 0.6	Good 1.0	Excellent 1.5	
Existing Flood Plain Quality Section 5.2.5.1	See Section 2.1.3.2.		Poor 0.2	Fair 0.6	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 (X) =				
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 X) =				

- Based on model developed by the Army Corps of Engineers
- Pros:
  - Ease of use
- Cons:
  - Subjective scoring factors
  - Still a linear foot model
    - Watershed size not accounted for

Weighting Factor Assessment

- Impact Assessment
  - Last draft: 6 weighting factors
    - Strongest influence based on existing use, habitat quality, and degree of impact
  - Debits =

    $\sum$ weighting factors x linear feet of impact

Weighting Factor Assessment

- Mitigation Weighting Factors
  - Last draft: 12 potential weighting factors
    - Subset determined by type of mitigation proposed
  - Credits=

    ∑Weighting Factors x linear feet of mitigation

Basic Assumptions 1

- The following relationships hold true:
  - Bankfull Width f DA
    - Combined with QHEI targets gives area-based habitat measurement
  - Flood Prone Width Targets f DA
    - Combined with floodplain form and functional parameter gives area-based measurement of floodplain services
  - Riparian Buffer Width Targets f DA
    - Combined with vegetation quality gives area-based measurement of riparian quality
- ALL three can be scaled to drainage area!

Basic Assumptions 2

- Restoration/Mitigation Targets:
  - Design targets or maximum criteria can be set
    - Examples:
      - The maximum QHEI score is 100
      - The target flood prone width is 12.6 x $DA^{0.38}$
  - Minimum design criteria can be set
    - Vary dependent upon beneficial use and drainage area
      - Examples:
        - WWH (Mit Cat 3) QHEI minimum restoration target is 60
        - Minimum flood prone width is 30% of target
  - The area (in acres) can be adjusted based upon the degree of deviation from the target within the range of values set for each metric

Debit – Credit Model

- Metrics proposed for the model are
  - Aquatic habitat area (acres)
    - Adjusted based on index score and condition
  - Riparian buffer acres: sum of two components
    - Flood prone area adjusted for elevation, width, and soils
    - Vegetated buffer acres adjusted for width and vegetation quality

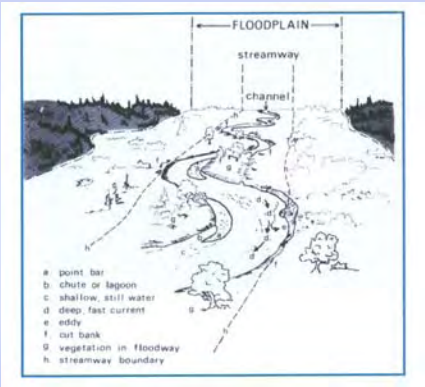
Debit – Credit Model

- Both metrics can be scored using similar approaches scaled based upon upstream drainage area and condition factors adjusted for the metric
- Applicability of metrics and mitigation targets are based on the Mitigation Category (tiered mitigation)
- Areas (acres) of debits and credits dealt with independently for mitigation
  - habitat and riparian not combined

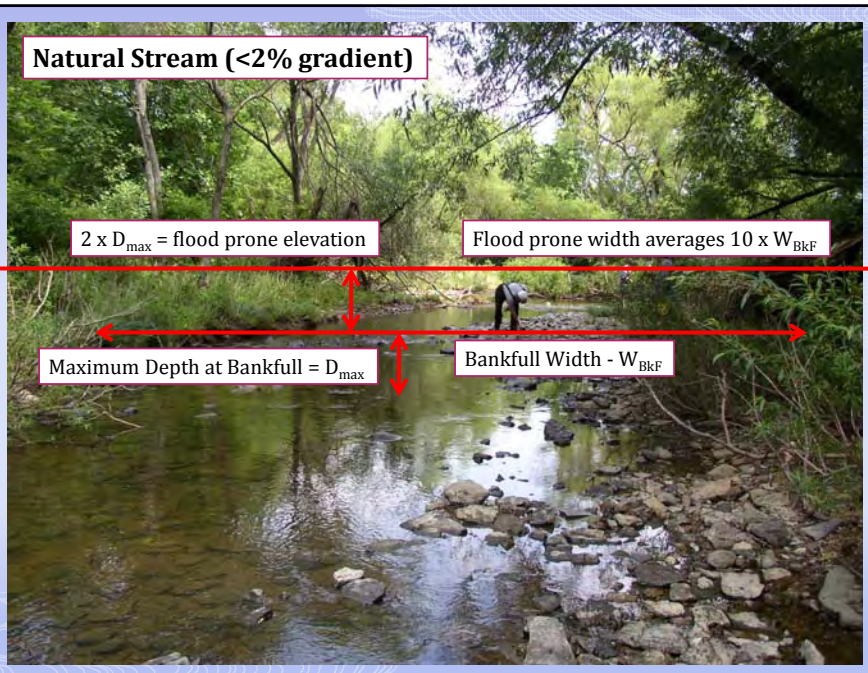
Debit – Credit Model

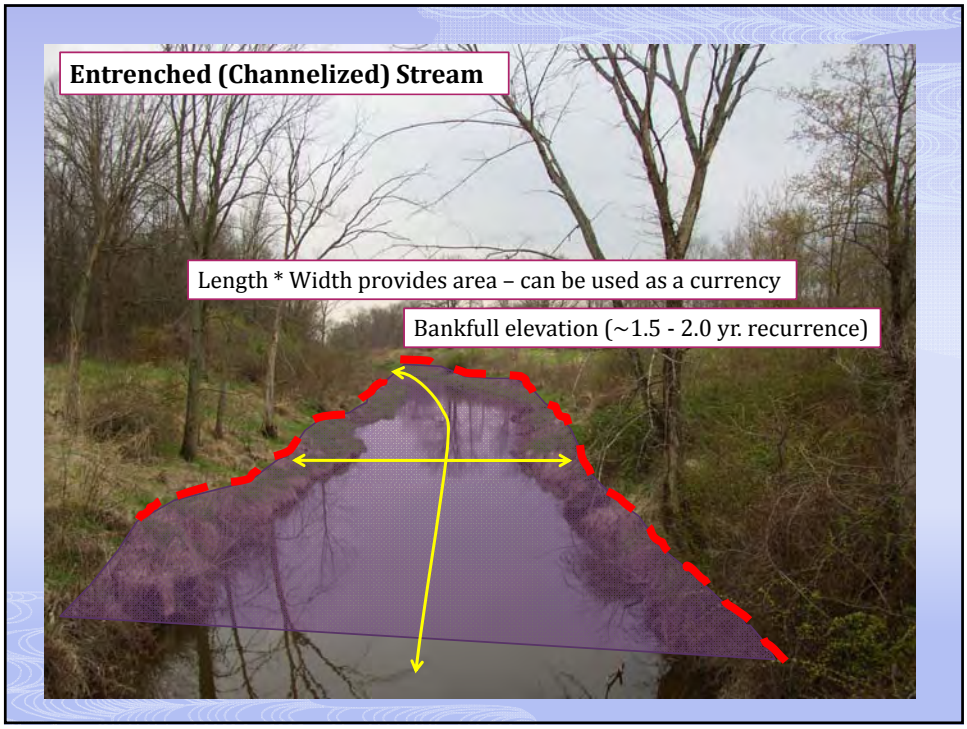
- Advantages:
  - Scaling and reference conditions are based upon endpoints supported by the science
  - Credits and debits adjusted based upon services provided
    - Area and quality of floodplain, vegetated buffer, and aquatic habitat
    - Use of subjective criteria is minimized
  - Standardized calculations can be provided via a spreadsheet or web-based application
    - Data can be captured electronically
  - The evaluation system can be used to score mitigation sites during monitoring to determine if performance criteria are met
- Disadvantages:
  - Level of training needed to complete the application and review process
  - May be perceived as “complicated”

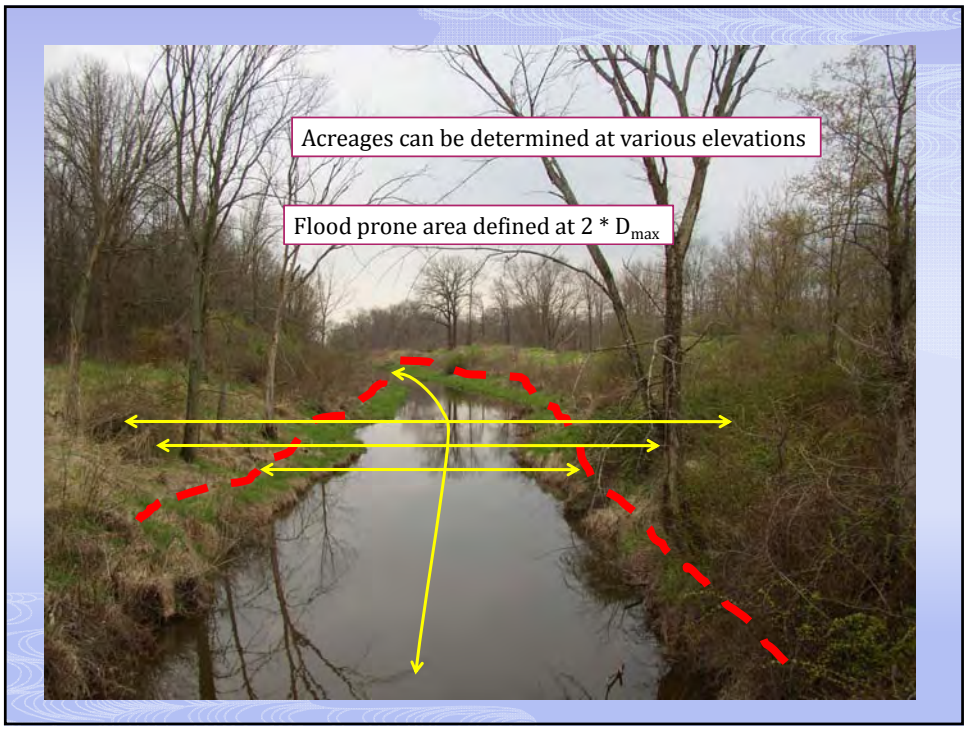
Flood Prone Area



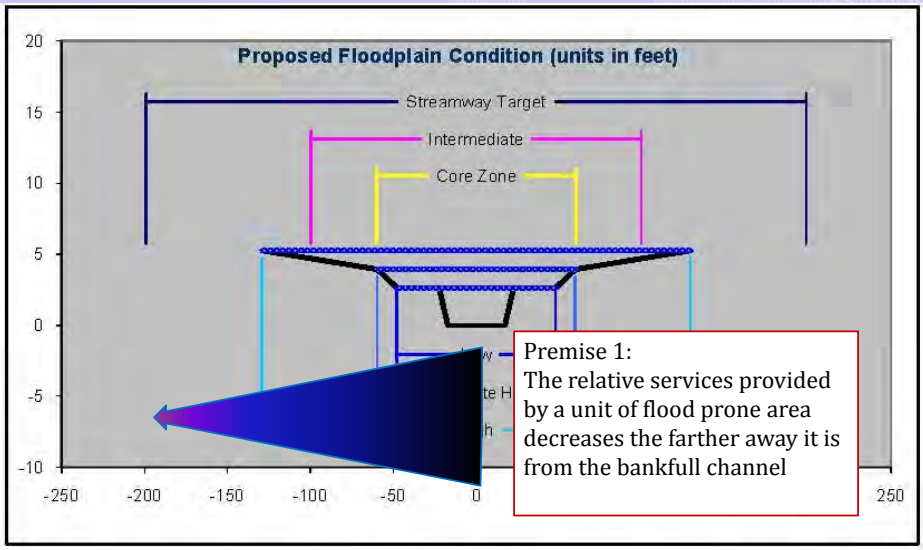
- Applies for all mitigation categories
- Reflective of stream stability and water quality functions
- Relates directly to ecological integrity
- Critical for protection of downstream uses




Entrenched (Channelized) Stream
Length * Width provides area – can be used as a currency
Bankfull elevation (~1.5 - 2.0 yr. recurrence)

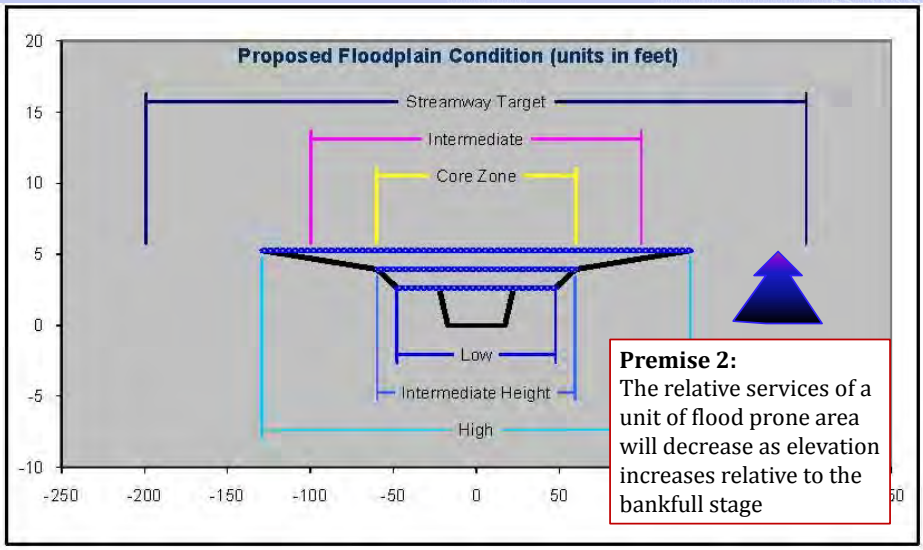

Acreages can be determined at various elevations
Flood prone area defined at 2 * D_{max}

Flood Prone Area Adjustment



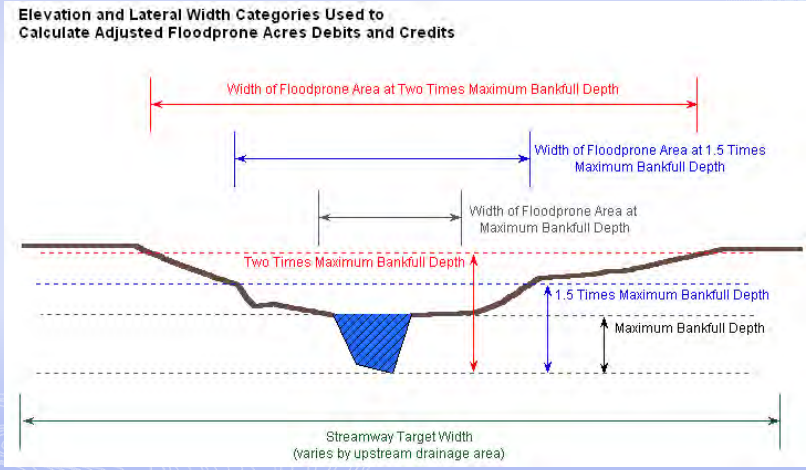
Premise 1:
The relative services provided by a unit of flood prone area decreases the farther away it is from the bankfull channel

Flood Prone Area Adjustment

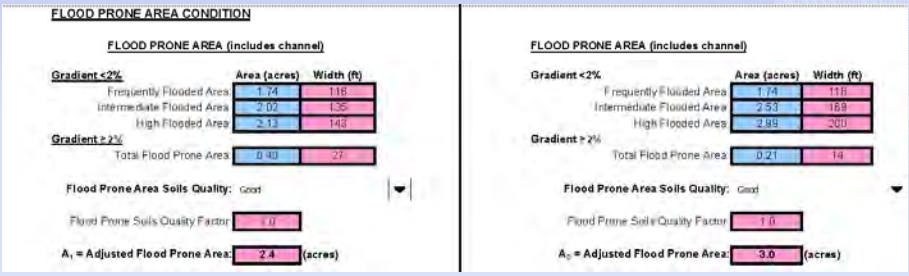


Premise 2:
The relative services of a unit of flood prone area will decrease as elevation increases relative to the bankfull stage

Flood Prone Area



Flood Prone Area



FLOOD PRONE AREA CONDITION

FLOOD PRONE AREA (includes channel)

Gradient <2%	Area (acres)	Width (ft)
Frequently Flooded Area	1.74	118
Intermediate Flooded Area	2.02	135
High Flooded Area	2.13	148
Gradient ≥ 2%		
Total Flood Prone Area	0.40	27

Flood Prone Area Soils Quality: Good

Flood Prone Soils Quality Factor: 1.0

A_1 = Adjusted Flood Prone Area: 2.4 (acres)

FLOOD PRONE AREA (includes channel)

Gradient <2%	Area (acres)	Width (ft)
Frequently Flooded Area	1.74	118
Intermediate Flooded Area	2.53	169
High Flooded Area	2.99	200
Gradient ≥ 2%		
Total Flood Prone Area	0.21	14

Flood Prone Area Soils Quality: Good

Flood Prone Soils Quality Factor: 1.0

A_2 = Adjusted Flood Prone Area: 3.0 (acres)

- Areas at or below the three stages (elevations) determined by a site survey
- Acres at each stage are adjusted by equation based upon the elevation and distance from the stream

Soil Quality Factor

Quality Factor (scoring value)	Permeability (µm/sec)	Permeability (inches/hr)	Percent Organic Matter
Excellent (1.2)	≥ 9.2	≥ 1.3	≥ 3%
Good (1.0)	5.6 - <9.2	0.8 - <1.3	2% - <3%
Fair (0.8)	3.5 - <5.6	0.5 - <0.8	1% - <2%
Poor (0.4)	<3.5	<0.5	<1%

- Soil quality is multiplied by the flood prone acres to provide a final adjusted flood prone area value
- The highest soil quality factor for either permeability or percent organic matter is used for determining the soils quality factor
- Soils characteristics can be obtained from existing soil survey or soil samples

Aquatic Habitat

- The amount of aquatic habitat can be expressed as an acreage
  - Channel length x bankfull width = area
  - Acreage of aquatic habitat can be adjusted for quality based upon the ratio of the existing (or proposed) index score to the target score
    - For the QHEI, the reference is 60
  - Condition factor (based on MWH attributes) also used to adjust the area calculation
- Result is a normalized measure of aquatic habitat

Aquatic Habitat

- The Aquatic Habitat acreage is calculated based upon the following equation:

$$QR * CF * C$$

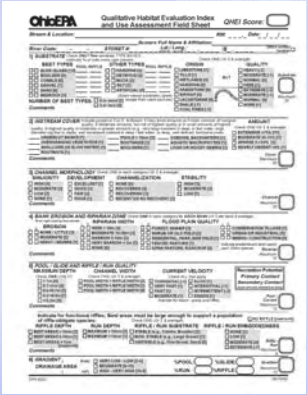
Where:

QR = QHEI Ratio, the ratio of the existing or resulting habitat index score to Q_{ref} (QHEI or HHEI)

Q_{ref} = reference habitat index score (QHEI in this example) = 60

CF = condition factor based upon the number of Modified Warmwater Habitat attributes

C = area of the channel (in acres) = $(W_{Bkf} * L) / 43{,}560$
Bankfull width * channel length (in feet)



Aquatic Habitat – Condition Factor

- CF (condition factor) is based upon the number of High Influence (HI) and Moderate Influence (MI) QHEI attributes present:

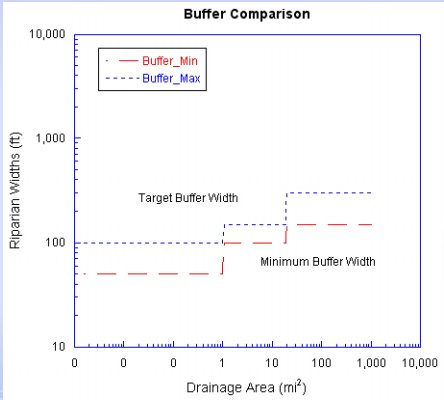
≥ 2 HI	= Poor	= 0.4
HI + MI > 4	= Fair	= 0.8
0 HI + 3 or 4 MI	= Good	= 1.0
0 HI + ≤ 2 MI	= Excellent	= 1.2

- The Condition Factor categories are derived from the QHEI methodology (Rankin, 1989; Ohio EPA, 2006)
  - Same categories used in habitat TMDL's in Ohio

Vegetated Buffer Metric

- Vegetated buffer required for Mitigation Category 3 and 4 stream projects
  - Applies to Mitigation Category 2 streams where the downstream use is Mitigation Category 4

Vegetated Buffer Metric



- Stakeholder process:
  - Watershed area-based minimum and target riparian buffer widths discussed
  - Derived from precedents:
    - Riparian setbacks
    - Big Darby stormwater permit
    - Silviculture practices
  - Resulted in a step-function
- Revised approach:
  - Drainage area-based equation approximates the step function
  - Provides for smooth transition along drainage area scale
  - Provides range for allocating credits and assessing debits
  - Minimum buffer required = 50% of target

Vegetated Buffer Metric

Scoring:

- Buffer areas below the flood prone elevation score higher
  - 1.2 * acreage vs. 0.7 * acreage
- Vegetation quality also considered
  - Scoring system similar to ORAM wetland plant community metric
  - 0 – 16 scoring scale based on three metrics:
    - Plant community quality
    - Tree size
    - Invasive/Non-native cover

Credit – Debit Accounting

- Metric Scoring:
- Each metric is scored separately for both impacts and mitigation
  - Adjusted Vegetated Buffer and Flood Prone area acreages are added to provide a single value for the Riparian Area acreage metric
  - Aquatic Habitat Acres are accounted for separately
- Debits and credits do not apply for mitigation category 1 stream impacts where on-site activities meet the antidegradation exclusion

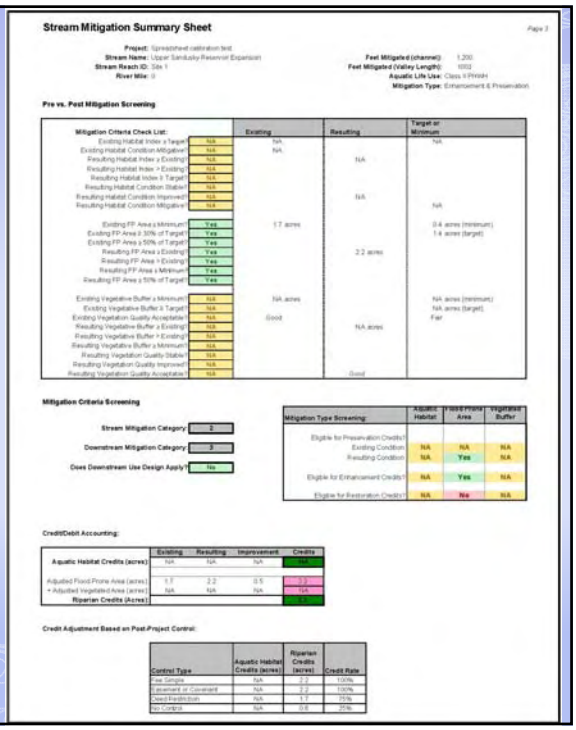
Credit – Debit Accounting

Applicability:

- Credits for Preservation Only projects allowed where permanent protection afforded and the site meets minimum design targets
  - Generally not allowed for Mitigation Category 1 and 2 streams except where allowed to protect Mitigation Category 4 downstream uses
  - Credits allocated based upon the existing condition
- Credits for Enhancement allowed where the stream condition meets minimum design targets but where metrics improve based on mitigation
  - Credits allocated based the improvement in metric scores (added acres)
- Credits for Restoration are allowed where a stream is improved from a sub-standard condition to a condition where minimum design targets are met.
  - Credits are allocated based upon the total resulting metric values
    - Where the restored site is preserve, the credit allocation equals the resulting value plus the added acres resulting from the project

Mitigation Spreadsheet

- A spreadsheet calculator has been designed to aid in the application and review process
- Tiered mitigation outcomes are evaluated
- Credits and debits adjusted according to the protocol
- Tool could be converted to a web-based application in the future


Stream Mitigation Summary Sheet

Project: Spreadsheet calibration test
Stream Name: Upper Sandusky Reservoir Expansion
Stream Reach ID: Site 1
River Mile: 0

Feet Mitigated (channel): 1,200
Feet Mitigated (Valley Length): 1000
Aquatic Life Use: Class II Primitive
Mitigation Type: Enhancement & Preservation

Pre vs. Post Mitigation Screening

Mitigation Criteria Check List:		Existing	Resulting	Target or Minimum
Existing Habitat Index ≥ Target?	NA	NA		NA
Existing Habitat Condition Mitigative?	NA	NA		
Resulting Habitat Index ≥ Existing?	NA		NA	
Resulting Habitat Index ≥ Target?	NA			
Resulting Habitat Condition Stable?	NA			
Resulting Habitat Condition Improved?	NA		NA	
Resulting Habitat Condition Mitigative?	NA			NA
Existing FP Area ≥ Minimum?	Yes	1.7 acres		0.4 acres (minimum)
Existing FP Area ≥ 30% of Target?	Yes			1.4 acres (target)
Existing FP Area ≥ 50% of Target?	Yes			
Resulting FP Area ≥ Existing?	Yes		2.2 acres	
Resulting FP Area > Existing?	Yes			
Resulting FP Area ≥ Minimum?	Yes			
Resulting FP Area ≥ 50% of Target?	Yes			
Existing Vegetative Buffer ≥ Minimum?	NA	NA acres		NA acres (minimum)
Existing Vegetative Buffer ≥ Target?	NA			NA acres (target)
Existing Vegetation Quality Acceptable?	NA	Good		Fair
Resulting Vegetative Buffer ≥ Existing?	NA		NA acres	
Resulting Vegetative Buffer > Existing?	NA			
Resulting Vegetative Buffer ≥ Minimum?	NA			
Resulting Vegetation Quality Stable?	NA			
Resulting Vegetation Quality Improved?	NA			
Resulting Vegetation Quality Acceptable?	NA		Good	

Mitigation Criteria Screening

Stream Mitigation Category:	2
Downstream Mitigation Category:	3
Does Downstream Use Design Apply?	No

Mitigation Type Screening:	Aquatic Habitat	Flood Prone Area	Vegetative Buffer
Eligible for Preservation Credits?			
Existing Condition	NA	NA	NA
Resulting Condition	NA	Yes	NA
Eligible for Enhancement Credits?	NA	Yes	NA
Eligible for Restoration Credits?	NA	No	NA

Credit/Debit Accounting:

	Existing	Resulting	Improvement	Credits
Aquatic Habitat Credits (acres)	NA	NA	NA	NA
Adjusted Flood Prone Area (acres)	1.7	2.2	0.5	0.2
+ Adjusted Vegetated Area (acres)	NA	NA	NA	NA
Riparian Credits (Acres)				0.2

Credit Adjustment Based on Post-Project Control:

Control Type	Aquatic Habitat Credits (acres)	Riparian Credits (acres)	Credit Rate
Fee Simple	NA	2.2	100%
Easement or Covenant	NA	2.2	100%
Deed Restriction	NA	1.7	75%
No Control	NA	0.6	25%

Schedule for Protocol and Rule

- September 1: stakeholder meeting
- September 30: complete mitigation protocol document
- October: begin interested party review period for WQ standards rule package including the stream mitigation rule
- November-December: end of interested party review period

Thank You!

"I'd rather be fishin"