# Evolution of the SQT

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Ecosystem Planning & Restoration

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# SQT Goals

INCENTIVIZE HIGH QUALITY STREAM RESTORATION

LINK RESTORATION GOALS TO RESTORATION POTENTIAL

IDENTIFY PARAMETERS AND METRICS SENSITIVE TO REACH-SCALE ACTIVITIES

MEASURABLE DIFFERENCE BETWEEN PRE-PROJECT AND POST-PROJECT ACTIVITIES

PARITY BETWEEN DEBITS AND CREDITS

# Timeline

**FEBRUARY 2016**
NC v1 w/ Spreadsheet UM
No debit tool, no data collection manual

**REGULATORY IMPLEMENTATION**
WY & TN (2018)

**ERDC REVIEW**
WSQT vBeta User Manual (2017)
CSQT vBeta Science Document (2019)

**AUGUST 2023**
WSQT v2 imminent
AKns in development
KY & IN are working independently

| Year | Month | State | Version |
|------|-----------|-------|---------|
| 2016 | February | NC | v1 |
| 2016 | December | NC | v2 |
| 2017 | August | WY | Beta |
| 2017 | September | NC | v3 |
| 2018 | April | GA | V1 |
| 2018 | July | WY | v1 |
| 2018 | November | TN | v1 |
| 2019 | May | TN | v1.2 |
| 2019 | April | CO | Beta |
| 2019 | July | MN | v1 |
| 2020 | July | CO | v1 |
| 2020 | October | MN | v2 |
| 2020 | December | MI | v1 |
| 2021 | February | AKint | Beta |
| 2021 | June | AKint | v1 |
| 2021 | June | SC | v1 |
| 2022 | December | SC | v1.1 |
| 2023 | August | WI | Beta |

# February 2016

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

StreamMechanics

**DRAFT**

**Quantification Tool for**

**Stream Restoration Projects in North Carolina**

**Spreadsheet User Manual**

February 2016

Will Harman

Cidney Jones

Stream

| Function-Based Parameters | Metrics |
|---|---|
| Catchment Hydrology | Catchment Assessment |
| Runoff | Impervious Cover (%) |
| Flow Duration | NATHAT-DHRAM |
| Floodplain Connectivity | Bank Height Ratio |
| | Entrenchment Ratio |
| Large Woody Debris | LWD Index |
| Lateral Migration | Erosion Rate (ft/yr) |
| | Dominant BEHI/NBS |
| | Percent Streambank Erosion (%) |
| Riparian Vegetation | Left Canopy Coverage (%) |
| | Right Canopy Coverage (%) |
| | Left Basal Area (sq.ft/acre) |
| | Right Basal Area (sq.ft/acre) |
| | Left Buffer Width (ft) |
| | Right Buffer Width (ft) |
| | Left Density (stems/acre) |
| | Right Density (stems/acre) |
| Bed Material Characterization | % fines (<2mm) |
| Bed Form Diversity | Pool Spacing Ratio |
| | Pool Depth Ratio |
| | Percent Riffle |
| Sinuosity | Plan Form |
| Temperature | Summer Mean Temperature |
| Specific Conductivity | Specific Conductivity (uS/cm at 25°C) |
| Bacteria | Fecal Coliform (Cfu/100 ml) |
| Stream Metabolism | Gross Primary Production |
| Organic Carbon | Leaf Litter Processing Rate |
| | Percent Shredders |
| Nitrogen | Falls Lake Nutrient Tool (mg/L) |
| Phosphorus | Falls Lake Nutrient Tool (mg/L) |
| Macros | Biotic Index |
| | EPT Taxa Present |
| Fish | North Carolina Index of Biotic Integrity |

Data collection instructions & Monitoring (Dec 2016)

Functional Loss Tool (2017)

Rationale/Science Document (2018)

DAM MEMO (2018)

REVIEW CHECKLIST (2020)

IMPROVED WEBSITE THAT COLLECT SQT'S

IMPROVED MANUALS, APPENDICES, FIELD FORMS, WORKBOOKS

# Worksheet Improvements

| FUNCTIONAL CHANGE SUMMARY | PROPOSED | MONITORED |
|---|---|---|
| Existing Condition Score (ECS) | 0.43 | |
| Proposed, Monitored Condition Score (PCS, MCS) | 0.55 | 0.52 |
| Change in Condition (PCS - ECS, MCS - ECS) | 0.12 | 0.09 |
| Categories Assessed | **2** | **2** |
| Percent Condition Change | 28% | 21% |
| Existing Stream Length (ft) | 1300.0 | |
| Proposed Stream Length (ft) | 1300.0 | |
| Additional Stream Length (ft) | 0.0 | |
| Existing Functional Feet (FF) | 559.0 | |
| Proposed, Monitored Functional Feet (FF) | 715.0 | 676.0 |
| **Proposed/Monitored FF - Existing FF ($\Delta$FF)** | **156.0 P3** | **117.0 P3** |
| Percent Change in FF (%) | 28% | 21% |
| Functional Yield ($\Delta$FF/LF) | 12% | 9% |

| Functional Category | Function-based Parameters | Metric | As-Built | | | |
|---|---|---|---|---|---|---|
| **MONITORING CONDITION ASSESSMENT** | | | **Year** | | | |
| | | **Time since as-built (yr)** | As-Built | | | |
| Hydrology | Catchment Hydrology | Land Use Coefficient | | | | |
| | Reach Runoff | Land Use Coefficient | | | | |
| | | Concentrated Flow Point Index | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio (ft/ft) | | | | |
| | | Entrenchment Ratio (ft/ft) | | | | |
| | Bankfull Dynamics | Width/Depth Ratio State (O/E) | | | | |
| Geomorphology | Large Woody Debris | LWD Index | | | | |
| | | LWD Frequency (#/100m) | | | | |
| | Lateral Migration | Dominant BEHI/NBS | | | | |
| | | Percent Streambank Erosion (%) | | | | |
| | | Percent Streambank Armoring (%) | | | | |
| | Riparian Vegetation | Effective Vegetated Riparian Area (%) | | | | |
| | | Canopy Cover (%) | | | | |
| | | Herbaceous Cover (%) | | | | |
| | | Woody Stem Basal Area (m$^2$/ha) | | | | |
| | Bed Form Diversity | Pool Spacing Ratio (ft/ft) | | | | |
| | | Pool Depth Ratio (ft/ft) | | | | |
| | | Percent Riffle (%) | | | | |
| | Bed Material Characterization | Percent Fines (% < 2mm) | | | | |
| | | Percent Fines (% < 6.35mm) | | | | |
| | | Median Particle Size (d50) (mm) | | | | |
| Physicochemical | Temperature | Summer Mean Temperature (°C) | | | | |
| | Nutrients | Benthic Algal Biomass | | | | |
| | | Diatom Phosphorus Index (DPI) (µg/L) | | | | |
| | Organics | Hilsenhoff Biotic Index (HBI) | | | | |
| Biology | Macroinvertebrates | mIBI | | | | |
| | Fish | fIBI | | | | |
| | | Fish Abundance (#/mile) | | | | |

# Reference Curves



Buffer Width - C or E Stream Type

$y = 0.0029x + 0.5714$

$y = 0.000370x^2 - 0.001111x + 0.000000$



BHR

$y = 0.4661x^2 - 2.5551x + 3.0907$
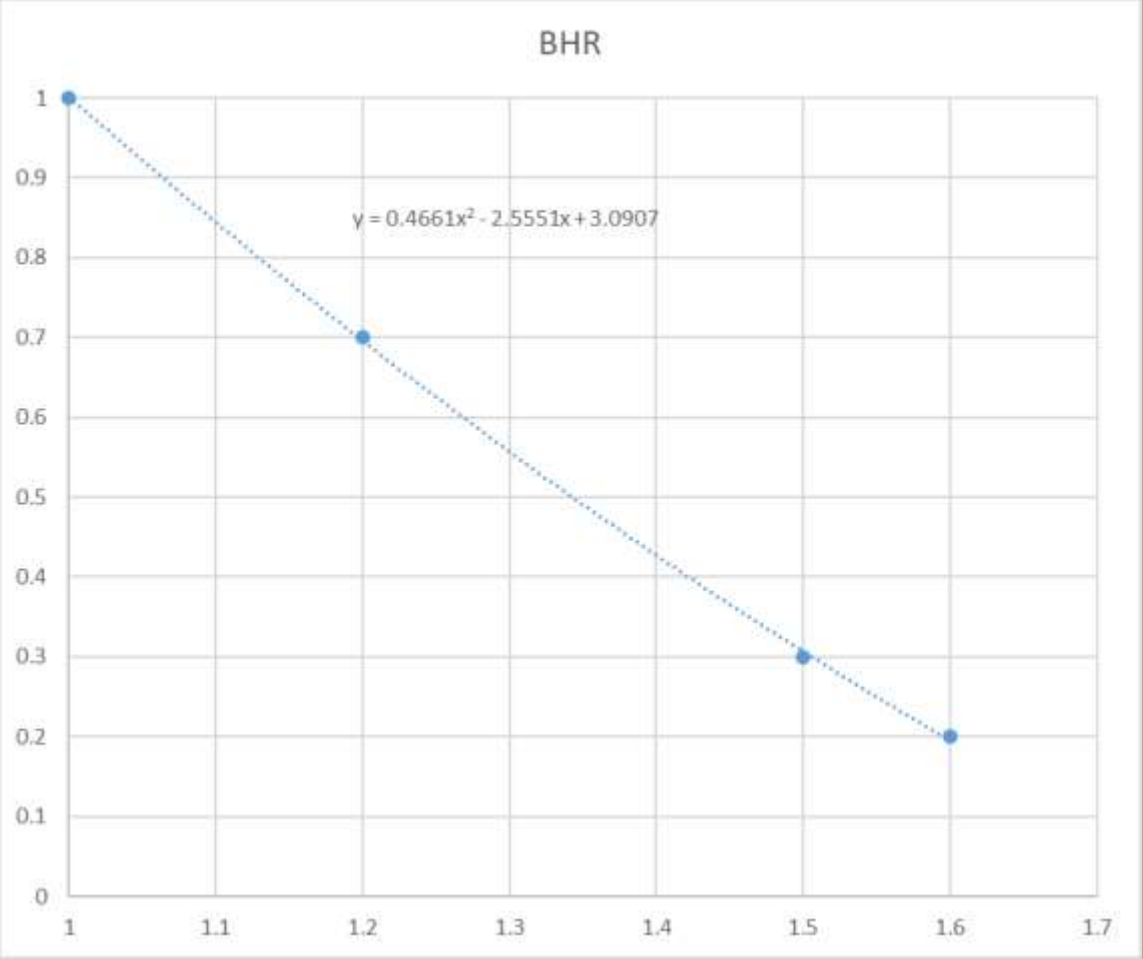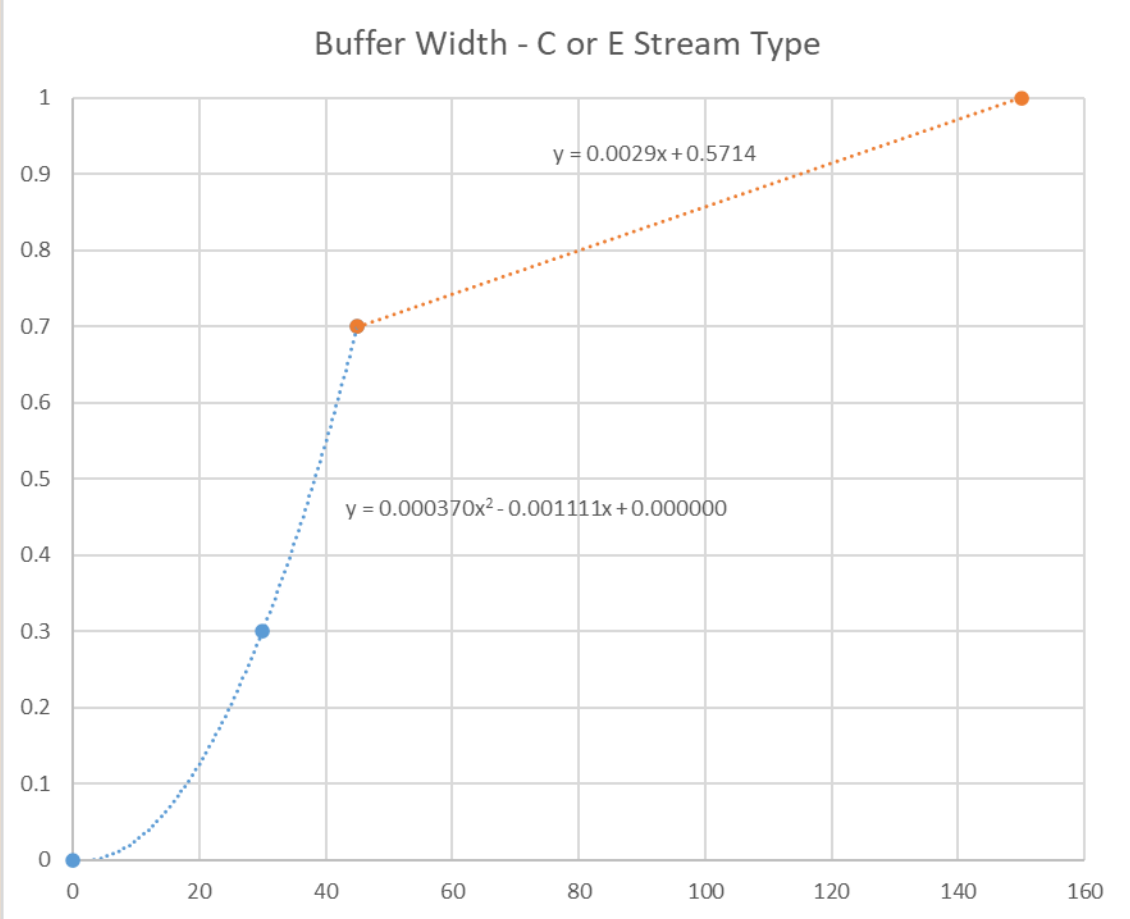
# Public Comments

> 10 commentors for WSQT vBeta (2017)
> 30 commentors for CSQT vBeta (2019)

There were large changes made based on the initial reviews of public notice for the WY and CO SQTs.

Areas for growth remain.

- Step-by-step field methods missing. Are we a data collection method or a collection of methods?

- Application requires a lot of nuanced judgements and expertise necessary.

- Restricted choice of parameters, metrics, and field methods to ensure repeatability. If not possible to remove choices then "use when" approach instead of "optional"

- Sufficient without excessive number of parameters and metrics.

# Are we a data collection method or a collection of methods?

- Desktop analyses
- Survey (rapid or detailed)
- Pebble counts (use when applicable)
- LWD (use when applicable)
- Vegetation
- BEHI/NBS
- BMP modeling (use when applicable)

# Are we a data collection method or a collection of methods?

Use when you think there will be lift (restoration)

Measure or assume functioning is similar to reference condition (impacts)

- Rock scraping (chlorophyll, diatoms)
- Gauges (water level, temperature, DO, turbidity)
- Grab samples (fecal, nutrients)
- Bug collecting
- Fish shocking

# Black Holes of SQT Regionalization

**Riparian Vegetation**     Extent, Structure, Composition

**Stormwater BMPs**     Do these fit in CWA404?

Is the lift provided ecologically relevant?

**Physicochemical Measurements**     Objective, verifiable, repeatable & affordable measures

Quantify:
Extent – Area or Width
Structure – Basal area, density, cover,
Composition – CoC, FQI, Native Cover

Devil in the details:
Differences in natural communities
Sampling methods (plots, LPI)
Strata definitions
Number of plots/transects

# Stormwater BMPs
## Modeling instead of measurements



Polluted Runoff: Nonpoint Source (NPS) Pollution

Spreadsheet Tool for Estimating Pollutant Loads (STEPL)

Minimal Impact Design Standards for enhancing stormwater management in Minnesota

| | | BMP 1 | |
|---|---|---|---|
| | | Field Value | Index Value |
| | | 85 | 0 |
| Temperature | Temperature (°F) | | |
| Specific Conductivity | Specific Conductivity (uS/cm at 25°C) | | |
| | | 3 | 0.13 |
| | | 0.2 | 0.2 |
| | | Field Value | Index Value |
| | | 5 | 0.84 |
| | | | |
| Nitrogen | Falls Lake Nutrient Tool (mg/L) | 1 | 0.59 |
| Phosphorus | Falls Lake Nutrient Tool (mg/L) | 0.1 | 0.66 |
| Results | | | |
| BMP Existing Score | 0.11 | | |
| BMP Proposed Score | 0.70 | | |
| Existing BMP Functional Foot Score | 59.90 | | |
| Proposed BMP Functional Foot Score | 379.34 | | |
| Proposed FFS - Existing FFS | 319.44 | | |

# Concentrated Flow Points (CFPs)



12 CFPs
Reach = 2,500 LF

12/2,500 = 0.0048 CFPs/LF

Field value = 4.8 CFPs/ 1,000 LF
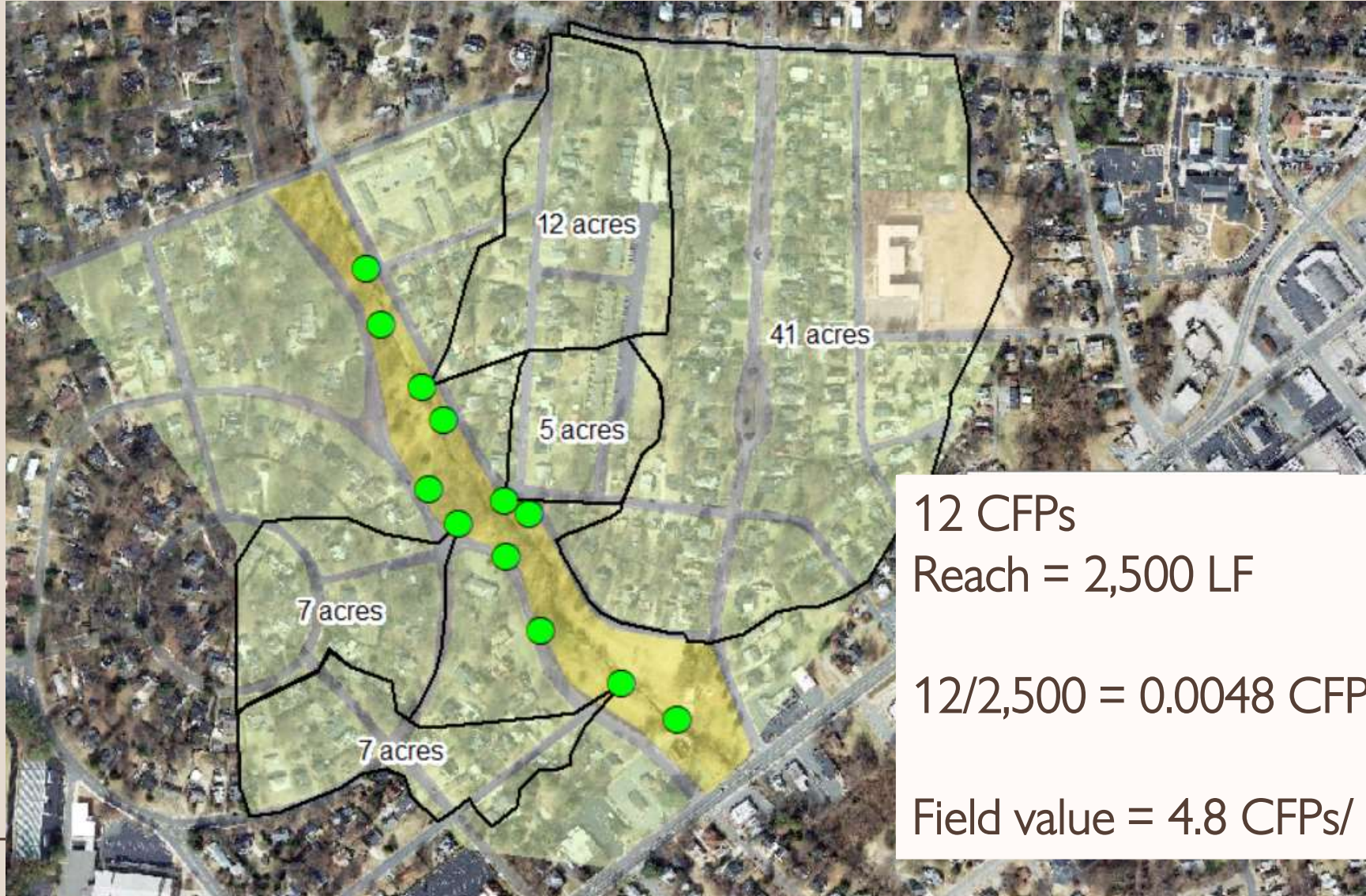
# CFP Index (Wisconsin)



| Concentrated Flow Point Index | | | | | |
|---|---|---|---|---|---|
| **C.** Concentrated Flow Point ID | Stream Side (L/R) | Station ID or Lat/Long | Acres Draining to CFP | CFP Ranking* | CFPI Score |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | **Total CFPI Score** | |
| *Key to CFP Channel Type and Ranking | Pipe or Open Concrete Channel = 1 | | | | |
| | Open Channel with >4% Slope or Impermeable Soils = 0.9 | | | | |
| | Open Channel With <4% Slope and <50% Vegetation Cover = 0.8 | | | | |
| | Open Channel with <4% Slope and 50-90% Vegetation Cover = 0.7 | | | | |
| | Open Channel with <4% Slope and >90% Vegetation Cover = 0.6 | | | | |

# Questions?

PRECISION AND CLARITY IN PURPOSE AND LANGUAGE

BETTER DOCUMENTATION, SPREADSHEETS, GUIDANCE.

PROGRESS TOWARD MINIMUM AND SUFFICIENT, LESS DILUTION.

2016 FOCUS: RESTORATION

BROADENING FOCUS: RESTORATION, MONITORING AND IMPACTS

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