

STREAM CREDIT DETERMINATION

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Interagency Review Team Course 2019

OUTLINE

1. General Considerations
2. Case Example
3. Example Methods
4. Common Challenges and Questions
5. Resources



PRESERVATION AND RIPARIAN AREAS

(6) Credits provided by preservation.

- *should apply a higher mitigation ratio*
- *consider the relative importance of the impacted and the preserved aquatic resources in sustaining watershed functions.*

(7) Credits provided by riparian areas, buffers, and uplands

- *only used when they are essential to maintaining the ecological viability of adjoining aquatic resources.*
- *if essential to sustaining aquatic resource functions in the watershed and are the most appropriate compensation.*

Summarized from §332.8(o)

SITE SELECTION: INCENTIVES OFTEN IN CREDIT CALCULATORS

Natural Incentives

- **Restoration potential:**
 - Looking for the degraded segment in a healthy watershed
 - Most credits for the least work
- **Cost:**
 - Land acquisition / protection
 - Long term management / stewardship
 - Construction / site access
- **Service Area (revenue base)**

Programmatic Goals

- **Watershed Priorities**
 - To be restored
 - To be preserved
 - To provide corridors
 - Protecting the whole drainage basin
- **Priority Resources**
 - Rare habitat types
 - Species requirements / presence
- **Distribution of green space**
- **Durability of the protections**

GENERAL CONSIDERATIONS: TRANSLATING TO UNIVERSAL UNITS

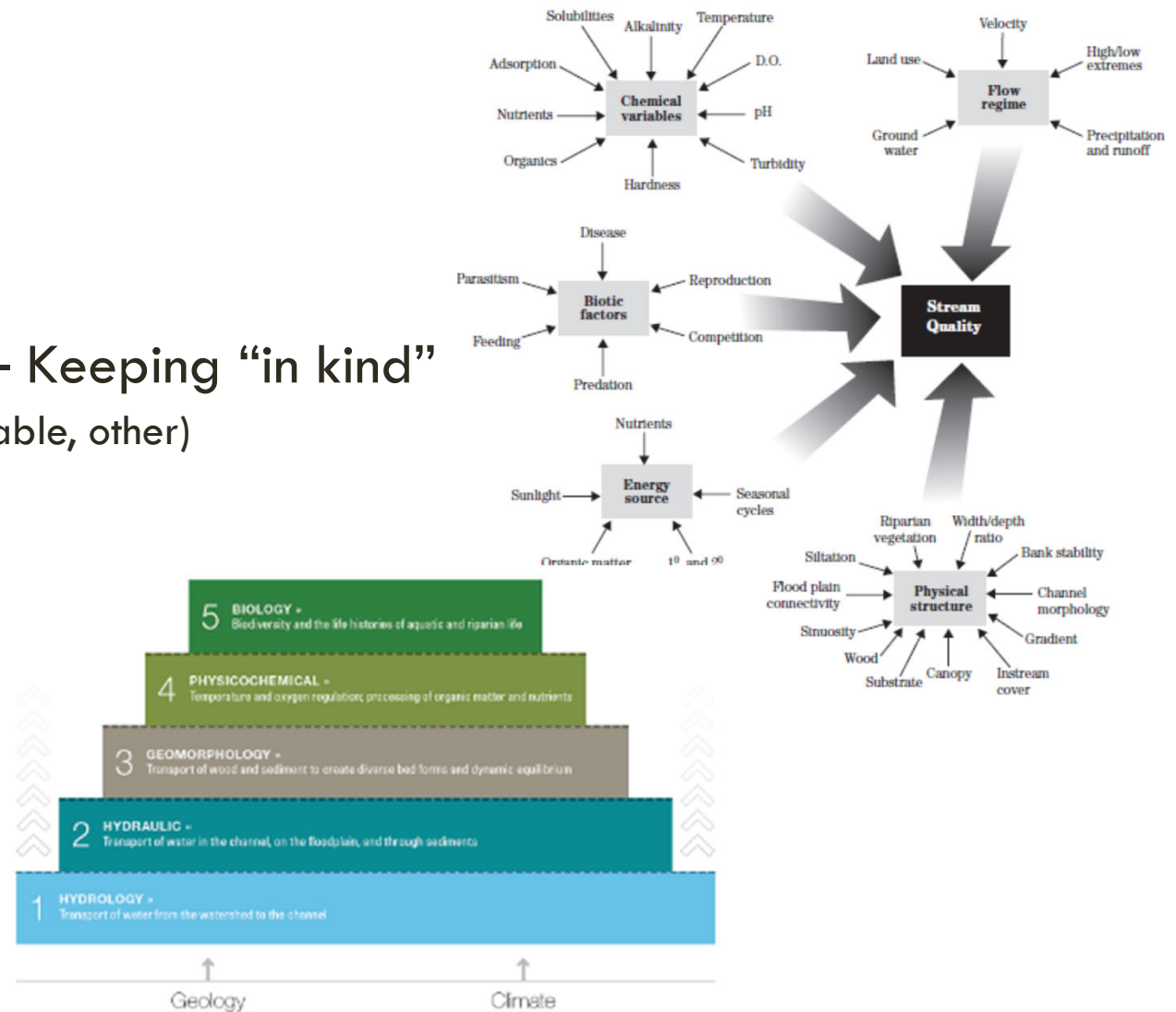
Base Units

- Linear Feet
- Acreage
- Functional Unit

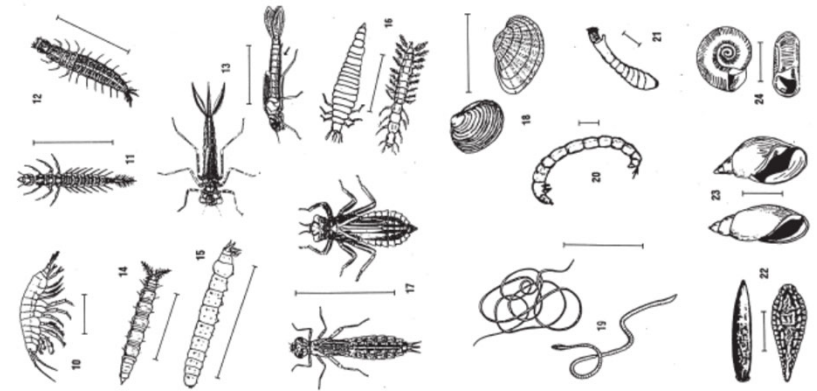
Resource Type – Keeping “in kind”

- Size (Order, wadeable, other)
- Flow duration
- Fishery
- Elevation

Comprehensive



CONSIDERATIONS: ASSESSMENT METHOD(S)



Use of Condition vs. Functional Measures

Does it measure indicators of function or the function directly?

- Each assumption of causal and determinative relationship is an assumption of risk by the agency
- Applies equally to impact and compensation assessment

Repeatability / Consistency of application

- All stream types? Or Agency opt out for different systems?
- Across the coverage area?
- Across the range of impacts reviewed? Burial to encroachment?
- Adequate training available for regulators, consultants and public?

Quantitative verse Qualitative measures

CONSIDERATIONS: ASSESSMENT METHOD(S) (CONTINUED)

Integrated or independent methodology for assessment of function or condition

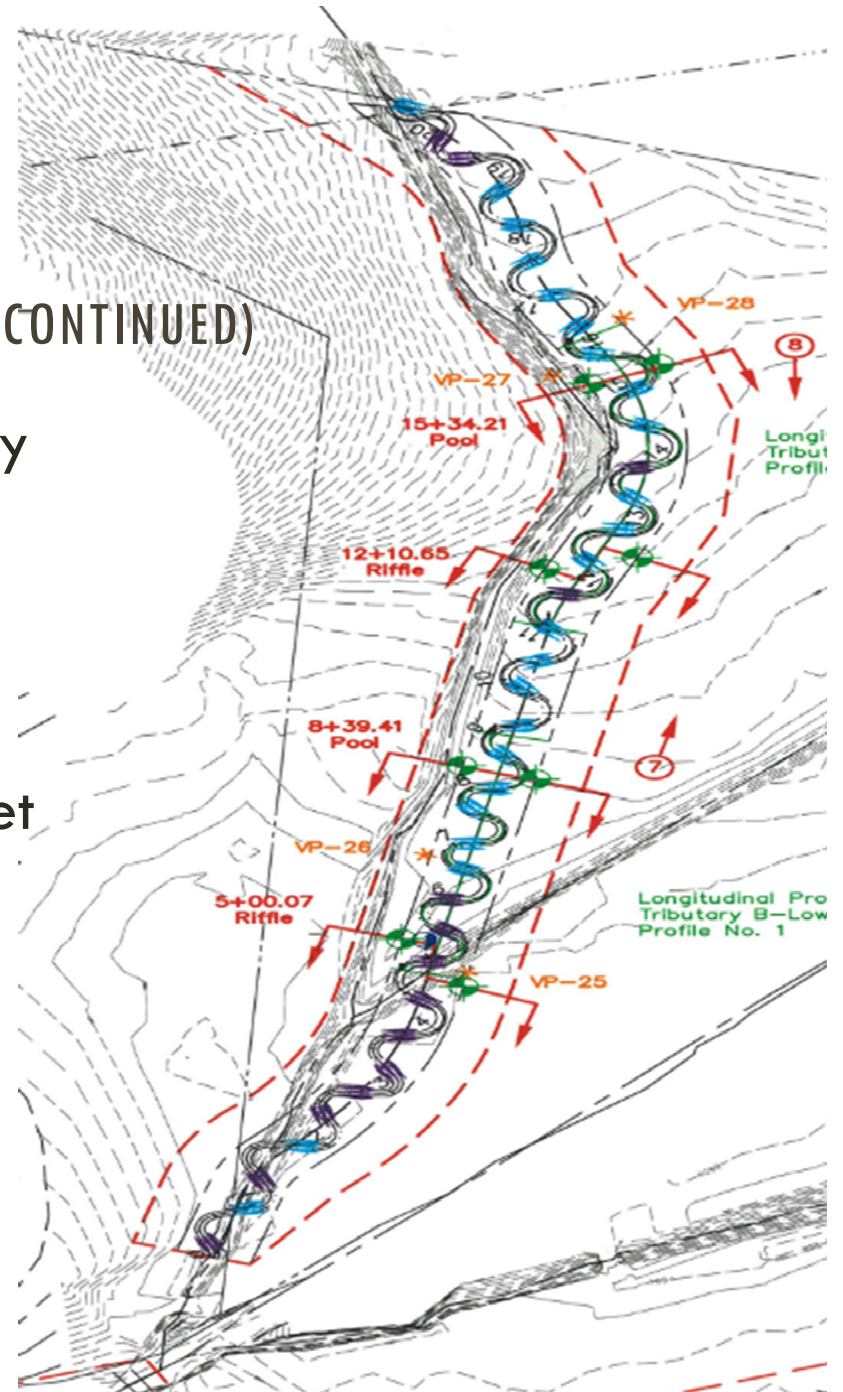
Integrity of the values

- Opportunities to game the system
- Creation of perverse incentives

Basis: Experience or Reference Data Set

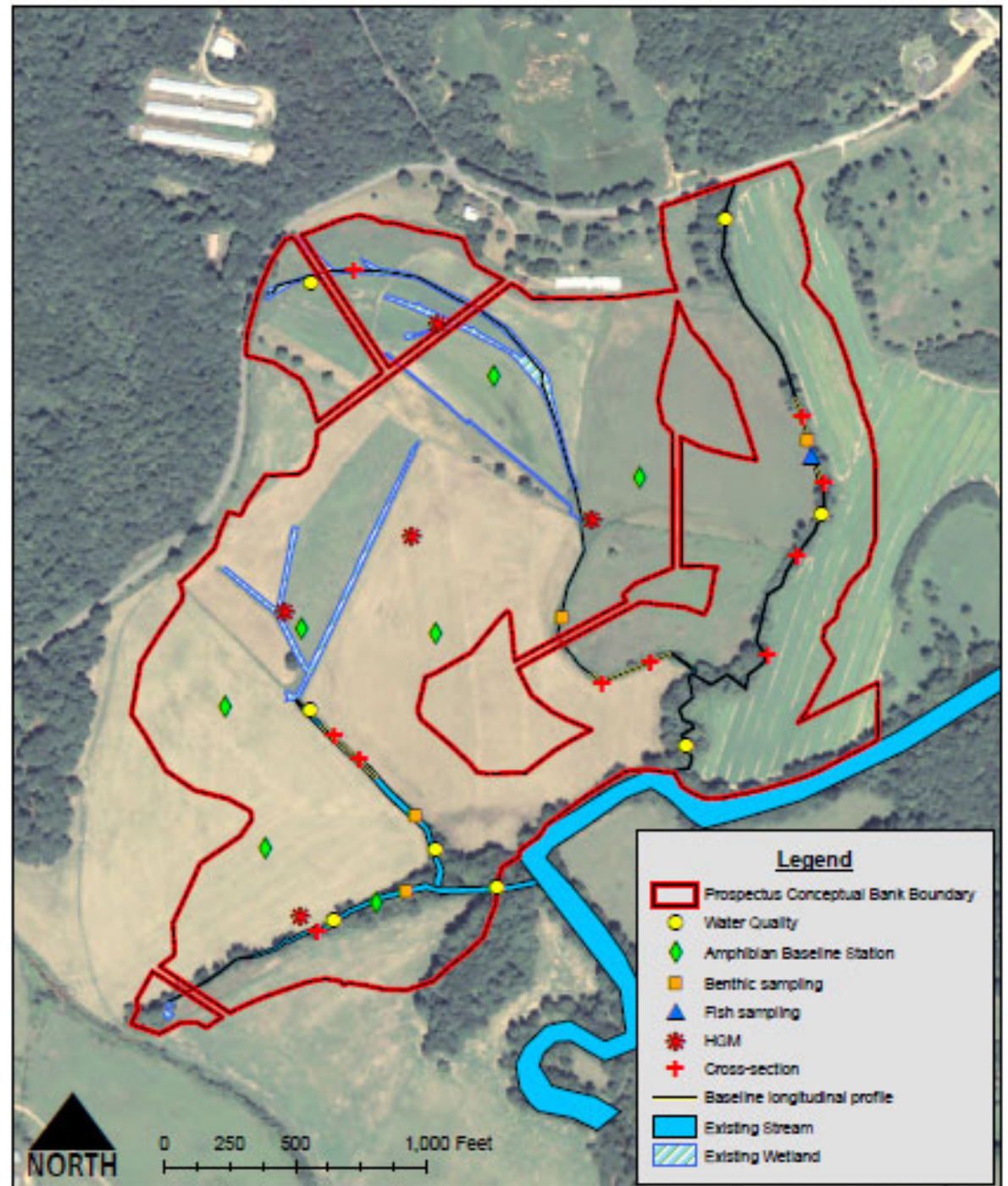
Adaptability - Does it only work with a limited range of:

- Design approaches
- Restoration practices / actions
- Restoration outcomes
 - Single channel verse braided systems
 - Floodplain connections verse stream/wetland complex
 - Beaver



EXAMPLE: BASELINE ETOWAH RIVER ROAD MITIGATION BANK

Baseline Monitoring
Locations and Image



EXAMPLE: BASELINE DATA ETOWAH RIVER ROAD MITIGATION BANK

Baseline Information Collected

- Channel dimension (cross-sectional profiles)
- Pattern (planform)
- Longitudinal profile (slope and bed features)
- Pebble count (channel bed materials)
- Stream bank stability (Bank Erosion Hazard Index)
- Macroinvertebrate sampling
- Fish survey

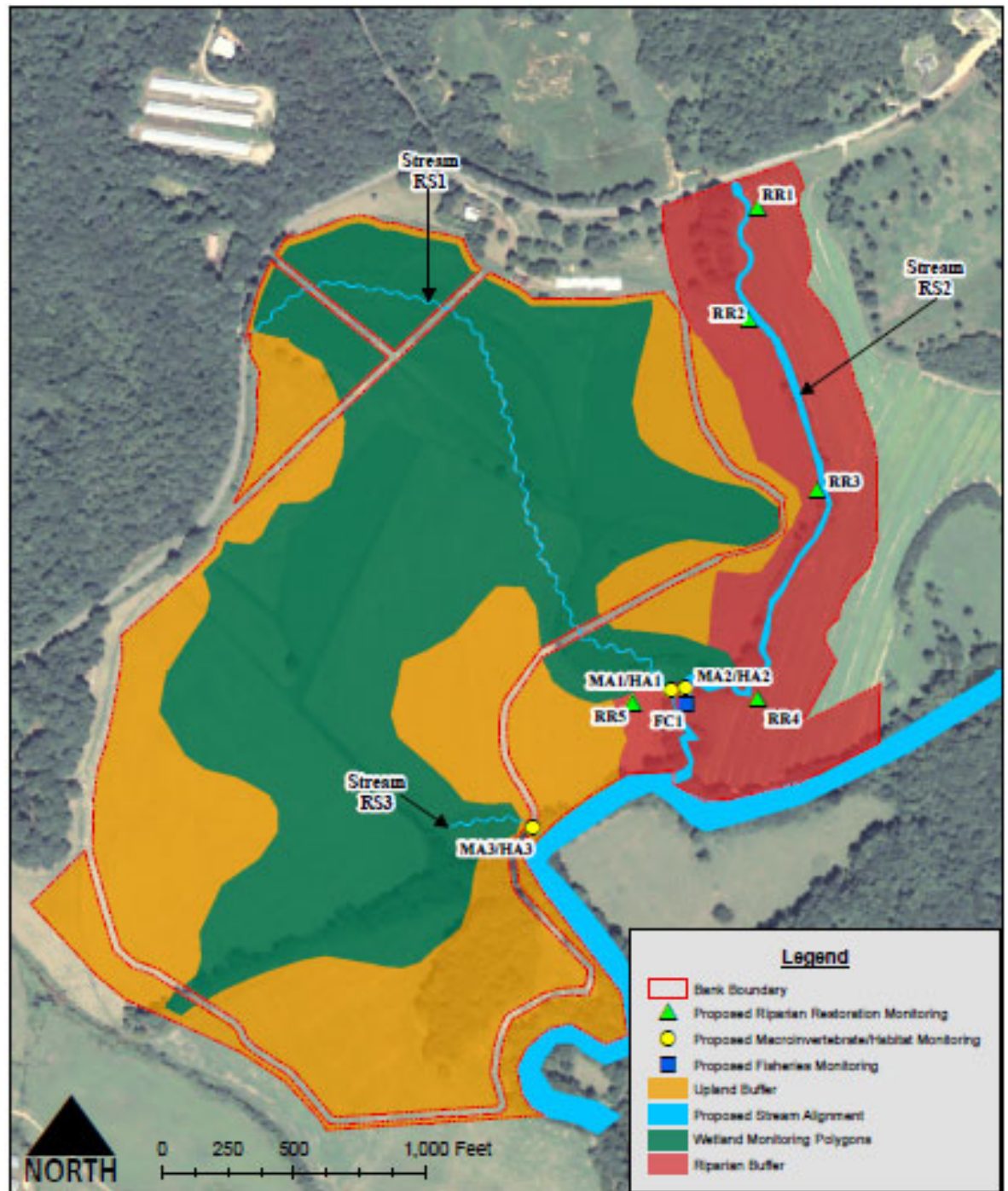
Collected using standard identified methods

Followed state procedures for biological sampling

Provide an explanation of the results specific to the site

EXAMPLE: PROJECT ETOWAH RIVER ROAD MITIGATION BANK

- Riparian
- Macroinvertebrate / Habitat
- Fish Monitoring
- Habitat Types
- Water Quality (not shown)



EXAMPLE: CREDITING CHANNEL WORK ETOWAH RIVER ROAD MITIGATION BANK

Table 34. Stream restoration credit calculations.

| STREAM CHANNEL RESTORATION, STREAM RELOCATION, AND STREAMBANK RESTORATION | | | | | | | |
|---|-------------------|-------------------|-------------------|------------------------------------|-------------------|-------------------|-------------------|
| FACTOR | RS1 Priority 1 | RS1 Priority 2 | RS2 Priority 2 | RS2 Streambank Stabilization | RS2 Priority 3 | RS3 Priority 1 | RS3 Priority 2 |
| NET BENEFIT | 8.0 | 8.0 | 8.0 | 2.0 | 4.0 | 8.0 | 8.0 |
| MONITORING/CONTINGENCY | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| PRIORITY AREA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| CONTROL | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| MITIGATION TIMING | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| SUM OF FACTORS | 10.4 | 10.4 | 10.4 | 4.4 | 6.4 | 10.4 | 10.4 |
| FEET OF STREAM IN REACH | 1708.0 | 1399.0 | 575.0 | 1425.0 | 830.0 | 202.0 | 231.0 |
| MX LF = | 17763.2 | 14549.6 | 5980.0 | 6270.0 | 5312.0 | 2100.8 | 2402.4 |
| TOTAL STREAM RESTORATION CREDITS = | | | 54,378.0 | | | | |
| TOTAL RIPARIAN RESTORATION CREDITS = | | | 18,979.0 | | | | |
| TOTAL STREAM CREDITS GENERATED = | | | 73,357.0 | | | | |

EXAMPLE: CREDITING RIPARIAN BUFFERS ETOWAH RIVER ROAD MITIGATION BANK

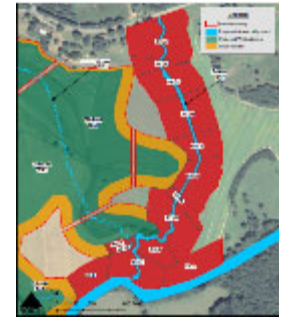
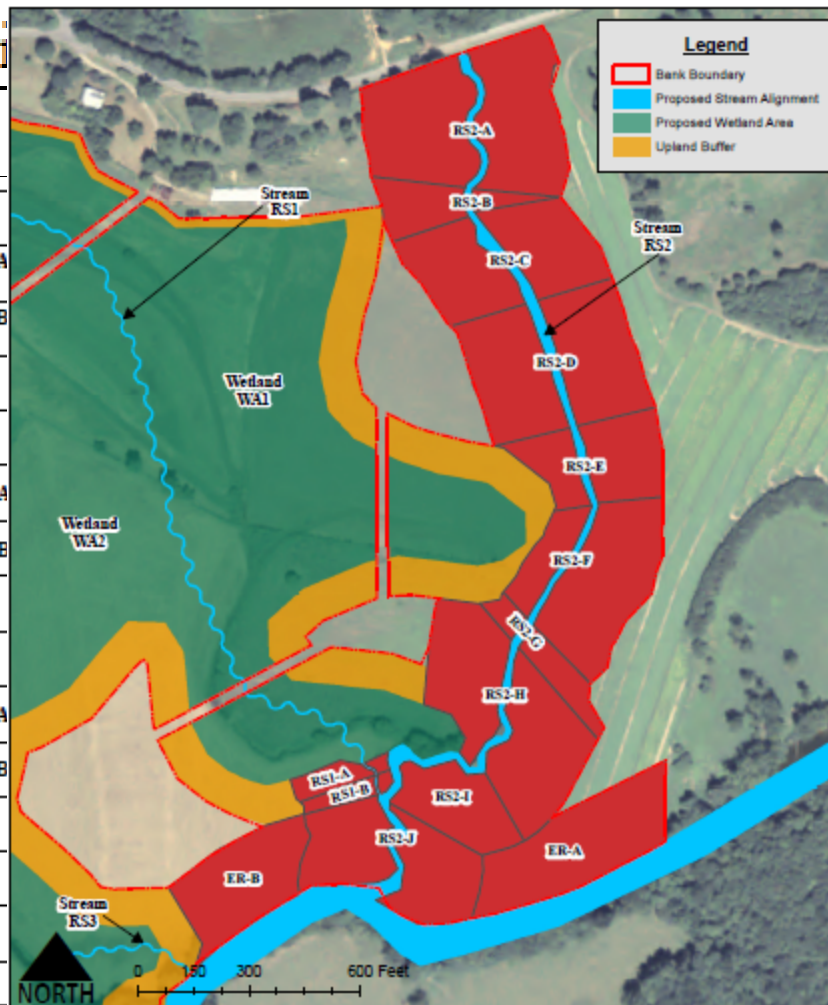


Table 35. Riparian

| FACTOR | |
|----------------------------|--------------------|
| NET BENEFIT | STREAM SIDE A (RB) |
| | STREAM SIDE B (LB) |
| SYSTEM CREDIT CONDITION 1 | |
| SYSTEM CREDIT CONDITION 2 | |
| MONITORING AND CONTINGENCY | STREAM SIDE A |
| | STREAM SIDE B |
| PRIORITY AREA | |
| CONTROL | |
| MITIGATION TIMING | STREAM SIDE A |
| | STREAM SIDE B |
| SUM OF FACTORS M | |
| FEET OF STREAM IN REACH | |
| M X LF = | |
| TOTAL RIPARIAN CREDITS = | 18,979.0 |



RISHEET

| RS2-F | RS2-G | RS2-H | RS2-I |
|--------|-------|--------|--------|
| 0.30 | 1.00 | 2.00 | 0.00 |
| 2.00 | 2.00 | 2.00 | 2.00 |
| 1.15 | 1.50 | 2.00 | 0.00 |
| 0.10 | 0.10 | 0.10 | 0.00 |
| 0.30 | 0.30 | 0.30 | 0.30 |
| 0.30 | 0.30 | 0.30 | 0.30 |
| 0.05 | 0.05 | 0.05 | 0.05 |
| 0.30 | 0.30 | 0.30 | 0.30 |
| 0.05 | 0.05 | 0.05 | 0.05 |
| 0.05 | 0.05 | 0.05 | 0.05 |
| 4.60 | 5.65 | 7.15 | 3.05 |
| 371.0 | 75.0 | 391.0 | 418.0 |
| 1706.6 | 423.8 | 2795.7 | 1274.9 |

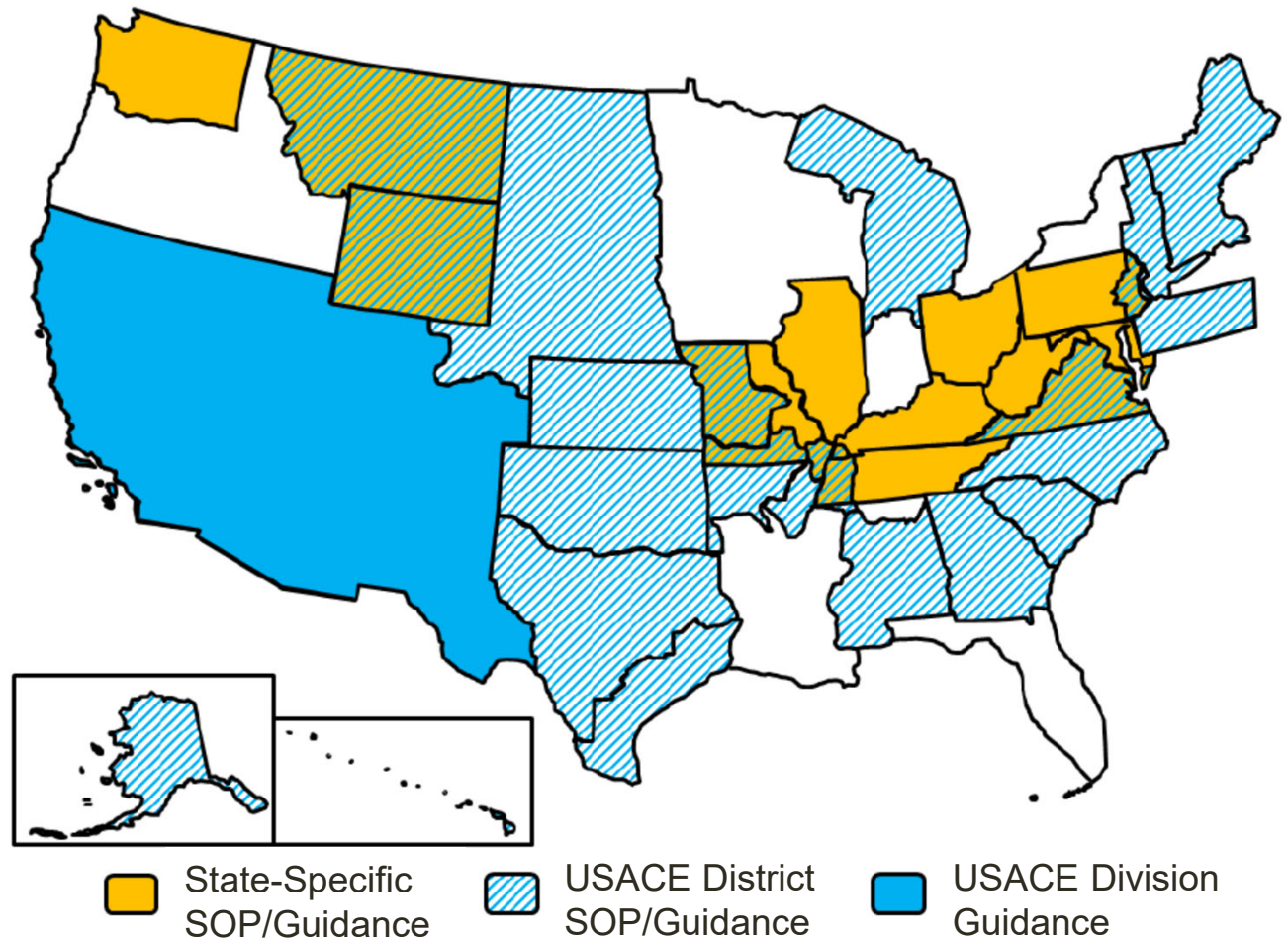
APPROACHES

Explain some of the common approaches

Highlight some unique aspects

Additional approaches now available

Figure 1: Areas of Coverage for SOPs or Guidance Documents for Stream Mitigation



Environmental Law Institute 2016
<https://www.eli.org/compensatory-mitigation/state-stream-compensatory-mitigation-science-policy-and-practice>

CREDIT DETERMINATION EXAMPLES

- Credit/Debit Tables - Wyoming
- Credit/Debit Tables with field assessments - New England, West Virginia, California
- Stand Alone Assessments for streams – Texas, Georgia



WYOMING STREAM MITIGATION PROCEDURE 2013 (WYSMP)

Traditional ratio calculator

- Sum of factors X Linear Feet = Credits (or Debits)
- Some factors used on both debits and credits
 - Stream Classification
 - Special Resources

Builds on the State's existing programs

- Stream Classification
- Existing Condition
- Special Resources

Assessment of Existing Condition, Net Stream Improvement and Net Riparian Improvement a set of qualitative categories with options:

- Proper Functioning Condition (BLM, USFS, NRCS)
- Stream Visual Assessment Protocol 2 (NRCS)
- Function-Based Framework for Stream Assessment and Restoration Projects (EPA, FWS)

Credit/Debit tables with out / with rapid assessments



United States Army Corps of Engineers
Omaha District
Wyoming Regulatory Office

WYOMING STREAM MITIGATION PROCEDURE (WSMP)



- February 2013 -

WYSMP: CREDITS TABLE

Table 3. Mitigation Measures (Credits)

| FACTORS | MULTIPLIERS | | | | | | | |
|--------------------------------------|---|-----|------------------------------|--------------------------|------------------------|---------------------------|---------------------------------|--------------------|
| Stream Classification (Pg 8) | Class 4 | | Class 3 | | Class 2 | | | Class 1 |
| | B | A | D | C or B | D | C | A, AB or B | |
| | 0.1 | 0.2 | 0.6 | 0.8 | 1.1 | 1.3 | 1.5 | 2.0 |
| Special Resources (Pg 8) | Red Ribbon 0.6 | | Conservation 1.0 | | Blue Ribbon 1.0 | | Wild & Scenic 1.5 | T&E Species 2.0 |
| Riparian Buffer (Pg 11) | Total Width of Riparian Buffers ÷ 1000 (+ 0.3 for both sides) | | | | | | | |
| Net Riparian Improvement (Pg 11) | Minimal 0.2 | | Moderate 0.7 | | | | Substantial 2.5 | |
| Net Stream Improvement (Pg 11) | Minimal 1.5 | | Moderate 3.5 | | | | Substantial 5.0 | |
| Type of Protection (Pg 12) | Deed Restriction 0.5 | | Permittee Easement 1.0 | | Agency Owned 1.0 | | Conservation Easement 3.0 | Fee Title 5.0 |
| Timing (Pg 12) | Schedule 3 -1.5 | | | Schedule 2 0.0 | | | Schedule 1 4.0 | |
| Location (Pg 13) | Outside watershed -1.0 | | | Off-Site HUC 8 0.0 | | Off-Site HUC 10 0.2 | | On-Site 0.4 |
| Watershed Approach (Pg 13) | 1.5 | | | | | | | |

NEW ENGLAND DISTRICT 2016

Thorough description of mitigation program, terms and policies

- Temporal loss
- Compensatory mitigation for temporary and secondary impacts

Appendix F: Stream Module

- Mitigation Type and Goals examples
- Stream specific site selection
- Review Checklist

Stream Visual Assessment Protocol Version 2 (SVAP2, NRCS)

- 16 elements
 - Not all assessed on all sites
 - Scored on 0-10 scale
 - Average value of elements assessed
- Descriptions and illustrations

(a) Cold-water streams

| >75% of water surface shaded within the length of the stream in landowner's property | 75–50% of water surface shaded within the length of the stream in landowner's property | 49–20% of water surface shaded within the length of the stream in landowner's property | <20% of water surface shaded within the length of the stream in landowner's property |
|--|--|--|--|
| 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |

WEST VIRGINIA STREAM AND WETLAND VALUATION METRIC 2015 (SWVM)

Ratio calculator

- Range of elements
- Minimal explanation / documentation
- Uses existing assessment methods and recognized reference conditions

Spreadsheet driven calculator

- Impacts
- Mitigation existing condition
- Mitigation at 5 years
- Mitigation at 10 years
- Mitigation at maturity

Physical indicators

- Component Rapid Biological Protocols (RBP) scores or HGM for Streams scores
- Uses existing protocols with supporting documentation and trainings

Chemical indicators

- Specific conductivity, pH, and Dissolved Oxygen (DO)
- Collected for ephemerals during or shortly after rain, or immediately downstream

Biological indicator

- WV DEP Stream Condition Index (macroinvertebrates)
- Not used for ephemeral streams

IMPACTS & MITIGATION

| | | | |
|--|-------------|--------------|------------|
| Stream Classification: | | Intermittent | |
| Percent Stream Channel Slope | | 5 | |
| HGM Score (attach data forms): | | | |
| | | Average | |
| Hydrology | 0.8 | 0.833333333 | |
| Biogeochemical Cycling | 0.9 | | |
| Habitat | 0.8 | | |
| PART I - Physical, Chemical and Biological Indicators | | | |
| | Point Score | 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 | 18 |
| 2. Embeddedness | 0-20 | | 18 |
| 3. Velocity/ Depth Regime | 0-20 | | 18 |
| 4. Sediment Deposition | 0-20 | | 18 |
| 5. Channel Flow Status | 0-20 | | 18 |
| 6. Channel Alteration | 0-20 | | 18 |
| 7. Frequency of Riffles (or bends) | 0-20 | | 18 |
| 8. Bank Stability (LB & RB) | 0-20 | | 18 |
| 9. Vegetative Protection (LB & RB) | 0-20 | | 18 |
| 10. Riparian Vegetative Zone Width (LB & RB) | 0-20 | | 18 |
| Total RBP Score | Optimal | | 180 |
| Sub-Total | | 0.9 | |
| CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams) | | | |

| CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams) | | | |
|--|-------|-----|-------|
| WVDEP Water Quality Indicators (General) | | | |
| Specific Conductivity | | 0-1 | |
| 100-199 = 85 points | 0-90 | | 125 |
| pH | | | |
| 6.0-8.0 = 80 points | 5-90 | | 6.3 |
| DO | | | |
| >5.0 = 30 points | 10-30 | | 8 |
| Sub-Total | | | 0.975 |
| BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams) | | | |
| WV Stream Condition Index (WVSCI) | | | |
| Very Good | 0-100 | 0-1 | 82 |
| Sub-Total | | | 0.82 |

MITIGATION AT: - 10 YEARS
 - EXISTING - MATURITY
 - 5 YEARS

| | | |
|--------------------------------|-------------|-------------|
| PART II - Index and Unit Score | | |
| Index | Linear Feet | Unit Score |
| 0.865833333 | 650 | 562.7916667 |

PART V- Comparison of U

| | | | |
|---|-------------|---|-------------|
| Final Unit Score (Debit) [No Net Loss Value] | 38.20833333 | Mitigation Existing Condition – Baseline (Credit) | 562.7916667 |
|---|-------------|---|-------------|

FINAL PROJECTED NET BALANCE

Part VI - Mitigation C

Extent of Stream Restoration
*Note1: Reference the instructional handout to determine the correct Restoration Levels (below) for your project
*Note2: Place an "X" in the appropriate category (only select one).

| | |
|--|--|
| <input type="checkbox"/> Restoration Level 1 | |
| <input type="checkbox"/> Restoration Level 2 | |
| <input type="checkbox"/> Restoration Level 3 | |

Compensatory Mitigation Plan incorporates HUC 12-based watershed approach? (Yes or No)
*Note: HUC 12-based watershed approach required to obtain Stream Restoration incentive

No

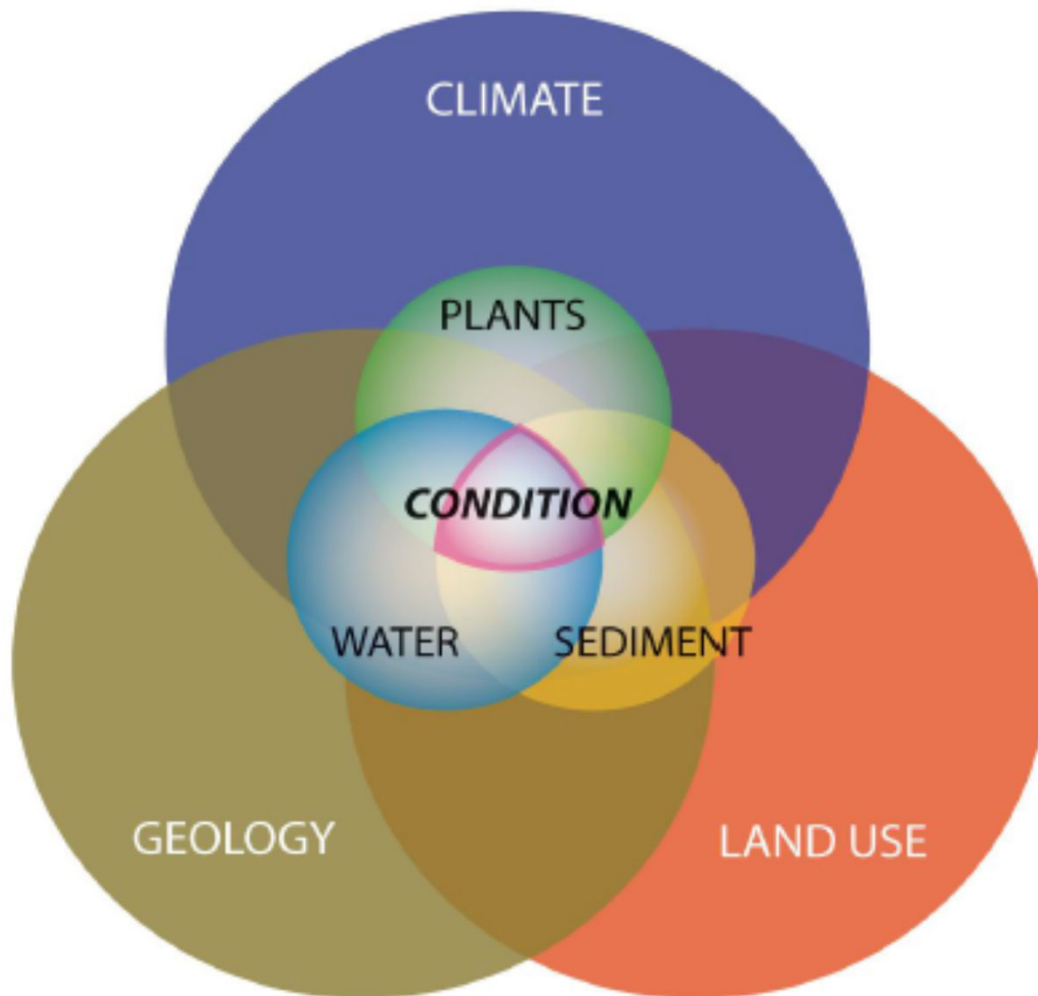
| | | | | | |
|---|-------------|---|-------------|--|-----------|
| Mitigation Projected at Five Years Post Completion (Credit) | 562.7916667 | Mitigation Projected at Ten Years Post Completion (Credit) | 562.7916667 | Mitigation Projected At Maturity (Credit) | 562.79167 |
| | 0 | | 0 | | 0 |

Considerations (Incentives)

| | | |
|--|------------|--|
| Extended Upland Buffer Zone *Note ¹ : Reference instructional handout for the definitions of the Buffer Zone Mitigation Extents and Types (below) *Note ² : Enter the buffer width for each channel side (Left Bank and Right Bank) *Note ³ : Select the appropriate mitigation type | | |
| Buffer Width | Left Bank | |
| 150 | 0-50 | Preservation and Supplemental Planting |
| | 51-150 | Preservation |
| Buffer Width | Right Bank | |
| 150 | 0-50 | Preservation and Supplemental Planting |
| | 51-150 | Preservation |

(SWVM)

CALIFORNIA RAPID ASSESSMENT METHOD FOR WETLANDS (CRAM) RIVERINE MODULE



Condition assessment

Regional and site scale influences

Overall value based on diversity and level of services

- Favors larger more structurally complex systems

Scoring represents the percent of best available condition as defined by statewide ambient surveys

CRAM: PROCEDURE

Step 1: Assemble background information

Step 2: Classify wetland

- Riverine – confined / nonconfined

Step 3: Verify the appropriate season

- vegetation growing season

Step 4: Sketch the CRAM Assessment Area (AA)

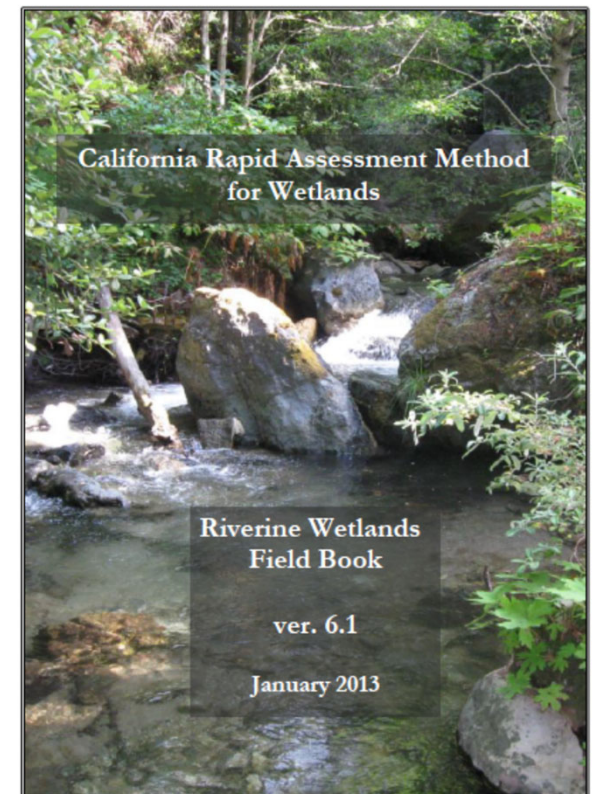
- channel, active floodplain and essential riparian area
- 10X mean Bankfull

Step 5: Conduct the office assessment of AA

Step 6: Conduct the field assessment of AA

Step 7: Complete CRAM QA/QC

Step 8: Submit assessment results using eCRAM



CRAM: ASSESSMENT

Buffer and Landscape Context

- Stream corridor continuity
- Percent with buffer
- Average buffer width
- Buffer condition

Hydrology

- Water source
- Channel stability
- Hydrologic connectivity

Physical Structure

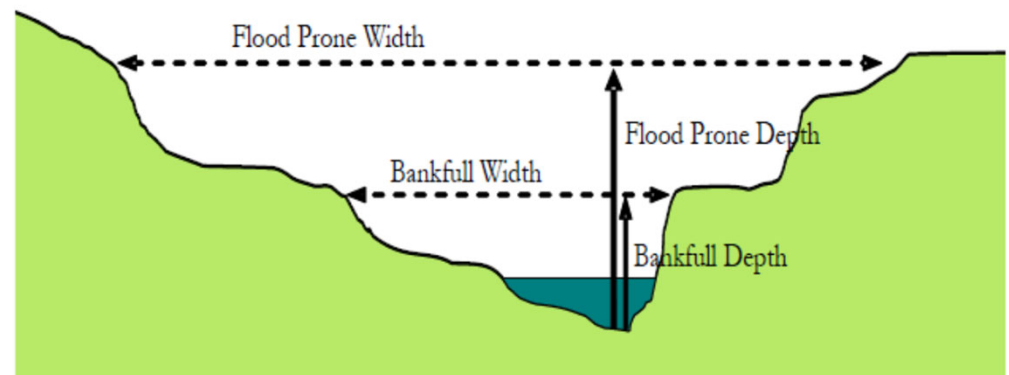
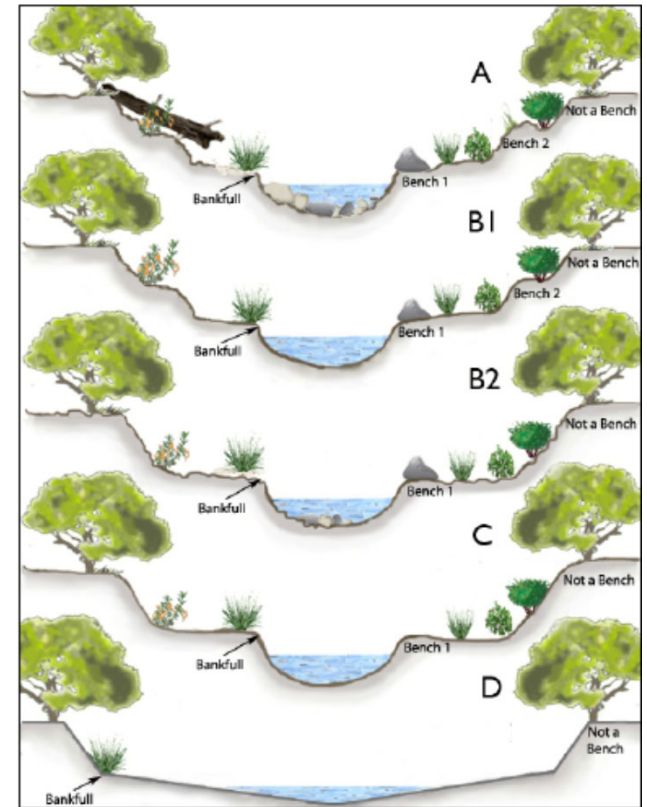
- Structural patch richness
- Topographic complexity

Biotic Structure

- Number of plant layers
- Number of co-dominant species
- Percent invasion
- Horizontal interspersation
- Vertical interspersation

Stressor Checklist

- To inform more effective responses



Credit/Debit tables with out / with rapid assessments

SOUTH PACIFIC DIVISION (SPD): STANDARD OPERATING PROCEDURE FOR DETERMINATION OF MITIGATION RATIOS 2013



Division wide SOP

Does not endorse one assessment method

Provides structure when assessing debits and credits in the absence of a function or conditional assessment method

Ratio adjustments

- Site location
- Net loss of aquatic resource area
- Type conversion
- Risk and uncertainty
- Temporal loss
- Minimum ratio 1:1 (unless functional/conditional assessment used)

| | | |
|--|---|--|
|  US Army Corps of Engineers | 12501-SPD REGULATORY PROGRAM STANDARD OPERATING PROCEDURE FOR DETERMINATION OF MITIGATION RATIOS |  South Pacific Division |
| <p>Table of Contents</p> <ul style="list-style-type: none">1.0 Purpose2.0 Applicability3.0 References4.0 Related Procedures5.0 Definitions6.0 Responsibilities7.0 Procedures8.0 Records & Measurements9.0 Attachments10.0 Flow Chart <hr/> <p>1.0 Purpose. The purpose of this document is to outline the process for determining compensatory mitigation requirements as required for processing of Department of the Army (DA) permits under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, and Section 103 of the Marine Protection, Research, and Sanctuaries Act. .</p> <p>2.0 Applicability. This process applies to the Regulatory Program within South Pacific Division (SPD), including its four subordinate districts, Albuquerque District (SPA), Sacramento District (SPK), Los Angeles District (SPL), and San Francisco District (SPN). Subordinate offices or organizations shall not modify this procedure to form a specific procedure. This procedure is applicable for all "new" (not requests to re-verify or modify previously-issued permits) permit applications received after 20 April 2011. For NWP's re-verification requests where the mitigation ratio checklist was not completed previously, use of the checklist is required in order to ensure minimal impacts (including consideration of compensatory mitigation), to ensure compliance with the 2008 Mitigation Rule (33 CFR Part 332), and to comply with this new QMS procedure designed to ensure compensatory mitigation is sufficient to offset authorized impacts. For individual permits (SIP and LOP), if the original application predates this QMS procedure (effective 20 April 2011), the checklist would not be required for subsequent modification requests (time extension or activity modifications), unless the requested</p> <p><i>Current Approved Version: 10/21/2013. Printed copies are for "Information Only." The controlled version resides on the SPD QMS SharePoint Portal.</i></p> <p>SPD QMS 12501-SPD Regulatory Program - Determining Mitigation Ratios 1 of 8</p> | | |

TXRAM

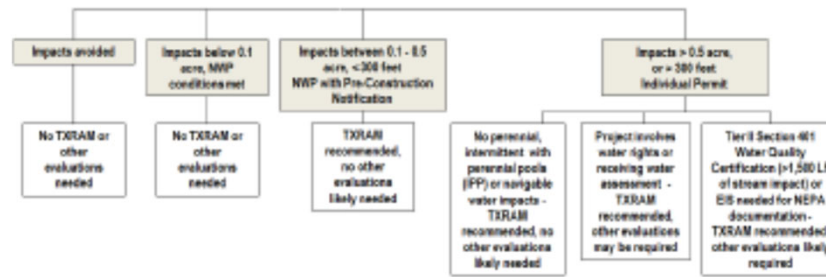


Figure 13. Flow chart for other technical evaluations



Developed for:

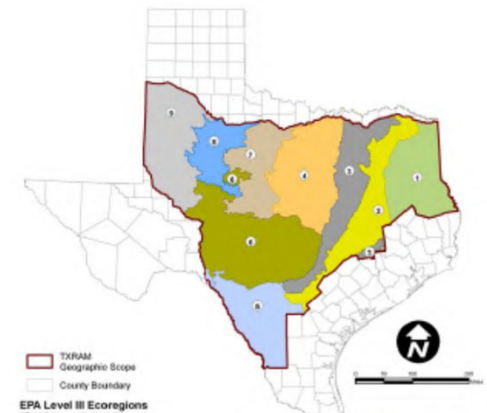
- Fort Worth District
- Streams and Wetlands
- Perennial, Intermittent and Ephemeral Streams
- Use comparing credits and debits within ecoregion and resource type

Discussions of:

- Laying out the assessment area
- When TXRAM needs to be used based on project size etc
- Condition verse Function and when more detailed analysis may be needed



Figure 3. Example of a bed and banks that contain a wetland with minor braided channels where the area functions primarily as a wetland and is assessed using the wetland module.



Georgia Interim Stream
Quantification Tool –
User Manual

SAVANNAH DISTRICT SOP: GEORGIA STREAM QUANTIFICATION TOOL (GA SQT)

2018 Implementation and Testing Period

3 Functional Categories

- Hydraulics
- Geomorphology
- Biology

Biology is optional, but max score only available with it

Equal weighting at all levels

- Metric
- Parameter
- Category



Version 1.0 (dated April 27, 2018)

Used to:

- Determine credits
- As performance standards

Additional metrics will be required and must be met before credit releases occur

| Site Information and Performance Standard Stratification | |
|--|--|
| Project Name: | |
| Reach ID: | |
| Mitigation Potential: | |
| Existing Stream Type: | |
| Proposed Stream Type: | |
| Region: | |
| County: | |
| Coordinates: | |
| Drainage Area (sqmi): | |
| Proposed Bed Material: | |
| Existing Stream Length (ft): | |
| Proposed Stream Length (ft): | |
| Stream Slope (%): | |
| Flow Type: | |
| Service Area: | |
| Stream Temperature: | |
| Date of Data Collection: | |
| Valley Type: | |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |

| FUNCTIONAL CHANGE SUMMARY | |
|--|---|
| Existing Condition Score (ECS) | |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Percent Condition Change | |
| Existing Stream Length (ft) | 0 |
| Proposed Stream Length (ft) | 0 |
| Additional Stream Length (ft) | 0 |
| Existing Functional Foot Score (FFS) | |
| Proposed Functional Foot Score (FFS) | |
| Proposed FFS - Existing FFS | |
| Functional Change (%) | |
| Total Number of Potential Stream Credits | |

WARNING: Sufficient data are not provided.

| FUNCTION BASED PARAMETERS SUMMARY | | | |
|-----------------------------------|---------------------------|--------------------|--------------------|
| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
| Hydraulics | Floodplain Connectivity | | |
| Geomorphology | Riparian Vegetation | | |
| | Bed Form Characterization | | |
| Biology | Macros | | |

| FUNCTIONAL CATEGORY REPORT CARD | | | |
|---------------------------------|-----|-----|-------------------|
| Functional Category | ECS | PCS | Functional Change |
| Hydraulics | | | |
| Geomorphology | | | |
| Biology | | | |

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|-------------------------------|---------------------------|--|-------------|-------------|-----------------|----------|----------|---------|---------|
| Functional Category | Function-Based Parameters | Assessment Metrics | Field Value | Index Value | Parameter | Category | Category | Overall | Overall |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio Entrenchment Ratio | | | | | | | |
| Geomorphology | Riparian Vegetation | Left Buffer Width (ft) Right Buffer Width (ft) | | | | | | | |
| | Bed Form Characterization | Pool Spacing Ratio Percent Riffle LWD Index | | | | | | | |
| Biology | Macros | Proportion EPT Taxa Richness Proportion Clinger Taxa Richness Proportion Shredder Taxa Richness Proportion Burrower Taxa Richness | | | | | | | |

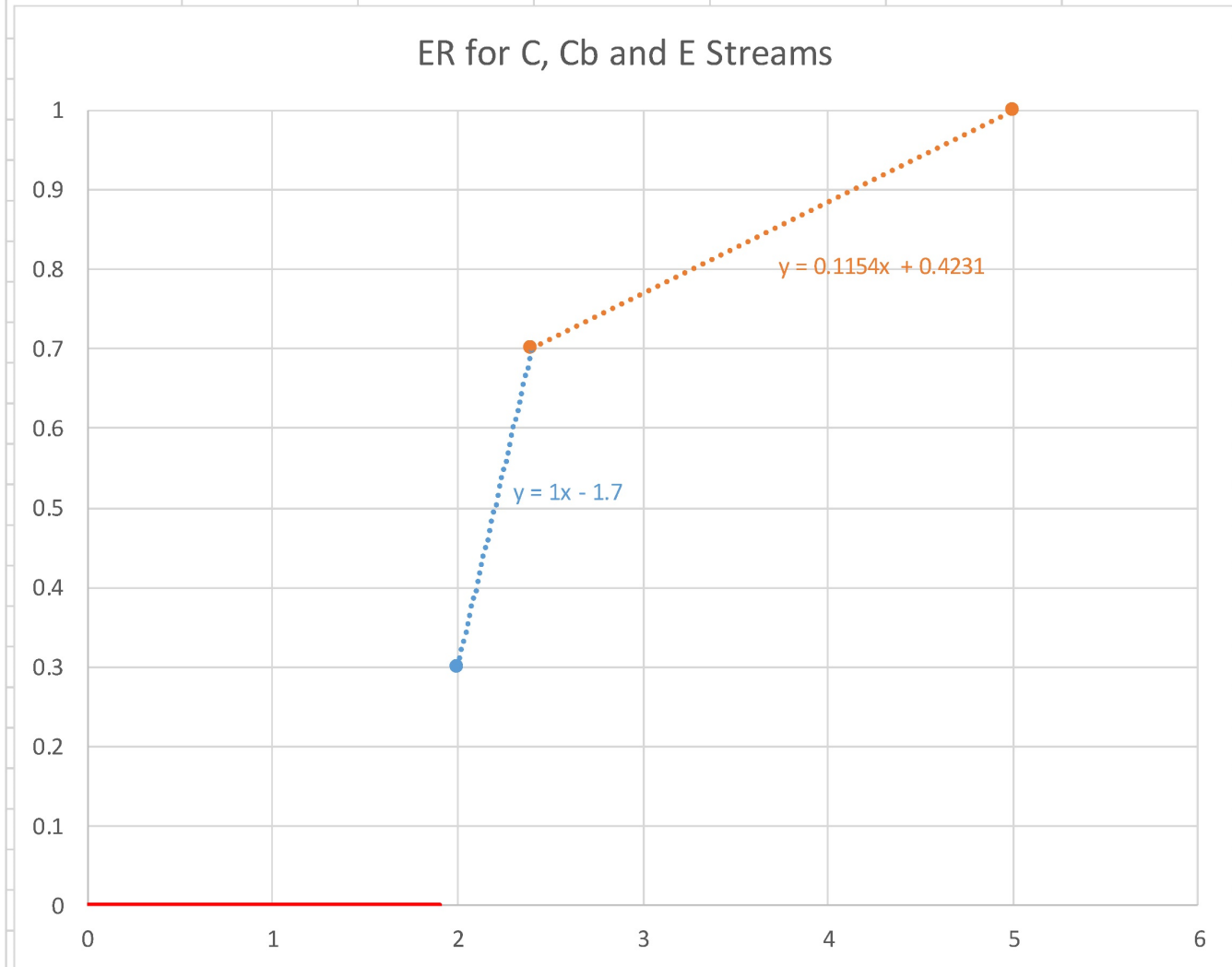
| PROPOSED CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|-------------------------------|---------------------------|--|-------------|-------------|-----------------|----------|----------|---------|---------|
| Functional Category | Function-Based Parameters | Assessment Metrics | Field Value | Index Value | Parameter | Category | Category | Overall | Overall |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio Entrenchment Ratio | | | | | | | |
| Geomorphology | Riparian Vegetation | Left Buffer Width (ft) Right Buffer Width (ft) | | | | | | | |
| | Bed Form Characterization | Pool Spacing Ratio Percent Riffle LWD Index | | | | | | | |
| Biology | Macros | Proportion EPT Taxa Richness Proportion Clinger Taxa Richness Proportion Shredder Taxa Richness Proportion Burrower Taxa Richness | | | | | | | |

Enrichment Ratio (ER) C, Cb and E Streams

| | | | | | | |
|-------------|---|------|-----|------|-----|---|
| Field Value | | | 2 | | 2.4 | 5 |
| Index Value | 0 | 0.29 | 0.3 | 0.69 | 0.7 | 1 |

Coefficients - $Y = a * X + b$

| | | | | | | |
|---|--------|----------|--|--|--|--|
| | F | FAR & NF | | | | |
| a | 0.1154 | 1 | | | | |
| b | 0.4231 | -1.7 | | | | |



SQT COMPONENTS:
PERFORMANCE
CURVES FOR EACH
METRIC

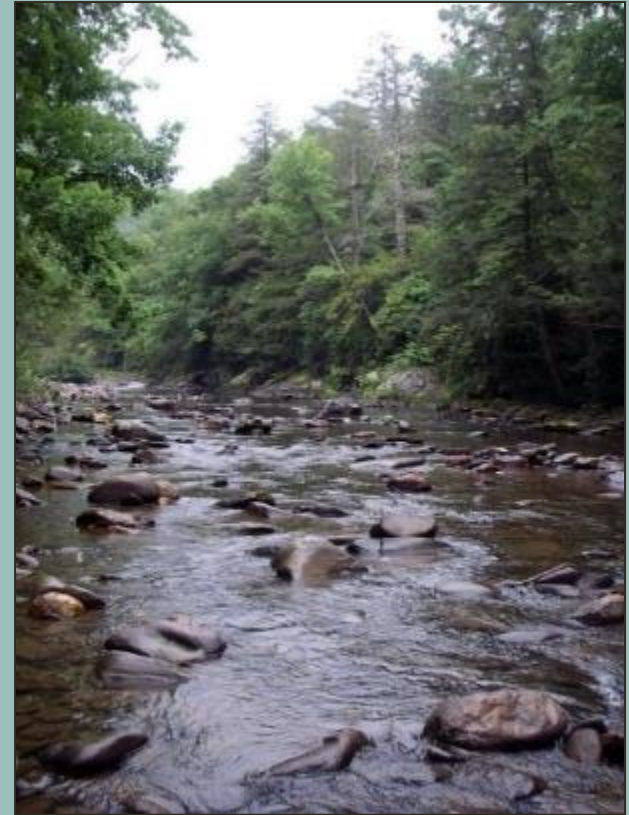
| Functional Category | Function-Based Parameters | Parameter | Category | Category | Overall | Overall |
|---------------------|-------------------------------|-----------|----------|---------------------|---------|---------------------|
| Hydrology | Catchment Hydrology | 0.80 | 0.81 | Functioning | 0.77 | Functioning At Risk |
| | Reach Runoff | 0.62 | | | | |
| | Flow Alteration | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | 0.78 | 0.78 | Functioning | | |
| Geomorphology | Large Woody Debris | | 0.90 | Functioning | | |
| | Lateral Stability | 0.77 | | | | |
| | Riparian Vegetation Structure | 1.00 | | | | |
| | Bed Material Characterization | | | | | |
| | Bed Form Diversity | 0.93 | | | | |
| | Sinuosity | | | | | |
| Physiochemical | Temperature | | 0.33 | Functioning At Risk | | |
| | Nutrients | 0.33 | | | | |
| Biology | Macroinvertebrates | 0.87 | 0.87 | Functioning | | |
| | Fish | | | | | |

| FUNCTIONAL CATEGORY REPORT CARD | | | |
|---------------------------------|------|------|-------------------|
| Functional Category | ECS | PCS | Functional Change |
| Hydrology | 0.66 | 0.68 | 0.02 |
| Hydraulics | 0.00 | 0.70 | 0.70 |
| Geomorphology | 0.14 | 0.75 | 0.61 |
| Physicochemical | 0.11 | 0.17 | 0.06 |
| Biology | 0.21 | 0.32 | 0.11 |

| FUNCTIONAL CHANGE SUMMARY | |
|--|------|
| Existing Condition Score (ECS) | 0.54 |
| Proposed Condition Score (PCS) | 0.84 |
| Change in Functional Condition (PCS - ECS) | 0.30 |
| Existing Stream Length (ft) | 1000 |
| Proposed Stream Length (ft) | 1000 |
| Change in Stream Length (ft) | 0 |
| Existing Functional Foot Score (FF) | 540 |
| Proposed Functional Foot Score (FF) | 840 |
| Proposed FF - Existing FF | 300 |
| Functional Change (%) | 56% |

COMMUNICATING PERFORMANCE

| FUNCTION BASED PARAMETERS SUMMARY | | | | | | | | | |
|-----------------------------------|---------------------------|--------------------|--------------------|----------|---------|------|------|------|------|
| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter | As-Built | Monitor | | | | |
| | | | | | 1 | 3 | 5 | 7 | 10 |
| Hydrology | Catchment Hydrology | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| | Reach Runoff | 0.69 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 |
| Hydraulics | Floodplain Connectivity | 0.10 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Geomorphology | Large Woody Debris | 0.29 | 0.48 | 0.99 | 0.99 | 1.00 | 1.00 | 1.00 | 0.93 |
| | Lateral Stability | 0.20 | 0.67 | 0.75 | 0.52 | 0.32 | 0.85 | 0.85 | 0.85 |
| | Riparian Vegetation | 0.02 | 0.72 | 0.29 | 0.40 | 0.44 | 0.53 | 0.68 | 0.72 |
| | Bed Material | | | | | | | | |
| | Bed Form Diversity | 0.20 | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 |
| | Sinuosity | 0.30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Physicochemical | Temperature | 0.37 | 0.48 | 0.37 | 0.37 | 0.43 | 0.37 | 0.43 | 0.43 |
| | Bacteria | | | | | | | | |
| | Organic Matter | 0.36 | 0.71 | 0.36 | 0.50 | 0.64 | 1.00 | 1.00 | 1.00 |
| | Nitrogen | | | | | | | | |
| | Phosphorus | | | | | | | | |
| Biology | Macros | 0.11 | 0.64 | 0.11 | 0.11 | 0.11 | 0.64 | 0.64 | 0.64 |
| | Fish | 0.00 | 0.36 | 0.00 | 0.00 | 0.28 | 0.23 | 0.49 | 0.49 |



COMMON QUESTIONS AND CHALLENGES

BUFFERS

(i) Buffers. DE may require the restoration, establishment, enhancement, and preservation, and maintenance, of riparian areas and/or buffers around aquatic resources where necessary to ensure the long-term viability of resources.

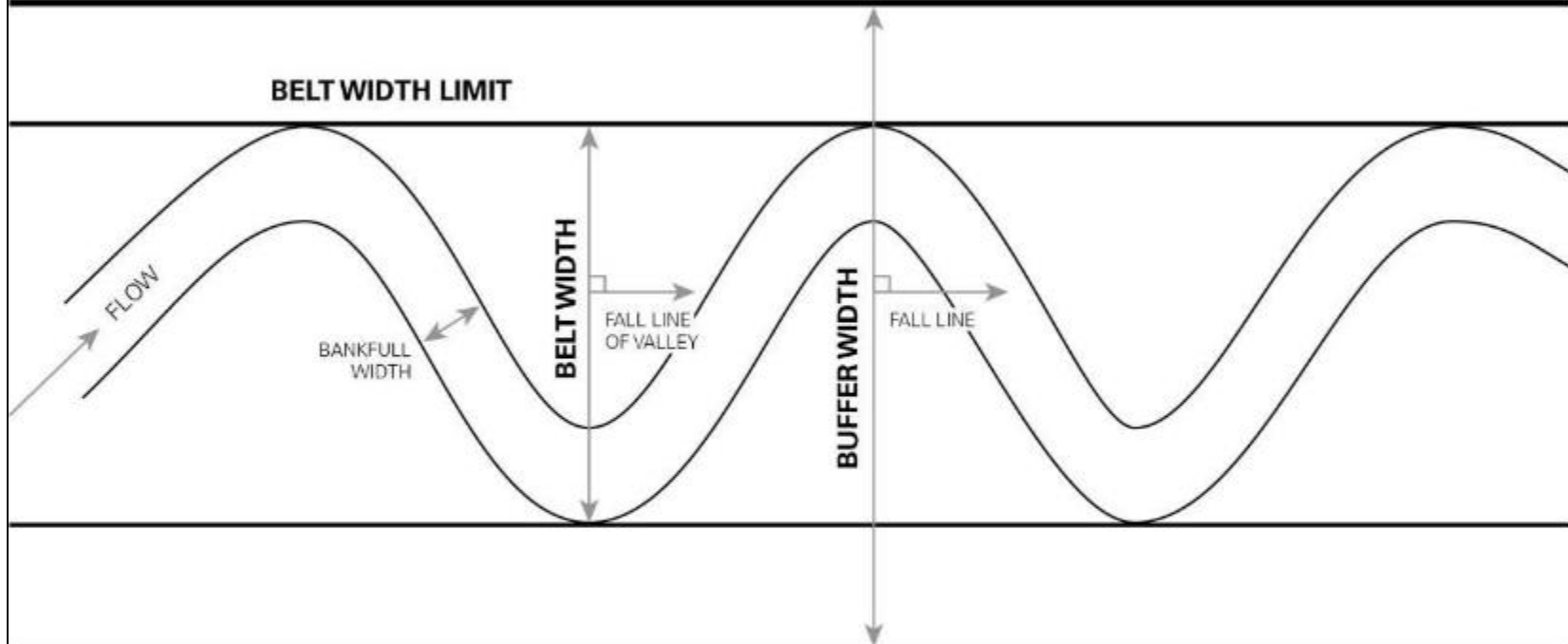
Buffers may provide habitat or corridors necessary for the ecological functioning of aquatic resources. **If buffers are required, mitigation credit will be provided.**

Summarized from §332.3(i)

MEASURING BUFFER WIDTH FROM THE BELT WIDTH

BUFFER WIDTH LIMIT

BELT WIDTH LIMIT



NOTE:

THE BUFFER WIDTH LIMIT IS ESTABLISHED AS A PARALLEL LINE TO THE BELT WIDTH.

THE MINIMUM BELT WIDTH IS 3.5 TIMES THE BANKFULL WIDTH.

THE MINIMUM WIDTH FROM THE BELT WIDTH LIMIT TO THE BUFFER WIDTH LIMIT IS 15 FEET.

GENERAL CONSIDERATION: ACTIONS VS RESULTS

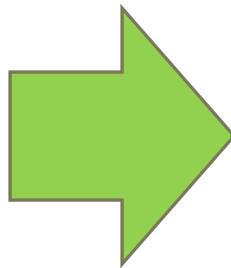
Action Focused

Many SOPs calculate stream restoration credits based on changes to dimension, pattern, and profile.

What is it?

Is it still there?

This is construction certification more than functional improvement.



Results Focused

Credits should be based on improvements to functional capacity.

What Changed?

How Much?

WHAT ABOUT RESTORATION LIKE PROJECTS FOR TMDL CREDITS?

Total Maximum Daily Load (TMDL) – a pollution budget

Municipalities and other permitted entities comply by creating reductions

Stream and wetland restoration practices generate pollutant reductions

Other projects in streams and wetlands enhance the site's ability to reduce specific pollutants

Baltimore District:
Chesapeake Bay TMDL Project RGP

Excludes some waters (e.g. tidal, high quality)

Impact and conversion thresholds and restrictions

Three Application Thresholds:

Type of activity proposed

Total impacts including conversion impacts.

In some cases, the location of the activity proposed in relationship to other resources.

<http://www.nab.usace.army.mil/Missions/Regulatory/Bay-TMDL/>

| Activity | Self-Verification Only | Self-Verification with 90-Day to 6-Month Report & Function-Based Assessment Required | Pre-Construction Notification (PCN) & Permit Application Required | 1-Year Project Monitoring & Function-Based Assessment Required |
|---|------------------------|--|---|--|
| CATEGORY I: | | | | |
| All projects on-site or existing stormwater management facilities | X | | | |
| All projects on-site or existing stormwater management facilities | X | | | |
| All projects on-site or existing stormwater management facilities | X | | | |
| All other projects with total temporary and permanent impacts not to exceed 100 linear feet or 5,000 square feet of disturbed water of the U.S., and 10,000 square feet of riparian habitat | X | | | |
| CATEGORY II: | | | | |
| Projects with total temporary and permanent impacts greater than 5,000 square feet but not exceeding 10,000 square feet of water of the U.S. | | X | | |
| Projects with total temporary and permanent impacts greater than 100 linear feet but not exceeding 500 linear feet of streams, rivers, and other open waters | | X | | |
| Projects with total temporary and permanent impacts not more than 5,000 square feet of riparian habitat | | X | | |
| CATEGORY III: | | | | |
| Projects with total temporary and permanent impacts greater than 10,000 square feet but not exceeding 40,000 square feet of water of the U.S. | | | X | X |
| Projects with total temporary and permanent impacts greater than 500 linear feet but not exceeding 1,000 linear feet of streams, rivers, and other open waters | | | X | X |
| Projects with total temporary and permanent impacts greater than 5,000 square feet but not exceeding 40,000 square feet of riparian habitat | | | X | X |
| Projects that will occur in or adjacent to a proposed or existing Federally authorized out work project | | | X | Dependent upon Project Thresholds |
| Projects that will occur within or within 100 feet of the horizontal boundary of a Federal navigation project | | | X | Dependent upon Project Thresholds |
| Projects that have the potential to result in any historic properties listed, determined to be eligible for listing, or potentially eligible for listing on the National Register of Historic Places, including prehistoric collection properties | | | X | Dependent upon Project Thresholds |
| Projects that may have effects on any Federally listed threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or substantially modify the designated critical habitat of such species | | | X | Dependent upon Project Thresholds |
| The Self-Verification and Construction Report must be provided to the Baltimore District Regulatory Branch within 90 days of project completion. The 90-day | | | | |

COMING SOON

Oregon Stream Mitigation

- Stream Functional Assessment Method Development
- EPA, State and Corps
- Statewide classification system
- Rapid Assessment Method Released
- Translation into debits and credits coming soon



Recommendations for Stream Assessment Coming

- When developing new or reviewing existing methods
- Minimum considerations
- ERDC lead interagency development team

More Stream Quantification Tools

- A few States/IRTs (e.g. CO, TN, NC, MN)
- Builds on the Functional-Framework for Stream Assessment and Restoration (Functional Pyramid)
- Directly links field data to credits and debits and performance standards

RESOURCES

EPA Compensatory Mitigation: <https://www.epa.gov/cwa-404/compensatory-mitigation> Click on “Technical Resources for Stream Mitigation”

- Compendiums of Stream Mitigation Protocols (2004 & 2010)
- A Function-Based Framework for Stream Assessment and Restoration Projects (2012)
- Natural Channel Design Review Checklist (2012)
- Appalachian Stream Mitigation Workshop (2011)

Association of State Wetland Managers (ASWM):
<http://www.aswm.org/wetland-programs/regulation/mitigation/stream-mitigation>

- Report on State Definitions, Jurisdiction and Mitigation Requirements in State Programs for Ephemeral, Intermittent and Perennial Streams in the United States
- Webinar series discussing report topics Fall of 2012 – Summer 2014 (recordings posted)

RESOURCES (CONTINUED)

Environmental Law Institute (ELI): The State of Stream Compensatory Mitigation: Science, Policy, and Practice

<http://www.eli.org/compensatory-mitigation/state-stream-compensatory-mitigation-science-policy-and-practice>

- Assessment of Stream Mitigation Guidelines at the Corps District and State Levels
- Assessment of Stream Mitigation Practice
- A Function-Based Review of Stream Restoration Science
- Stream Mitigation: Science, Policy, and Practice Report

Fish & Wildlife Service:

<https://www.fws.gov/chesapeakebay/stream/protocols.html>

- Stream Restoration Design Review Checklists for Analytical Processes, Natural Channel Design, Regenerative Storm Conveyance, and Valley Restoration approaches
- Monitoring Protocols and Assessment methods

RESOURCES (CONTINUED)

Forest Service - National Stream & Aquatic Ecology Center:

<http://www.fs.fed.us/biology/nsaec/index.html>

- Technical reports, tools and new home of Stream Notes
- Guidance for Stream Restoration and Rehabilitation 2016

EPA National Rivers and Streams Assessment:

<https://www.epa.gov/national-aquatic-resource-surveys/nrsa>

- Assessment protocols used nationally and familiar to most state monitoring programs, data collected every five years

