Stream Buffers and Streambank Restoration by

Photographs provided by Dave Rosgen, PhD with Wildland Hydrology,
Brian King, PE with Engineering303 and John Vermont formerly with Corblu.

What is a Stream?

Stream Types

- Ephemeral Streams
  - Only flows during and shortly after precipitation.
  - These streams do not have wrested vegetation.
  - They do not require stream buffers in Georgia.

Ephemeral Stream/Ditch

This Ephemeral Stream/Ditch shows signs of a Head Cut working upstream.

Stream Types

- Intermittent Streams
  - Flows for part of the year.
  - These streams have wrested vegetation.
  - They require stream buffers in Georgia.
  - They may have bed features and perennial pools.
  - They provide habitat for juvenile aquatic life.

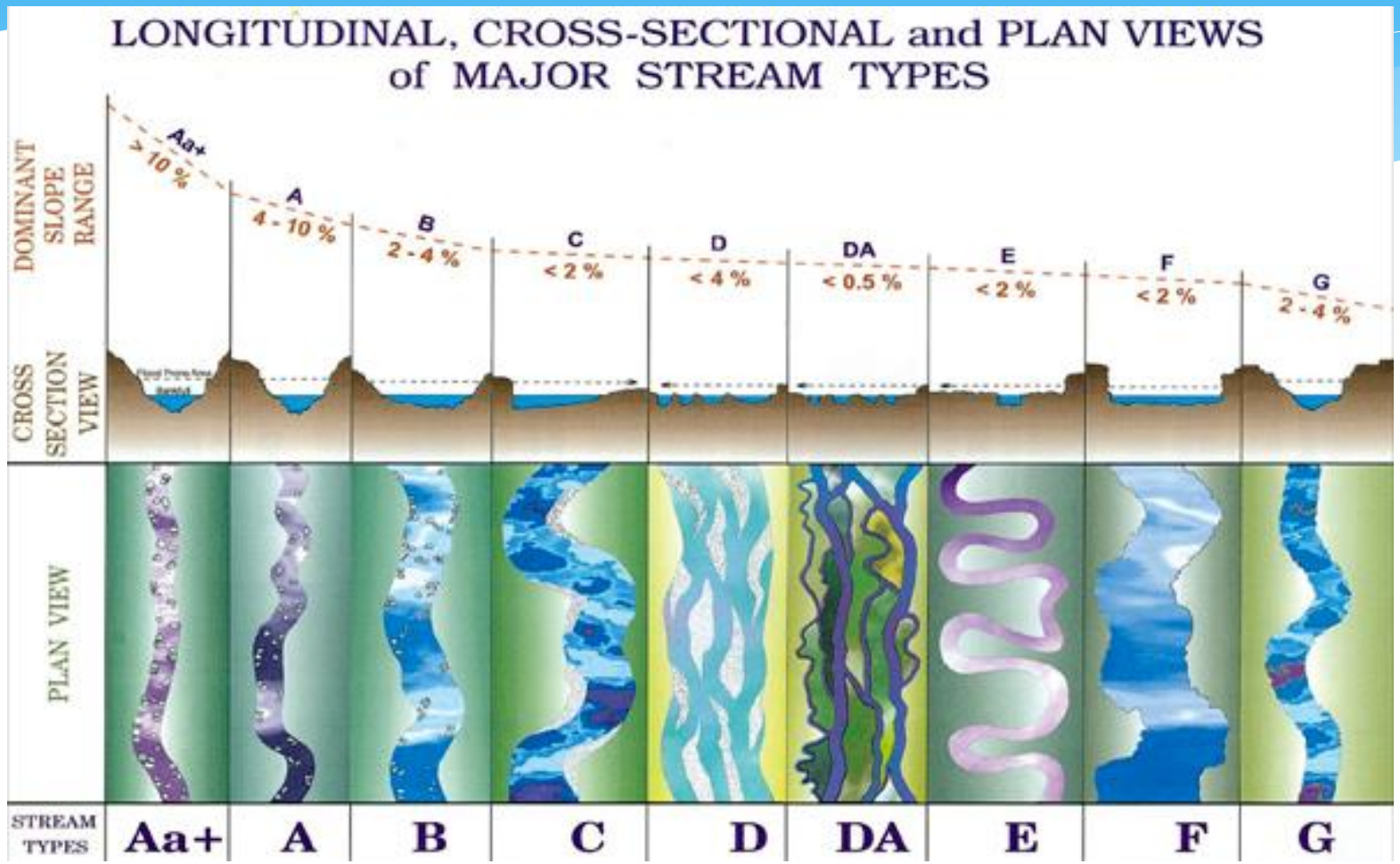
Intermittent Stream

Stream Types

- Perennial Streams
  - Flows year round.
  - These streams have wrested vegetation.
  - Sinuous Pattern.
  - They have bed features, Riffles & Pools.
  - Evidence of fluctuation high-water marks.
  - Evidence of Sediment Transportation.
  - Hydric Soils
  - They provide habitat for Algae, Benthic Macroinvertebrates, Fish & Amphibians.
  - They require Stream Buffers in Georgia.

Perennial Stream

Rosgen Stream Classification



Stream Buffers

- State
  - Warm Water = 25’ Stream Buffer
  - Trout Stream = 50’ Stream Buffer
  - State Buffers measured from Wrested Veg.
  - EPD Field Guide for Determining State Waters that Require a Buffer

EPD Field Guide

WRESTED VEGETATION

Examples of situations that usually do not require a buffer due to lack of wrested vegetation are:

1. Freshwater Wetlands
2. Concrete Channels
3. Bulkheads, Seawalls or Retaining Walls
4. Rip Rap
5. Vegetated Waterways (excluding aquatic vegetation)
6. Impoundments with completely vegetated banks

Note: Structures that are in disrepair may require a buffer if vegetation has been reestablished.

Freshwater Wetlands

Concrete Channel

Bulkhead

Rip Rap Bank

Vegetated Waterway

Grassed Impoundment

DEFINITIONS

a. "Base Flow" means the discharge that enters a stream channel mainly from groundwater, but also from lakes during periods when no precipitation occurs.

b. "Buffer" means the area of land immediately adjacent to the banks of State Waters in its natural state of vegetation, which facilitates, when properly vegetated, the protection of water quality and aquatic habitat (O.C.G.A. 12-7-3(2)).

c. "Ephemeral Stream" means a stream that typically has no well-defined channel, and which flows only in direct response to precipitation with runoff. (O.C.G.A. 12-7-6(b)(15))

d. "Intermittent Stream" means a stream that flows in a well-defined channel during wet seasons of the year but not for the entire year.

e. "Land Disturbing Activity" means any activity which may result in soil erosion and the movement of sediments into State Waters or onto lands within the State, including but not limited to grubbing, dredging, grading, excavation, transporting, and filling of land, but not including those practices to the extent described in O.C.G.A. 12-7-17 (O.C.G.A. 12-7-3(9)).

f. "Normal Stream Flow" for non-trout waters only, means any stream flow that consists solely of base flow or consists of both base flow and direct runoff during any period of the year. Base flow results from groundwater that enters the stream channel through the soil. This includes spring flows into streams. Direct runoff is the water entering stream channels promptly after rainfalls or snow melts (Rule 391-3-7-.01(bb)).

g. "Perennial Stream" means a stream that flows in a well-defined channel throughout most of the year under normal climatic conditions

h. "State Waters" means any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, and other bodies of surface or subsurface water, natural and artificial, lying within or forming a part of the boundaries of the State which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation, except as may be defined in O.C.G.A. 12-7-17(8) (O.C.G.A. 12-7-3(16).

i. "Stream Bank" means the confining cut of a stream channel and is usually identified as the point where the normal stream flow has wrested the vegetation (Rule 391-3-7-.01(bb)).

j. "Wrested Vegetation" means movement of water that removes soil, debris and vegetation, creating a clear demarcation between water flow and vegetative growth.

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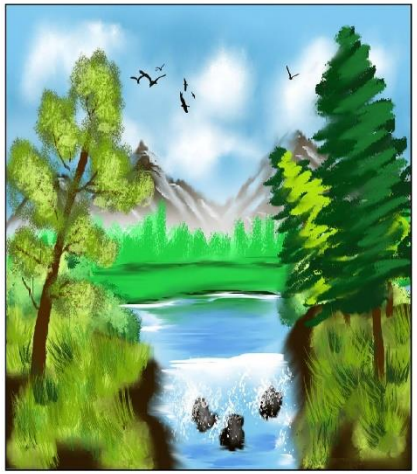
April 2017

Field Guide for Determining the Presence of State Waters That Require a Buffer



The Guidance does not change or modify any requirements in the Erosion and Sedimentation Act of 1975 O.C.G.A. 12-7 or DNR Rules on Buffer Variance Procedures and Criteria 391-3-7-.05, as amended.

This field guide supersedes any previous manuals, memos, or guidance issued by the Georgia Environmental Protection Division on the identification of State Waters that require a buffer. It does not supersede the requirements of any Rule or Law.

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
WATERSHED PROTECTION BRANCH
NONPOINT SOURCE PROGRAM

This guidance is based on the Rules for Erosion and Sedimentation Control (Rules), 391-3-7, promulgated under the Georgia Erosion and Sedimentation Act (Act), O.C.G.A. 12-7.

This guidance only addresses the identification of rivers, streams, creeks, branches, canals, and impoundments that require a buffer. The State mandated buffer requirements apply to these State Waters that have wrested vegetation by normal stream flow. Coastal marshlands are addressed in a separate document and have state mandated buffers that are measured from the Jurisdictional Determination (JD) Line established by the Coastal Marshland Protection Act and implemented by the Coastal Resources Division (CRD).

For the purposes of this guidance, Normal Stream Flow is defined as "any stream flow that consists solely of base flow or consists of both base flow and direct runoff during any period of the year. Base flow results from groundwater that enters the stream channel through the soil. Direct runoff is the water entering stream channels promptly after rainfalls or snow melts." This definition is found in the definition of Stream Bank in the Rules, and only applies to non-trout streams. Streams that have Normal Stream Flow as defined in the Rules have characteristics that are not normally associated with ephemeral streams.

Please note the following:

1. The definition of Normal Stream Flow that appears in the guidance applies only to non-trout streams. Ephemeral trout streams are not exempt from buffer requirements, but may be eligible for the General Stream Buffer Variance in 391-3-7-.05(9) of the Rules for Erosion and Sedimentation Control. Refer to the Georgia Water Quality Control Rules (391-3-6-.03) for a listing of trout streams. **DNR Wildlife Resources Division trout maps should not be used.**
2. Ponds, lakes and other impoundments located within a trout stream watershed may be subject to trout stream buffer requirements (50 foot buffers).
3. Detention, retention and other water quality/water quantity ponds may be subject to buffer requirements.
4. Draining a pond may not eliminate the buffer. In addition, if the pond is altered after draining the new buffer will be based on the new conditions of the feature, i.e.,(instead of a buffered pond there may be a buffered stream).
5. The buffer on an impoundment is measured from the point of "wrested vegetation." Normal pool elevation should not be used unless it coincides with the point of "wrested vegetation."
6. The buffer is 25 or 50 feet as measured horizontally from the point where "vegetation has been wrested by normal stream flow or wave action."
7. Buffer requirements are included in the General NPDES Permit for Storm Water Discharges Associated With Construction Activities.
8. Agricultural **activities**, such as the cultivation and harvesting products of the field or orchard, planting of pasture land, construction of a pond for agricultural purposes, dairy operations, and livestock and poultry operations, are exempt from the buffer requirements (O.C.G.A. 12-7-17(5)). However, the construction of **agricultural buildings, such as poultry houses** may be subject to the buffer requirements included in the NPDES General Permits for Stormwater Discharges Associated With Construction Activities.
9. Contact DNR, Coastal Resources Division for guidance involving any land disturbing activity within the coastal marshland itself.
10. State Waters may also be classified as Waters of the U.S. and may require a U.S. Army Corps of Engineers Section 404 permit.

EPD Field Guide

STEPS FOR DETERMINING THE PRESENCE OF STATE WATERS AND BUFFER REQUIREMENTS ON A SITE

Please note that this guidance is primarily written to assist local issuing authorities with their determinations of State waters and buffer requirements. However, it is also a tool for plan preparers and environmental consultants to use in the preparation of accurate Erosion, Sedimentation and Pollution Control Plans.

Step 1 Review the topography of the Erosion, Sedimentation and Pollution Control Plan for natural or artificial features that may indicate the presence of State Waters.

Step 2 Walk the entire length of the river, stream, creek, branch or canal until it exits the property to verify that the feature is not completely contained upon the property of a single individual, partnership or corporation. If the feature is an impoundment then the perimeter should be inspected for an inlet and/or outlet and property lines identified to verify that the feature is not completely contained upon the property. If a feature is completely contained upon the property of a single individual, partnership or corporation and there is no inflow/outflow, the feature is not a State Water and is not buffered.

Step 3 If it is determined that the feature is a State water the next step is to determine if the feature is a buffered State water. This involves determining if the feature has wrested vegetation and base flow. The buffer determination should be made at least 48 hours after the last rain event to accurately identify base flows.

Step 4 The feature should first be inspected for wrested vegetation. If there is no point of wrested vegetation, the feature is not buffered. The absence of wrested vegetation can be due to completely vegetated banks and/or bottoms (excluding aquatic vegetation), rip rap or a solid bulkhead, seawall or retaining wall.

Step 5 If there is flowing water in the wrested vegetated channel 48 hours after a rain event the feature is either perennial or intermittent and will require a buffer. If there is no water in the channel the feature is either ephemeral or intermittent. **NOTE:** Ephemeral non-trout streams do not require buffers so great care should be exercised when conducting field investigations for ephemeral and intermittent stream determinations. Ephemeral trout streams are buffered if they have wrested vegetation, regardless of the presence of base flows.

Step 6 Further investigation is required if the feature has wrested vegetation and is dry at the time of the site inspection. In such conditions inspections should be accomplished by professionals trained or otherwise familiar with methods used to determine whether the stream is in a season where base flows may not be observable, or if the stream is ephemeral and simply flows in direct response to precipitation.

Step 7 The most current version of the "North Carolina Division of Water Quality Stream Identification Method" should be used to verify whether the stream is ephemeral. For impoundments a test hole should be dug upland of the high water mark and a few inches below the elevation of the existing water level. The water level in the test hole should stabilize at the same elevation of the subject feature if there is a ground water component.

Step 8 If it is determined that there is both wrested vegetation and base flow present on the site then a State-mandated buffer exists and the buffer is measured from the point of wrested vegetation. Please note that ephemeral trout streams are buffered regardless of the presence of base flow.

Step 9 The determination should be documented in writing. Photo documentation is strongly recommended.

PERENNIAL STREAM CHARACTERISTICS

North Georgia Perennial

Piedmont Perennial

Coastal Perennial

All perennial streams flow throughout the year in a normal climatic year. Site inspections should result in visually discernible stream flows as evidence of base flow contribution between rain events, even in low flow conditions. After confirming perennial flow regimes, the presence of one or more of the following characteristics indicates that the drainage feature is a perennial stream:

1. Base flow that maintains stream flow throughout the year under normal circumstances.
2. Well-developed stream banks and channels include riffles/pools.
3. A channel that is almost always sinuous (winding, snake-like, etc.) The degree of sinuosity is specific to physiographic regions. For example, in geographic regions that have mountainous terrain, or in the coastal plain where many streams have been channelized, the channels are less sinuous.
4. Presence of iron oxidizing bacteria in the streambed.
5. Evidence of soil and debris movement (scouring) in the stream channel. Leaf litter is usually transient or temporary in the flow channel.
6. Algae and wetland or hydrophytic vegetation are usually associated with the stream channel. However, perennial streams with deeply incised or "down-cut" channels will usually have wetland vegetation present along the banks or flood-prone zone. Examples include sedges, rushes, mosses, ferns, and the riparian grasses, shrubs and other woody species.
7. Stream bank soils with hydric conditions, including dominant black/gray (gleying) and/or redoximorphic features evident in the exposed stream bank profiles at or above the low flow conditions.
8. Exposure of rock or gravel or sand in a continuous or nearly continuous low lying channel. In the coastal plain, the soils may be sandy with veins of black.
9. The presence of aquatic mollusks, crayfish, amphibians, aquatic insects (in any life phase) or fish (For help identifying insects as aquatic, use the GA Adopt-A-Stream Aquatic Macroinvertebrate Field Guide, http://www.georgiaadoptastream.com/db/index.html).

INTERMITTENT STREAM CHARACTERISTICS

North Georgia Intermittent

Piedmont Intermittent

Coastal Intermittent

After confirming whether base flows are seasonally present, one or more of the following characteristics indicates that the drainage feature is an intermittent stream:

1. Well-developed stream bank and defined channel. Riffles/pools channel morphology is evident.
2. Presence of iron oxidizing bacteria in the streambed.
3. Evidence of soil and debris movement (scouring) in the stream channel. Leaf litter is usually transient or temporary in the flow channel.
4. Algae and wetland or hydrophytic vegetation are usually associated with the stream channel or flow area. Intermittent streams with deeply incised or "down-cut" channel will usually have wetland vegetation present along the banks or flood prone zone. Examples include sedges, rushes, mosses, ferns, and the riparian grasses, shrubs and other woody species.
5. Exposure of rock or gravel or sand in a continuous or nearly continuous low lying channel.
6. Stream bank soils with hydric conditions, including dominant black/gray (gleying) and/or redoximorphic features evident in the exposed stream bank profiles at or above the low flow conditions. In the coastal plain, the soils may be sandy with veins of black.
7. Exposure of rock or gravel or sand in a continuous or nearly continuous low lying channel.
8. The presence of aquatic mollusks, crayfish, amphibians, aquatic insects (in any life phase) or fish (For help identifying insects as aquatic, use the GA Adopt-A-Stream Aquatic Macroinvertebrate Field Guide, (http://www.georgiaadoptastream.com/db/index.html).

EPHEMERAL STREAM CHARACTERISTICS

North Georgia Ephemeral

Piedmont Ephemeral

Coastal Ephemeral

The most reliable method for differentiating between intermittent and ephemeral stream types during drier conditions requires investigation of the stream bank (i.e., from the stream bed to the top of the bank).

Intermittent stream banks typically are dominated by soils with hydric indicators, such as: visually confirmed oxidized rhizospheres in the stream bank, matrix of gray or black soils, reducing conditions present and confirmed by a redox meter, or the stream banks otherwise include indicators of hydric soils as determined by the most current list of *Regional Indicators of Soil Saturation* as produced by the National Technical Committee for Hydric Soils.

Ephemeral streams usually have poor channel development and lack groundwater-induced base flows that normally result in hydric soils dominating the banks of intermittent and perennial streams.

The prerequisite for a drainage feature to be classified as ephemeral is there must be no evidence of base flows in the stream bank (see methods discussed in intermittent stream characteristics). After meeting the prerequisite above, the presence of one or more of the following characteristics indicates that the drainage feature is an ephemeral stream:

1. Poorly developed stream banks.
2. Absence of riffles/pools.
3. A flow area that is almost always straight and either "flattens" out at the bottom of the slope or grades into intermittent or perennial streams.
4. Absence of iron oxidizing bacteria in the streambed.
5. An abundant amount of leaf litter in the flow areas. Usually sparse or no algae and/or wetland (hydrophytic) vegetation present.
6. Fibrous roots and/or rooted upland plants in the streambed.
   Side slope soils with characteristics typical of the surrounding landscape. Soil texture usually more loamy than the surrounding upslope landscape and usually has a clay subsurface.

Stream Buffers

- Local
  - Check with Local Municipality as some use Top of Bank versus Wrested Vegetation.
  - Larger buffers required as much as 7 miles upstream of water intakes.

Stream Buffers

- Forsyth County
  - 50’ Buffer from top of bank on intermittent and perennial streams.
  - 75’ Impervious setback from top of bank.

Stream Buffers

Alpharetta

- Intermittent
  - 50’ Buffer from Wrested Veg.
  - 75’ Impervious setback.
- Perennial
  - 100’ Buffer from Wrested Veg.
  - 150’ Impervious setback.

Past Agricultural Practices: Planting corn along a river. Northeastern Tennessee, May 1940

Note: Little to No Stream Buffer

Regulating Authorities

- Federal – U.S. Army Corps of Engineers
  - Nationwide Permitting
  - US Fish and Wildlife, Cultural Resources, EPA, Historic Society & National Parks
- State – GA EPD
  - State Buffer Variance
- Local – City and/or County
  - Local Land Disturbance Permitting
- HOA, etc.
  - Regulation by Covenants

Permitting

- Federal – U.S. Army Corps of Engineers
  - Two options
    - Nationwide Permit (NWP 13 & 27 for Stream Restoration)
    - Individual Permit (very difficult and for large permits)
    - NWP 45-day process but requires expertise in permitting to know how to use the NWPs
    - Requires monitoring after construction
- State – GA EPD
  - State Buffer Variance
  - 120-day process (Requires detailed Erosion and Sediment Control plans and replanting plans)
- Local – City and/or County
  - Local Land Disturbance Permitting
  - May require filing for a Variance before submittal of LDP documents
- HOA, etc.
  - Regulation by Covenants

Call the experts at Corblu Ecology Group for permitting.

Streambank Stabilization vs. Stream Restoration

- Discouraged Practices (Hard Armoring)
  - Riprap
  - Gabions
  - Bulkheads and Seawalls
- Temporary
- Does not reconnect stream to floodplain
- Does not address the problem.

Streambank stabilization practices listed as per "Streambank and Shoreline Stabilization" Guidance Book, Revised April 2011, by Georgia EPD and the Georgia Soil and Water Conservation Commission (GSWCC).

The Evolution of Streambank Stabilization

Riprap

Riprap Erosion

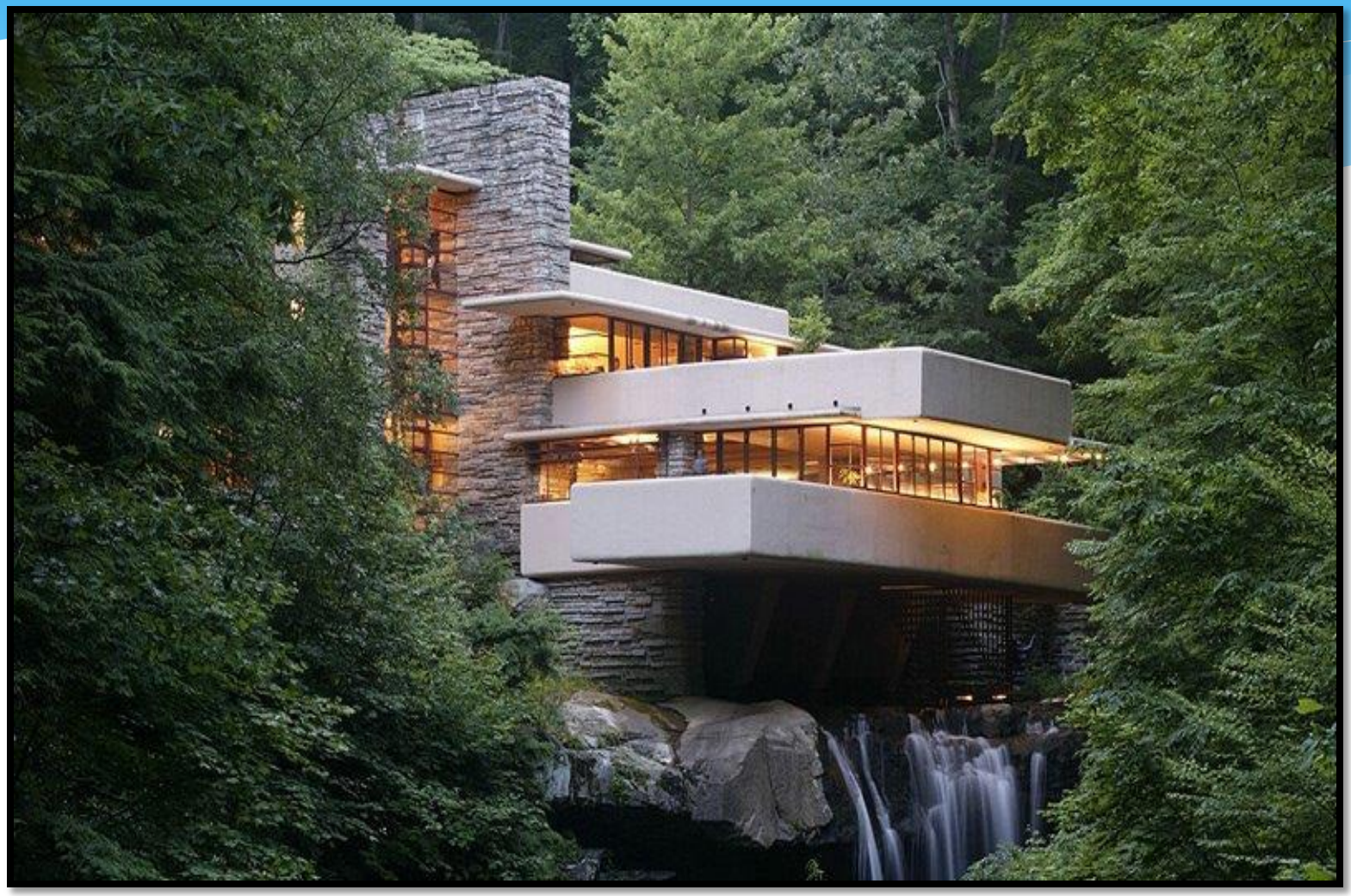
Riprap placed without first determining the problem.

Gabion Baskets

Question:

Do you need a Stream Buffer Variance?

Is a Stream Buffer Variance Required ?



Streambank Restoration using Natural Channel Design

E303's Recommendations

* **Master Planning**
    1. **Establish Preliminary Assessment and Restoration Goals**
    2. **Overall Watershed Assessment**
        a. **Maps & Aerial Photos**
        b. **Stream Walk and Photo Journal**
            a. **Landowner Coordination**
            b. **Identify and Trace Potential Issues**
            c. **Revisit and Refine Restoration Goals**

E303's Recommendations

* **Master Planning**
  3. **Prioritize areas for remediation**

  4. **Develop a plan for the Short and Long Term**
     - **Identify areas in need of immediate attention**
     - **Budget for the long term**
     - **Always Work from Upstream to Downstream**

Incised / Entrenched Rivers

(Total Lack of Connection to the Floodplain)

Raccoon Creek: Dallas, GA

10’ Vertical Streambank Endangers Transmission Tower

Accelerated Bank Erosion

Sediment is our largest pollutant.

This is an extract from a Streambank Erosion Study by E303.

The stream was an F5 channel located in Columbia County, GA.

The study involved 3,952 feet of stream-bank that yielded 850 tons of sediment per year.

A stream restoration of this project could reduce a minimum of 750 tons of sediment from the stream per year.

	(1) Station (ft)	(2) BEHI rating (Worksheet 5-8) (adjective)	(3) NBS rating (Worksheet 5-9) (adjective)	(4) Bank erosion rate (Figure 5-38 or 5-39) (ft/yr)	(5) Length of bank (ft)	(6) Study bank height (ft)	(7) Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)	(8) Erosion Rate (tons/yr/ft) {[(7)/27] × 1.3 / (5)}
32.	# 29	High	Low	0.12	85	5	51	0.0289
33.	# 31	High	Moderate	0.17	65	5.8	64.09	0.0475
34.	# 32	Moderate	Low	0.03	140	10	42	0.0144
35.	# 33	High	Moderate	0.17	115	5.2	101.66	0.0426
36.	# 34	High	Moderate	0.17	65	5.8	64.09	0.0475
37.	# 35	High	Moderate	0.17	75	6	76.5	0.0491
38.	# 36	High	Moderate	0.17	75	6.4	81.6	0.0524
39	# 37	High	Moderate	0.17	170	7	202.3	0.0573
40.	# 38	Moderate	Moderate	0.06	300	4	72	0.0116
41.	# 39	High	High	0.2	80	5	80	0.0481
42.	# 40	Very High	Moderate	0.7	145	6	609	0.2022
43.	# 41	High	Moderate	0.17	140	5	119	0.0409
44.	# 42	Very High	Moderate	0.7	50	7.5	262.5	0.2528
45.	# 43	High	Moderate	0.17	85	8	115.6	0.0655
46.	# 44	Moderate	Moderate	0.06	250	2.6	39	0.0075
Sum erosion subtotals in Column (7) for each BEHI/NBS combination						Total erosion (ft^3/yr)	17676.39	
Convert erosion in ft^3/yr to yds^3/yr {divide Total erosion (ft^3/yr) by 27}						Total erosion (yds^3/yr)	654.68	
Convert erosion in yds^3/yr to tons/yr {multiply Total erosion (yds^3/yr) by 1.3}						Total erosion (tons/yr)	851.09	
Calculate erosion per unit length of channel {divide Total erosion (tons/yr) by total length of stream (ft) surveyed}						Total erosion (tons/yr/ft)	0.2154	

Bankfull Bench

With Transplanted Alders and Live Willow Stakes

Water Quality

Before

After

Coosa River

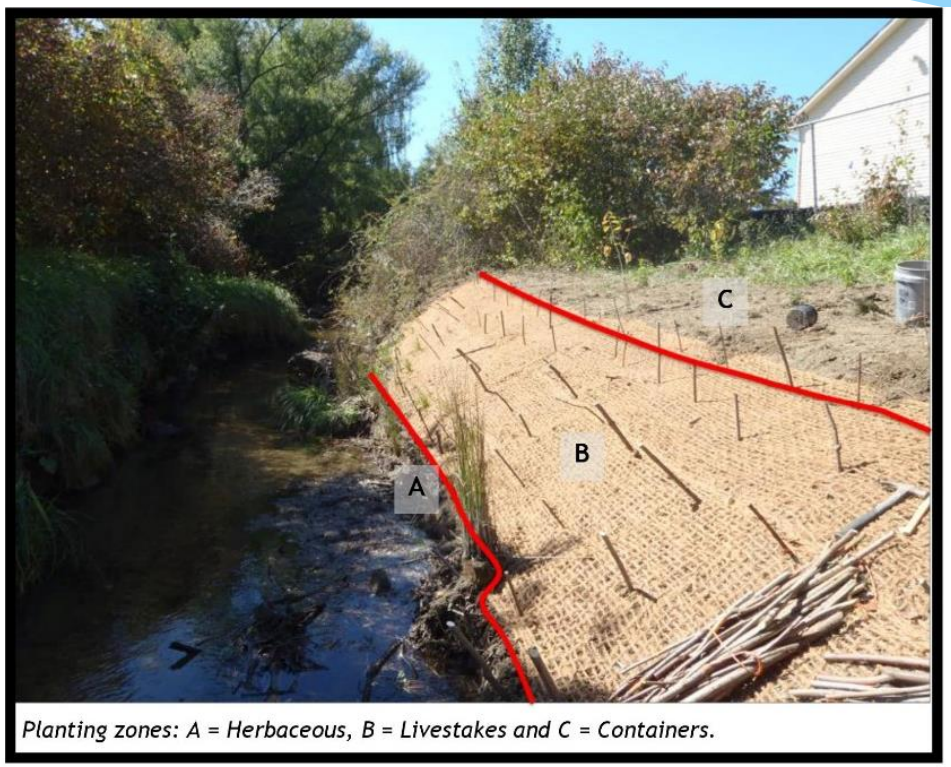
Photo taken at confluence just below stream restoration project during a flood. Note there is less sediment in the restored stream.

What is a Healthy Stream?

- Connected to the floodplain at bankfull.
- Deep rooted vegetation along stream banks
  - Soil Stability
  - Habitat
- Healthy Riparian Buffer
  - Remove Invasives
    - Chinese Privet
    - Mimosa, English Ivy
    - Kudzu, Multiflora Rose

Planting

Root Mass is Mother Natures Rebar



Planting zones: A = Herbaceous, B = Livestakes and C = Containers.

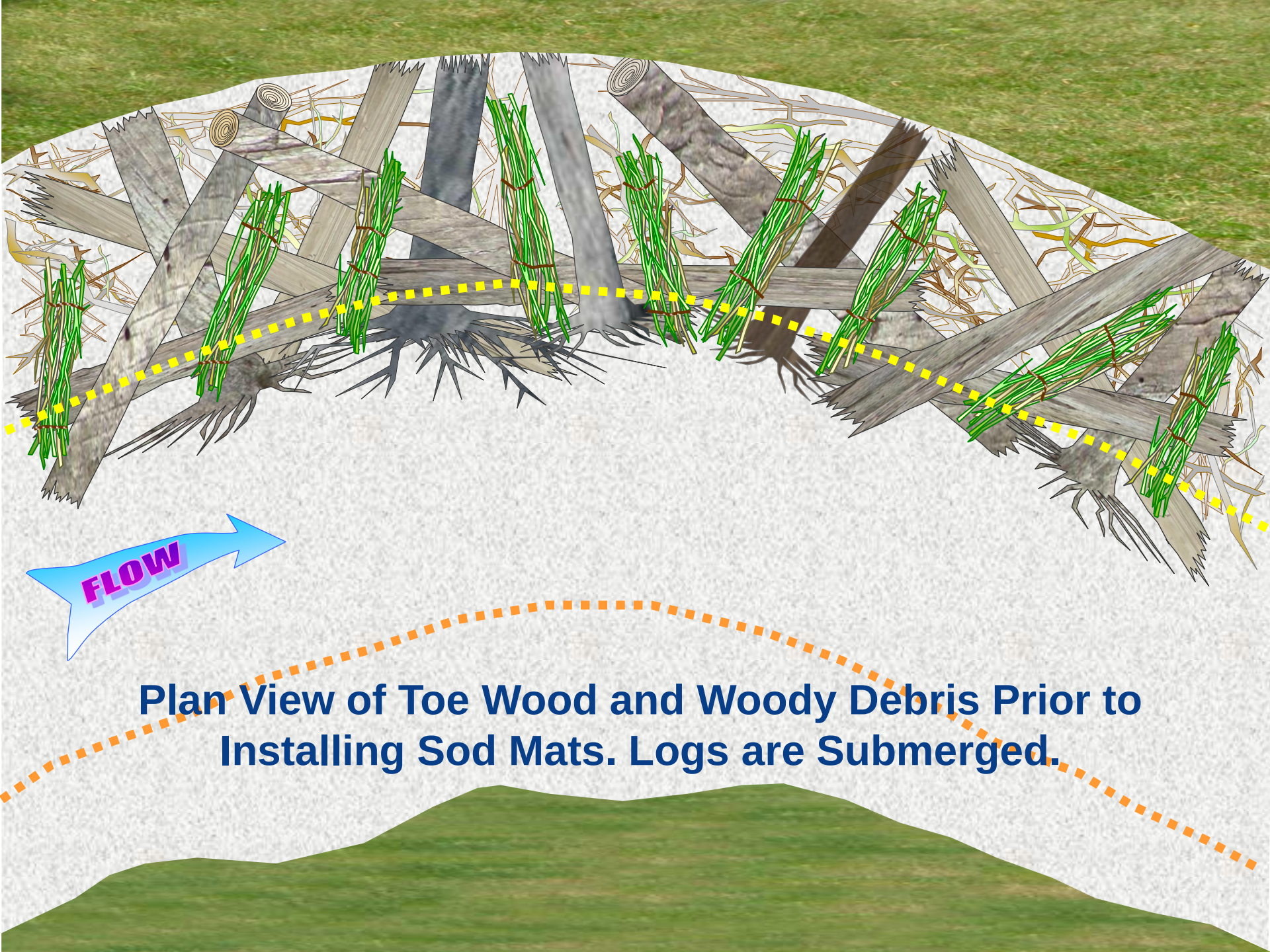
- Zone A
  - Base Flow Channel
    - Soft Rush and Reeds
    - Riparian Seed Mix
- Zone B
  - Streambank
    - Black Willow, Tag Alder, Elderberry, Silky Dogwood
- Zone C
  - Bankfull / Flood Prone
    - Water Oak, River Birch,
    - Sycamore, Witch-Hazel

Toe Wood-Sod Mats with Woody Debris

Stabilize Streambanks

Enhance Fish Habitat

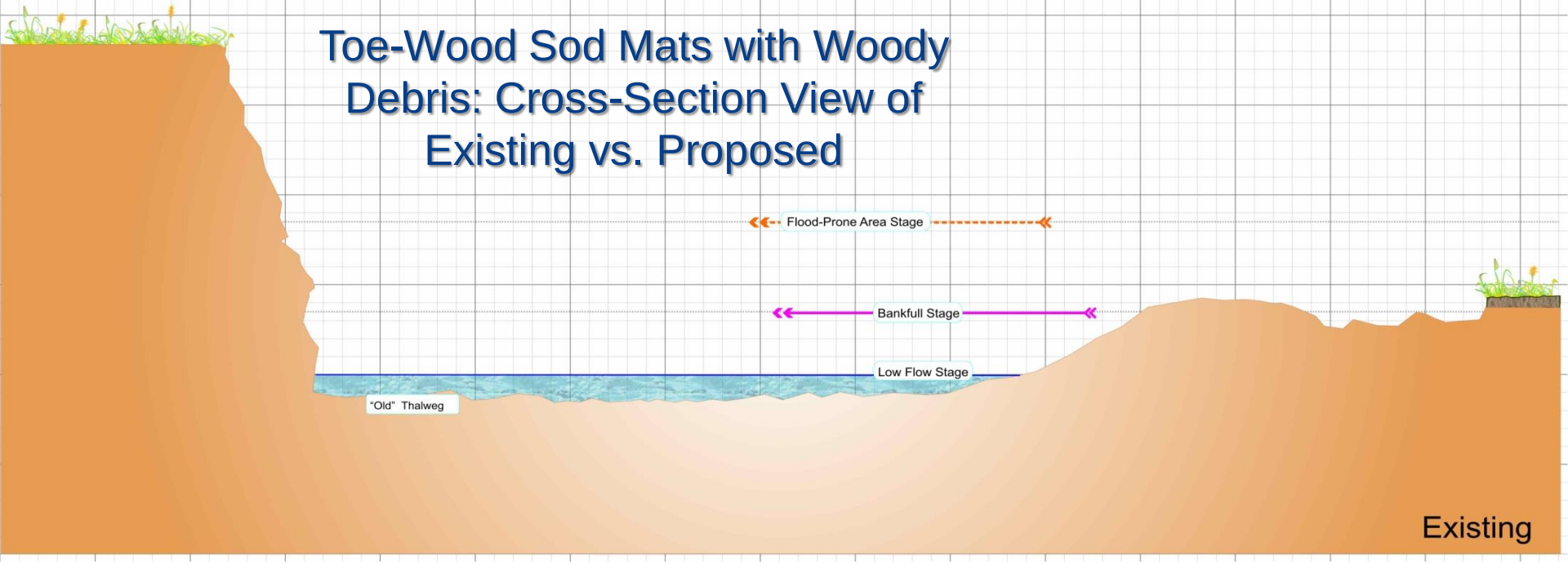
Maintain a Low Width/Depth Ratio

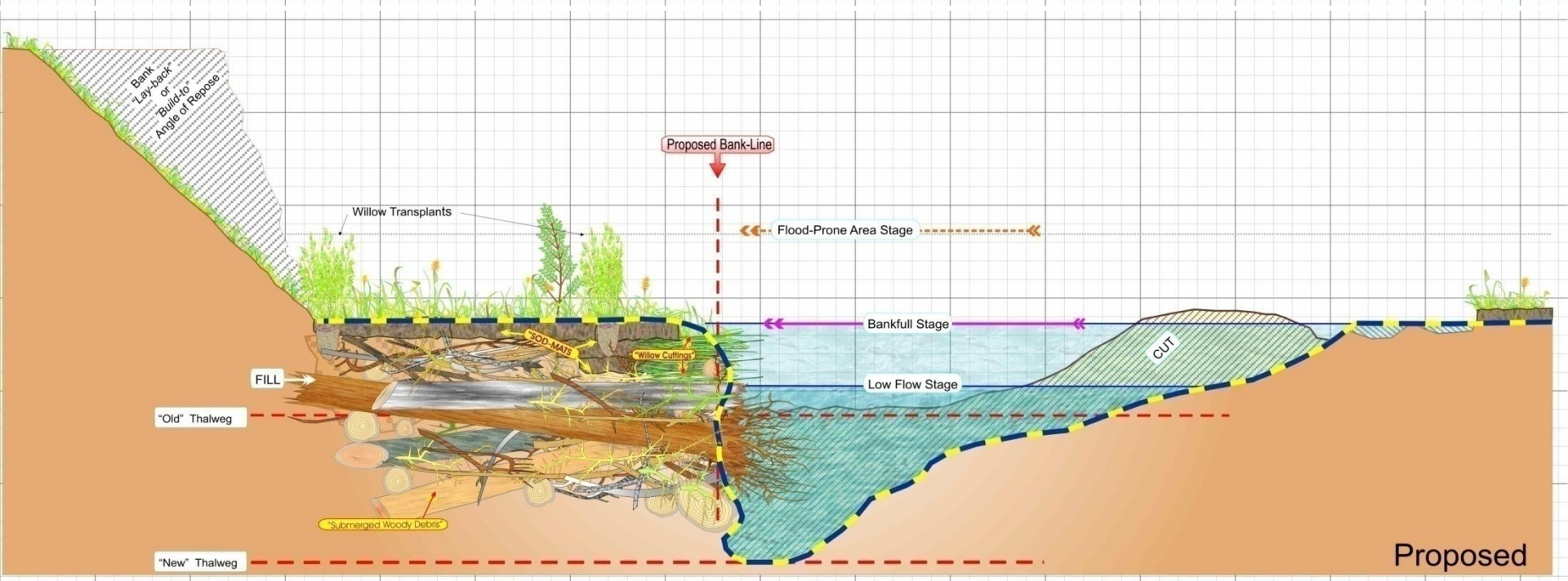


Plan View of Toe Wood and Woody Debris Prior to Installing Sod Mats. Logs are Submerged.

Plan View of Toe Wood-Sod Mats w/ Woody Debris & Vegetation Cover. Wood is submerged and counter-weighted so that 80% of wood is covered & integrated with bank.

Toe-Wood Sod Mats with Woody Debris: Cross-Section View of Existing vs. Proposed





Toe Wood Installation

Divert creek away from work area

Under-cut creek bed 3 to 4 feet

Toe Wood Installation

Footing Logs

Root Wads

Toe Wood Installation

Add Woody Debris and
Willow Cuttings

Cover with Geo-Textile Fabric
Add more Willow Cuttings

Toe Wood Installation

Backfill and rebuild streambank

Streambank 10 weeks later

Coosa Mitigation Bank: Rome, GA

Log Cross Vane

Natural Channel Design

Head Cut Works on Poor Design

Log J Hooks with Alder Transplants

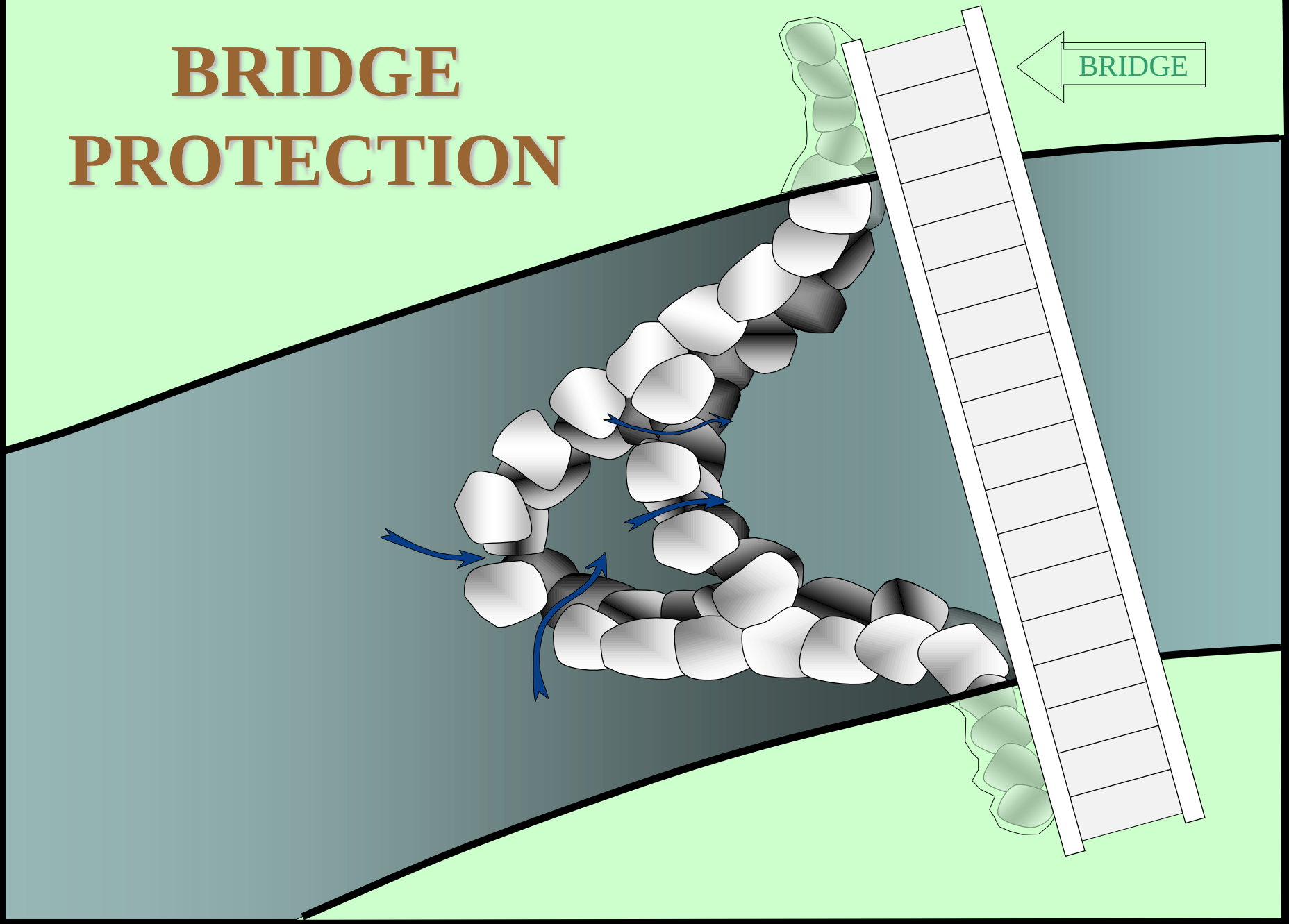
Log J Hook

After 5 Bankfull Events and 1 Flood of Record
(Project was constructed in April 2009.)

Cross-Vane Diversion Middle Fork

Little Snake River, CO

BRIDGE PROTECTION



W-Weir at Bridge with Center Pier
South Platte River, CO

Bridge Protection Structure
Cobb County, GA

Log Cross Vane

Used to redirect flows to the center of the stream.

Utility Protection Design

The sanitary sewer was encased in the concrete dam.

The redesign drained the pond and used a rock vane to protect the aerial sanitary sewer.

The drained pond was converted to a wetland and provides both water quality and flood storage.

Stream Relocation to Protect Power Substation

Georgia Power Roswell Substation Restoration Before and After Photos

Streambank Restoration project located in the City of Roswell, Fulton County, Georgia, on Riverside Creek No.1. Drainage basin at this site is 1.80 sq. miles.

Contacts:

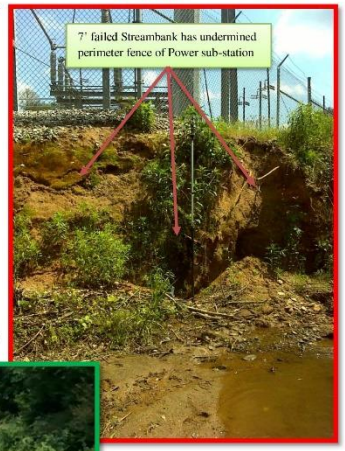
Designer: Engineering303, LLC.	Brian King	770.442.0500
Contractor: C.S. Britton, Inc.	Scott Britton	770.489.6581
Ga. Power Environmental Affairs	Brian Estes	404.799.2110

The existing stream had downcut & exposed the sanitary sewer & at the same time changed direction & eroded to the Sub-Station.

Design goals were accomplished through the use of Natural Channel Design Principles:

1. Protect the structural integrity of the Power Sub-Station
2. Stabilize the Streambank
3. Reconnect stream to flood plain
4. Protect the Sanitary Sewer

Note: This project was live staked after these photos were taken.



- *Before photos taken- 5/04/12*
- *After photos taken- 8/22/12.*

Where do I put the Silt Fence ?

If you get it right, we can all enjoy our streams!

Restoration of Eco-Systems

Importance of Wetlands for Flood Control

* https://www.youtube.com/watch?v=ucb-Y8iipng

Why Stream Meander

* https://www.youtube.com/watch?v=8a3r-cG8Wic

Woody Debris Jam and Fish Habitat

* https://www.fs.usda.gov/detail/r5/news-events/audiovisual/?cid=stelprd3824607