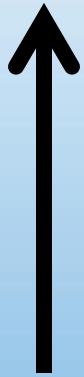# Quantifying Functional Lift From Stream Restoration Activities
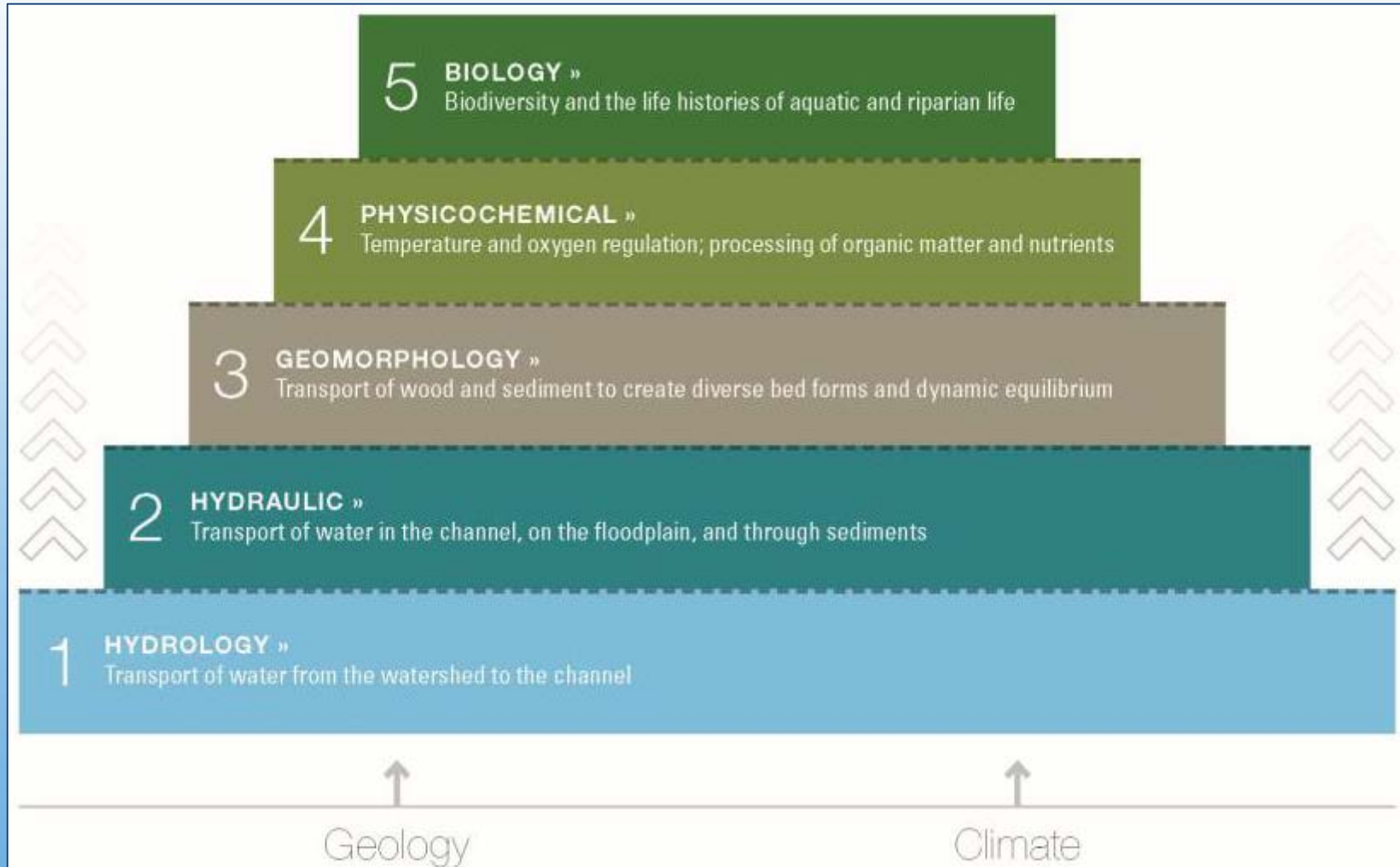
Will Harman, PG

Stream Mechanics
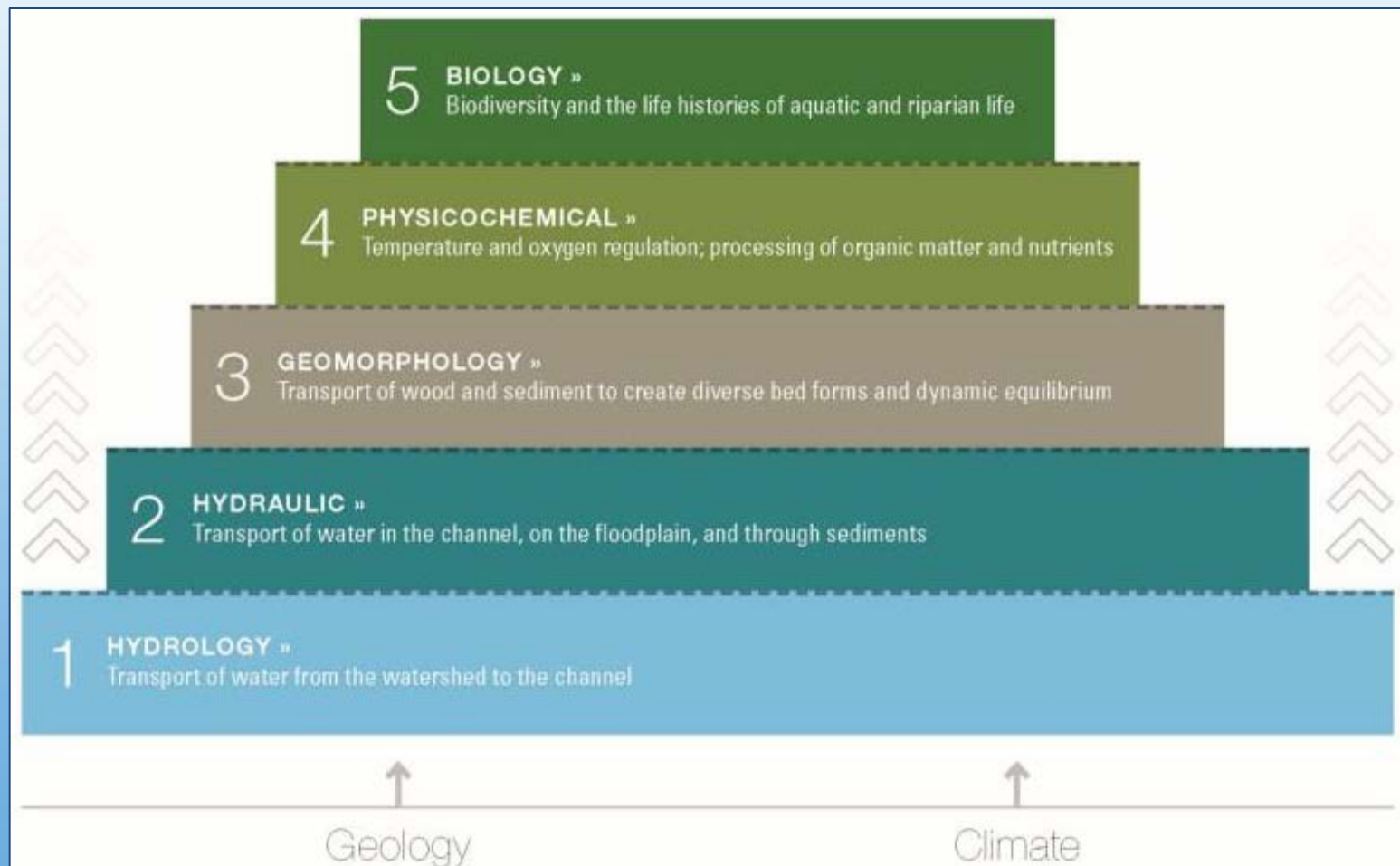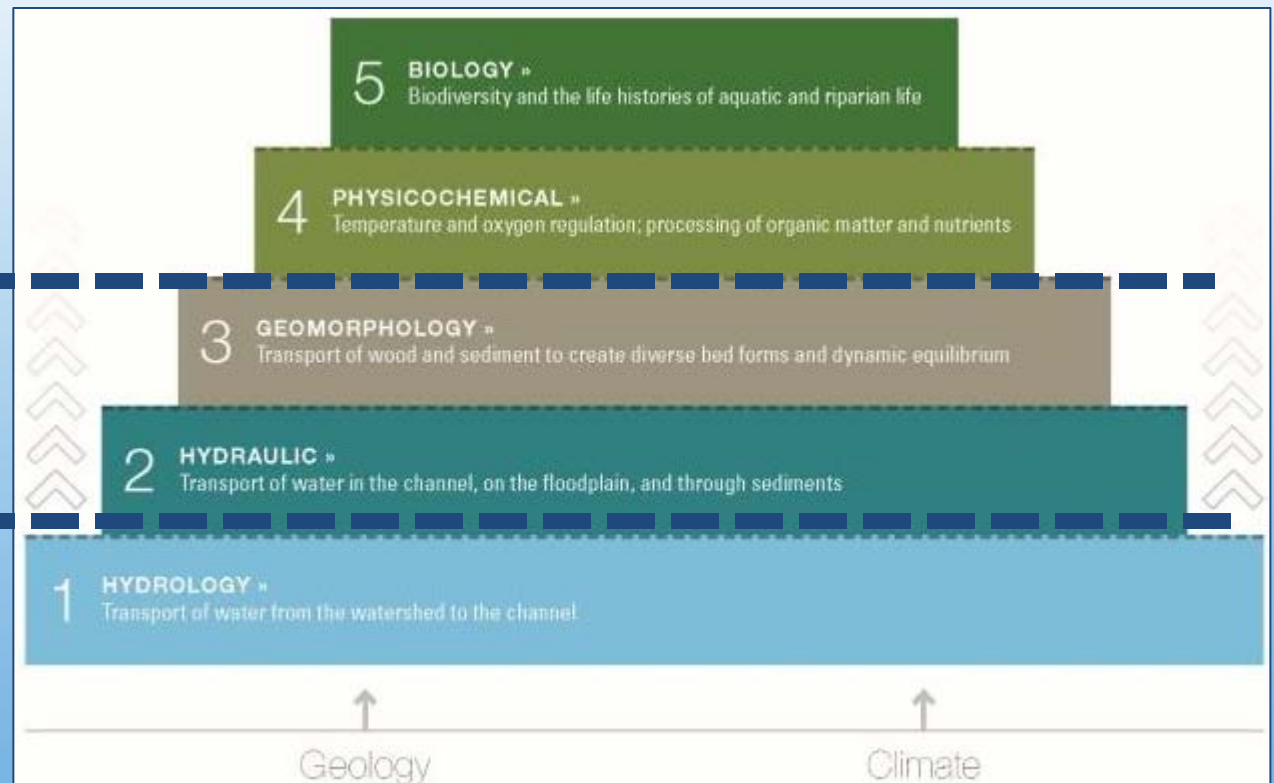
Habitat ≠ Biology

Site Selection & Project Length

Reach Scale Improvements

Generally Independent Variables.

May be altered in headwater streams and large projects.
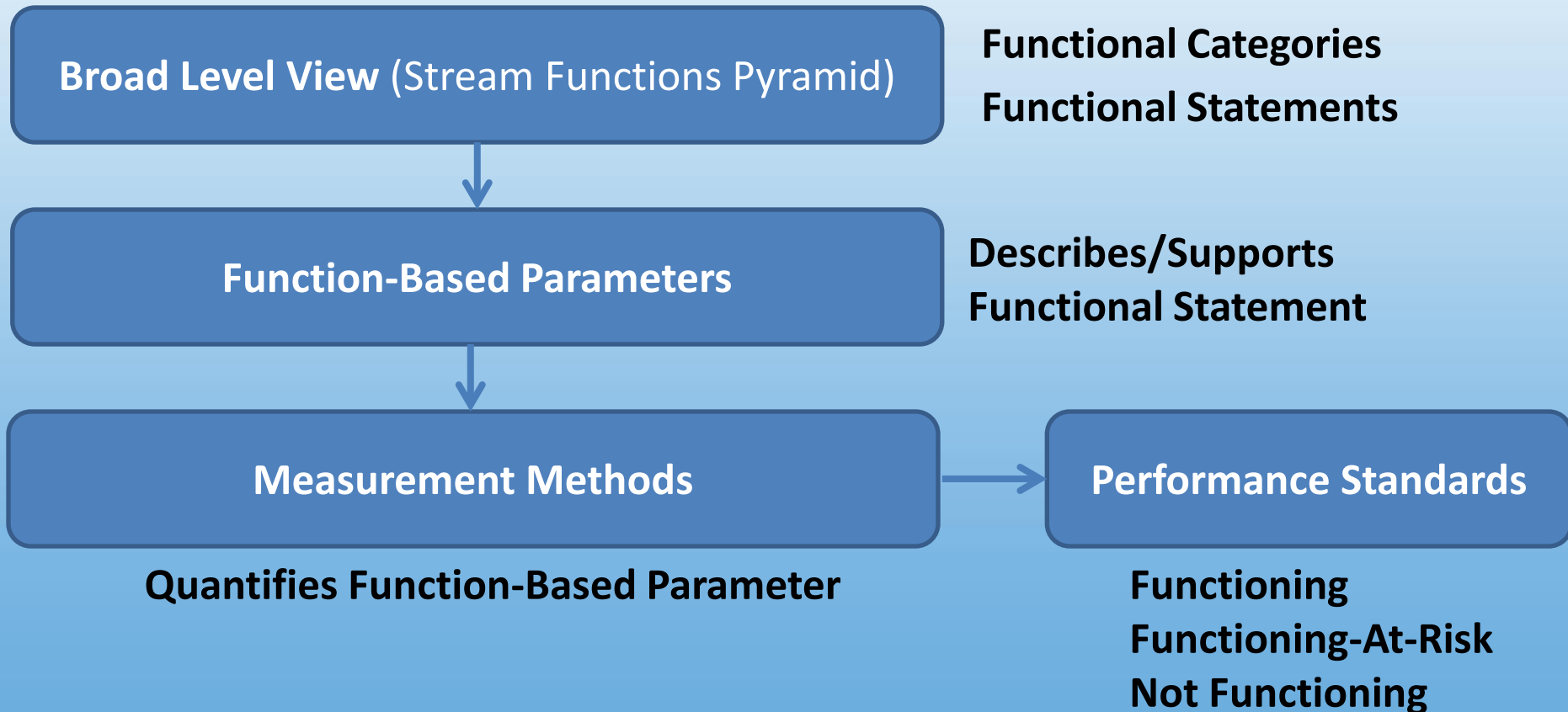
5 BIOLOGY »
Biodiversity and the life histories of aquatic and riparian life

4 PHYSICOCHEMICAL »
Temperature and oxygen regulation; processing of organic matter and nutrients

3 GEOMORPHOLOGY »
Transport of wood and sediment to create diverse bed forms and dynamic equilibrium

2 HYDRAULIC »
Transport of water in the channel, on the floodplain, and through sediments

1 HYDROLOGY »
Transport of water from the watershed to the channel

Geology   Climate

Restoration Potential

Highest level of restoration that can be achieved based on catchment conditions, results of the reach assessment and project constraints.

Restoration Potential Results

Level 5 – Biology

(Aqua...

Level 3 can improve biology, but not back to a reference condition.

Level

(Water Quality)

Level 3 – Geomorphology

(Stability / Habitat)

Excel Workbook
(For One Reach)

Seven Worksheets:

- Restoration Potential and Goals / Objectives
- Catchment Assessment
- Parameter Selection Guide
- Quantification Tool
- Performance Standards
- **Monitoring Data**
- **Monitoring Summary**

StreamMechanics

Restoration Activities

Function-Based Parameters

Functional Lift / Credits

$

Incentivize High Quality and High Lift Restoration

- Minimum Quality Score and then focus on Lift.

- Minimum Quality

    - Floodplain Connectivity

    - Bed form Diversity

    - Lateral Stability

    - Riparian Vegetation

Restoration Activities "Cause"

- Improvements to Physicochemical and Biological Functions

Monitoring "Effect"

Prevents …

Condition Scoring

Not Functioning	Functioning-At-Risk	Functioning
0.0 - 0.29	0.3 – 0.69	0.7 – 1.0

Think Quality

Performance Standards Worksheet

LWD Index Perennial C and E Streams										
Field	0			303				503			
Index	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1

LWD C and E Streams

$y = 2.00776\text{E-}06x^2 + 3.81749\text{E-}04x - 2.22045\text{E-}15$
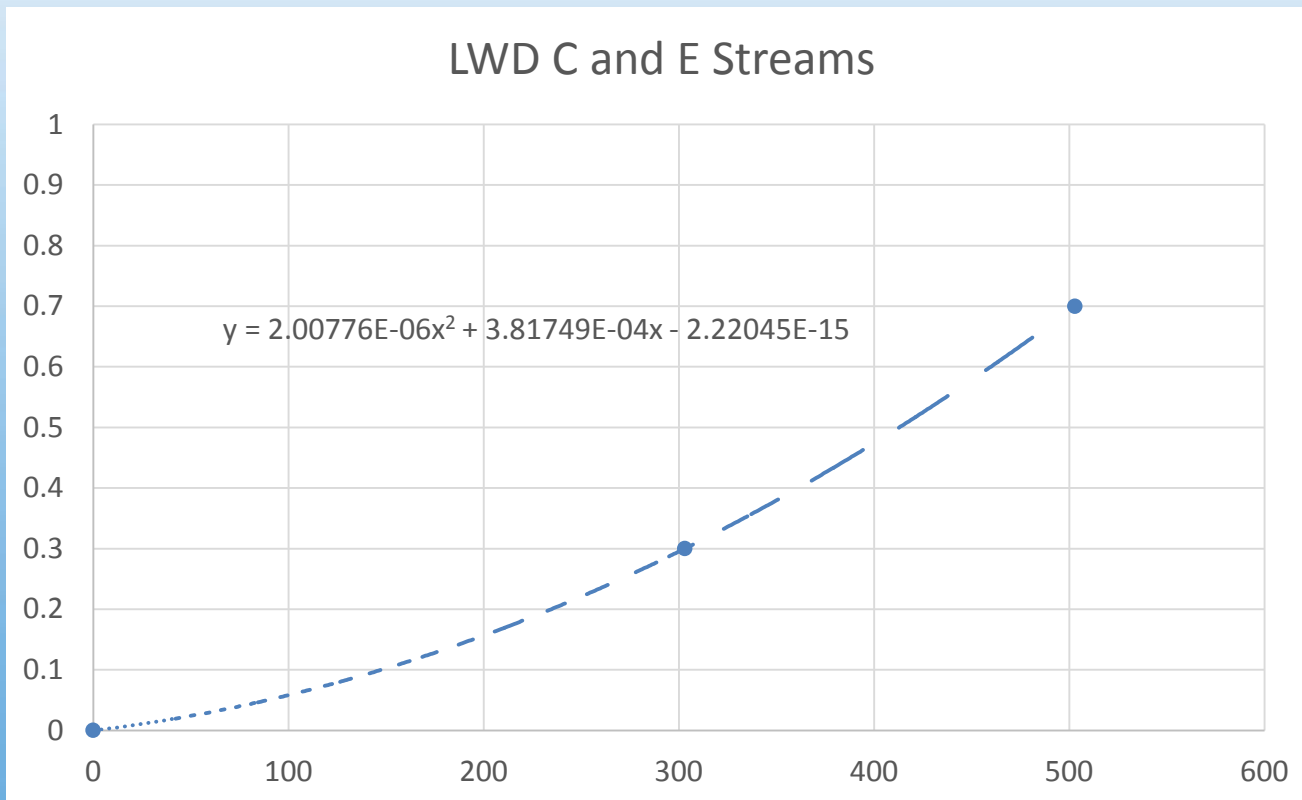
Performance Standard Stratification

Site Information and Performance Standard Stratification	
Project Name:	Kraft
Reach ID:	1
Restoration Potential:	Level 3 - Geomorphology
Existing Stream Type:	E
Proposed Stream Type:	C
Region:	Mountains
Drainage Area (sqmi):	4
Proposed Bed Material:	Gravel
Existing Stream Length (ft):	736
Proposed Stream Length (ft):	957
Stream Slope (%):	0.62
Flow Type:	Perennial
River Basin:	Yadkin-PeeDee
Stream Temperature:	

- Project Information
- Stratification that determines the performance standards to use.

Functional Feet Scoring

Pre-Restoration Functional Feet

Existing Condition Score X Existing Stream Length

After-Restoration Functional Feet

Proposed Condition Score X Proposed Stream Length

- Proposed is predicted and then verified with monitoring

Parameter Summary

Functional Category	Function-Based Parameters	Existing Parameter	Proposed Parameter
Hydrology	Catchment Hydrology	0.4	0.4
Hydrology	Reach Runoff	0.2	0.72
Hydrology	Flow Alteration		
Hydraulics	Floodplain Connectivity	0.5	1.0
Geomorphology	Large Woody Debris	0.1	0.58
Geomorphology	Lateral Stability	0.42	0.75
Geomorphology	Riparian Vegetation	0.25	0.65
Geomorphology	Bed Material Composition		
Geomorphology	Bed Form Diversity	0.59	0.8
Geomorphology	Sinuosity	0.70	0.93
Physicochemical	Temperature		
Physicochemical	Bacteria	0.0	0.79
Physicochemical	Organic Matter	0.50	0.90
Physicochemical	Nitrogen		
Physicochemical	Phosphorus		
Biology	Macros	0.36	0.60
Biology	Fish	0.0	0.61

Stream Quantification Tool

Functional Category	ECS	PCS	Functional Lift
Hydrology	0.40	0.40	0.00
Hydraulics	0.50	1.00	0.50

Each functional category is multiplied by 0.2 and then summed to yield an overall reach score.

StreamMechanics

Existing Condition:

Existing Condition Score = 0.21
Existing Stream Length = 1600 Ft
Functional Foot = 336 Feet

Proposed Condition:

Proposed Condition Score = 0.75
Proposed Stream Length = 1640 Ft
Functional Foot = 1,230 Feet

Proposed Credits = 1,230 – 336 = 894

StreamMechanics

Existing Condition:

Existing Condition Score = 0.49
Existing Stream Length = 1600 Ft
Functional Foot = 784 Feet

Proposed Condition:

Proposed Condition Score = 0.55
Proposed Stream Length = 1600 Ft
Functional Foot = 880 Feet

Proposed Credits = 880 – 784 = **96**

Debit Side Options

- No Assessment.

- Run SQT for Existing and Proposed Condition.

- Run SQT for Existing and Use <u>Debit Calculator</u> for Proposed.

  - Impact Severity Tiers and Modeling

- No Existing Condition Assessment and Use <u>Debit Calculator</u> for Proposed.

- All use same scale as SQT.

States Regionalizing the Stream Quantification Tool

- North Carolina
- South Carolina
- Tennessee
- Wyoming
- Colorado
- Michigan

Key Acknowledgements

- **Environmental Defense Fund** (Funding and Project Management)
- **Ecosystem Planning and Restoration**
- **US Army Corps of Engineers**
- **US Environmental Protection Agency**
- **NC Division of Mitigation Services**
- **NC Division of Water Resources**
- **Penrose Environmental**
- **NC State University**
- **TN Department of Environment and Conservation**
- **WY Game and Fish**
- **CO Parks and Wildlife**

Thank You!

Will Harman, PG

www.stream-mechanics.com