Testimony on ANR River Management to the Senate Natural Resources and Energy Committee

February 17, 2015

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Background - The Rivers Program manages streams toward their equilibrium condition. Testimony is offered to explain;

1) Stream equilibrium, what it is, and why it matters;

2) The physical laws dictating how streams evolve back to equilibrium through a channel evolution process;

3) The consequences when human activities push streams out of equilibrium or disrupt the channel evolution process;

4) The role of floodplain restoration on the storage of water, sediment, and nutrients; and, in conclusion

5) How practices that help absorb and distribute stream power along the stream network can reduce damaging erosion over time.

Instream Practices and the technical and regulatory assistance provided by the ANR:

Stream bank stabilization: The ANR supports and authorizes the stabilization of eroding banks that are at or near equilibrium morphology and those necessary to protect public safety. Other bank stabilizations that cause or contribute to downstream erosion are not supported and/or authorized. Bank sloping and revegetation may be recommended as an alternative on incised streams to minimize sediment and nutrient loading.

Bridges and culverts: Permanent stream crossings must meet the ANR stream alteration performance standard to maintain vertical stability at the reach and site scales. This standard engenders crossing the stream with a structure that is at or near the bankfull width of the stream.

Gravel Removal: Riparian landowners may remove up to 50 cubic yards of gravel from a stream on an annual basis. To do so they must give the ANR a 72 hour notice. ANR typically visits the landowner in the field and provides technical assistance on how to avoid creating a discharge into surface water or making an extraction that would cause a significant discontinuity in the longitudinal or horizontal profiles.

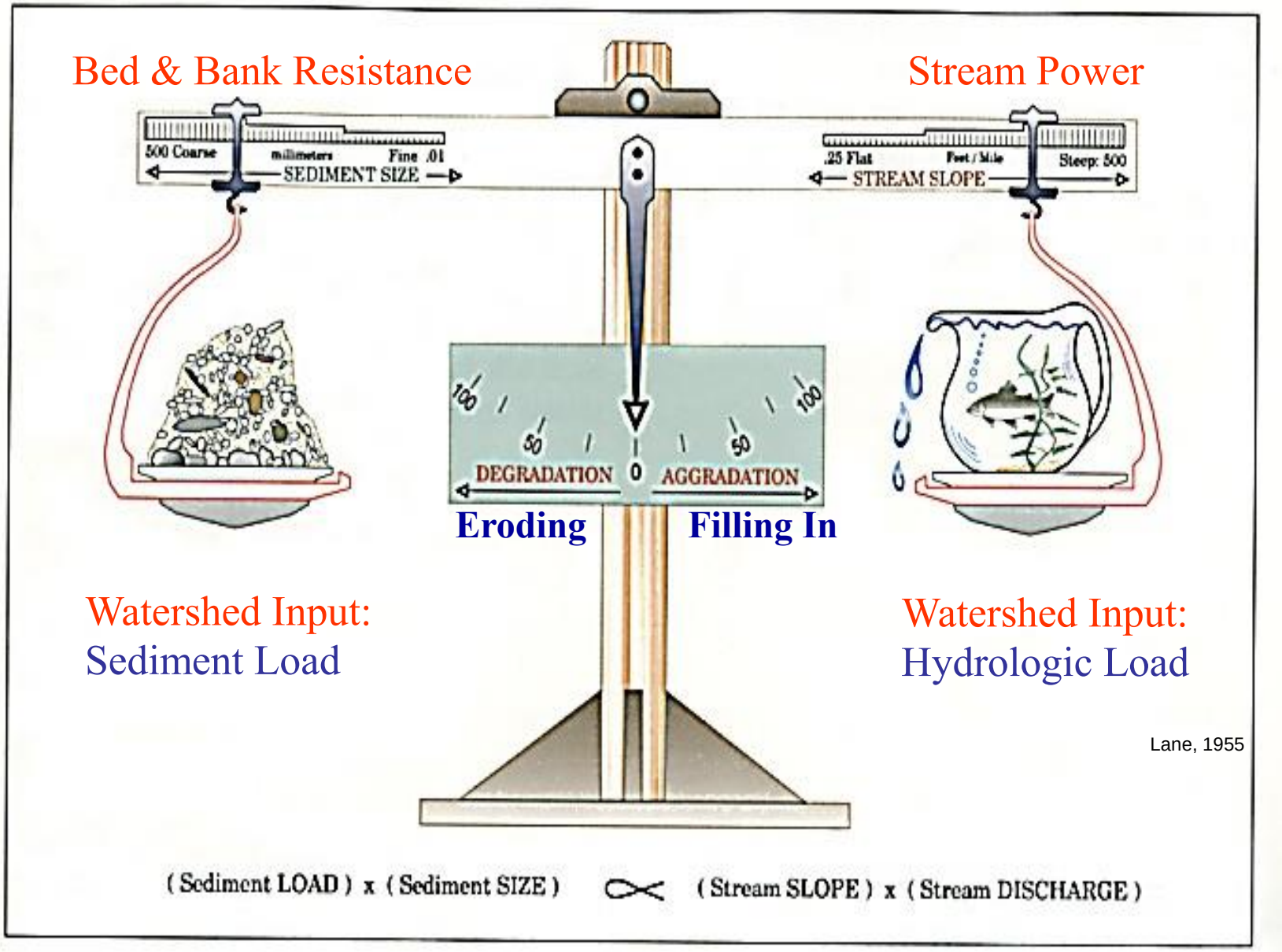
Dredging and berming: These practices are generally permitted only if necessary to protect public safety. During floods a channel may fill with sediment and debris causing the flows to leave the channel and adversely affect public safety through flood and fluvial erosion hazards. Dredging may be conducted to achieve prior channel dimensions or dimensions associated with equilibrium conditions. The ANR will permit channel dredging a priori where it is observed that the channel does not have the hydraulic capacity for the calculated bankfull flow and creating conveyance before the next flood will protect lives and property. New berms must be removed after an emergency, if, after other practices are completed, they are no longer protecting public safety.

Goal: Stream Equilibrium – least erosive form of the river, channel dimensions naturally maintained over time.

Stream Disequilibrium

Eroding channel – degradation from increased power (i.e., slope or depth), less channel resistance, increased flow, or decreased sediment
(activities: channel straightening, dredging too deep, berming, land drainage, stormwater, below undersized culverts and dams)

Filling In channel – aggradation from decrease in power, slope or depth, decreases in flow, increases in sediment load
(activities: dredging to wide, mass wasting from upstream erosion, water diversions, above undersized culverts and dams)



Most Vermont Rivers are undergoing channel evolution:

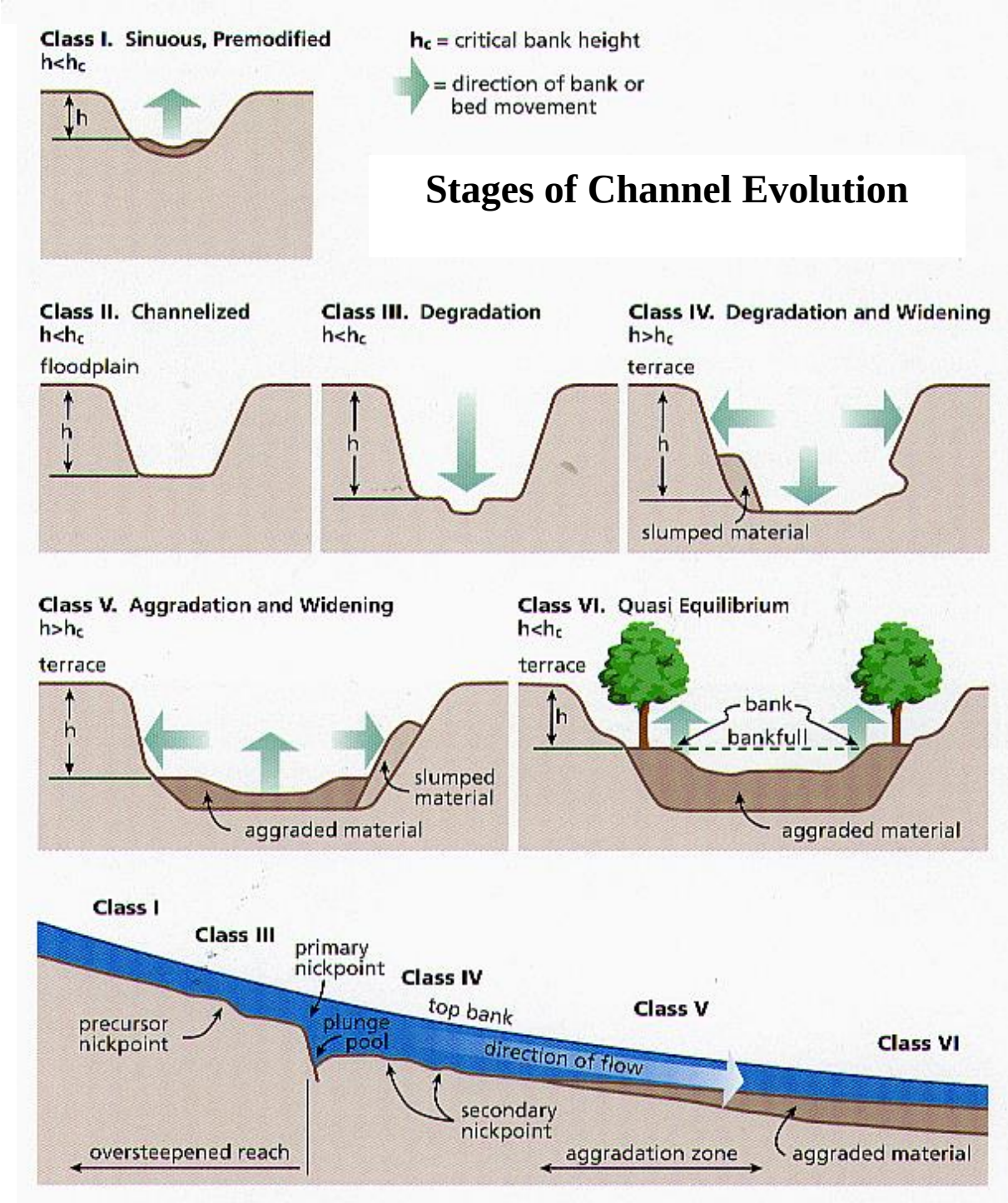
1. **Stream, vertically stable and connected to its floodplain, becomes energized (i.e., more power)**
2. **Channel down-cuts through bed sediments increasing bank heights;**
3. **Degradation continues, increasing stream power as a function of depth;**
4. **Channel bed coarsens and the banks start sloughing, i.e., stream banks become less resistant then the channel bed;**
5. **Bed aggrades as the channel widens; and**
6. **New inset floodplains form through in-fill process eventually allowing for a quasi-equilibrium channel to be maintained.**

A majority of Vermont streams (75%) are in the degraded and widening stages of the evolution process.

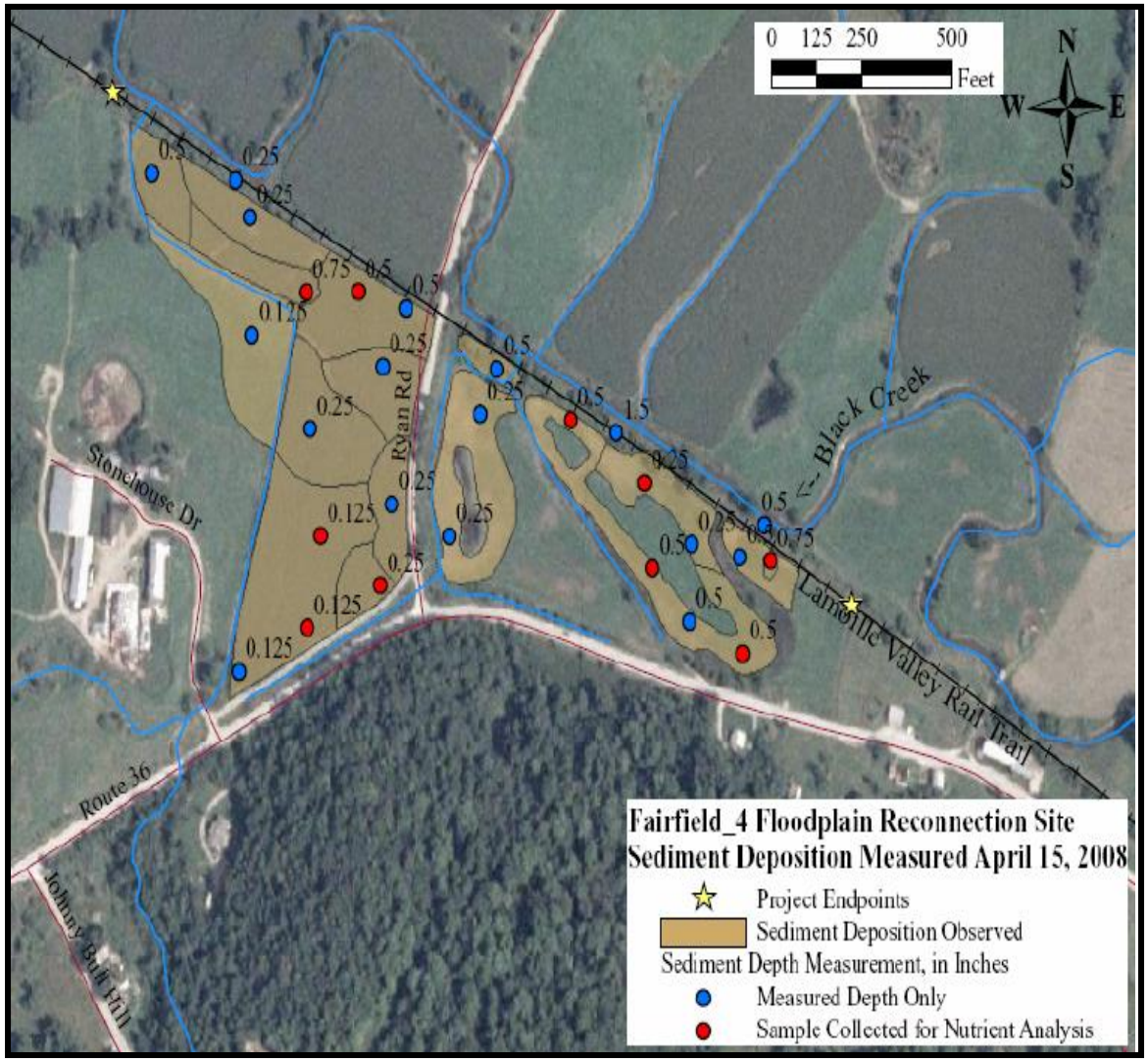
River systems equilibrate over time unless practices are used as spot fixes without recognizing the systemic nature of the instability; i.e., that degradation will move upstream and widening and aggradation will move downstream.

Armoring and denying the stream's expenditure of energy in one place often results in that energy being expended somewhere else downstream.

Vermont's history of trying to contain flood flows and stop erosion (post-deforestation) has led to more stream power, erosion, property damage, and loading of fine sediment and nutrients to Lake Champlain.



Sediment Deposition along Restored Black Creek Floodplains



Rail levee removed giving the Black Creek access to floodplain area for the first time in over 100 years.

Two years after the restoration of floodplain function, fine sediment deposits were measured on 3 of the 7 restored sites, and total phosphorus was measured on the sediments.

Reconnecting floodplains in cooperation with Vermont landowners is a high priority restoration practice identified in the lake Champlain TMDL.

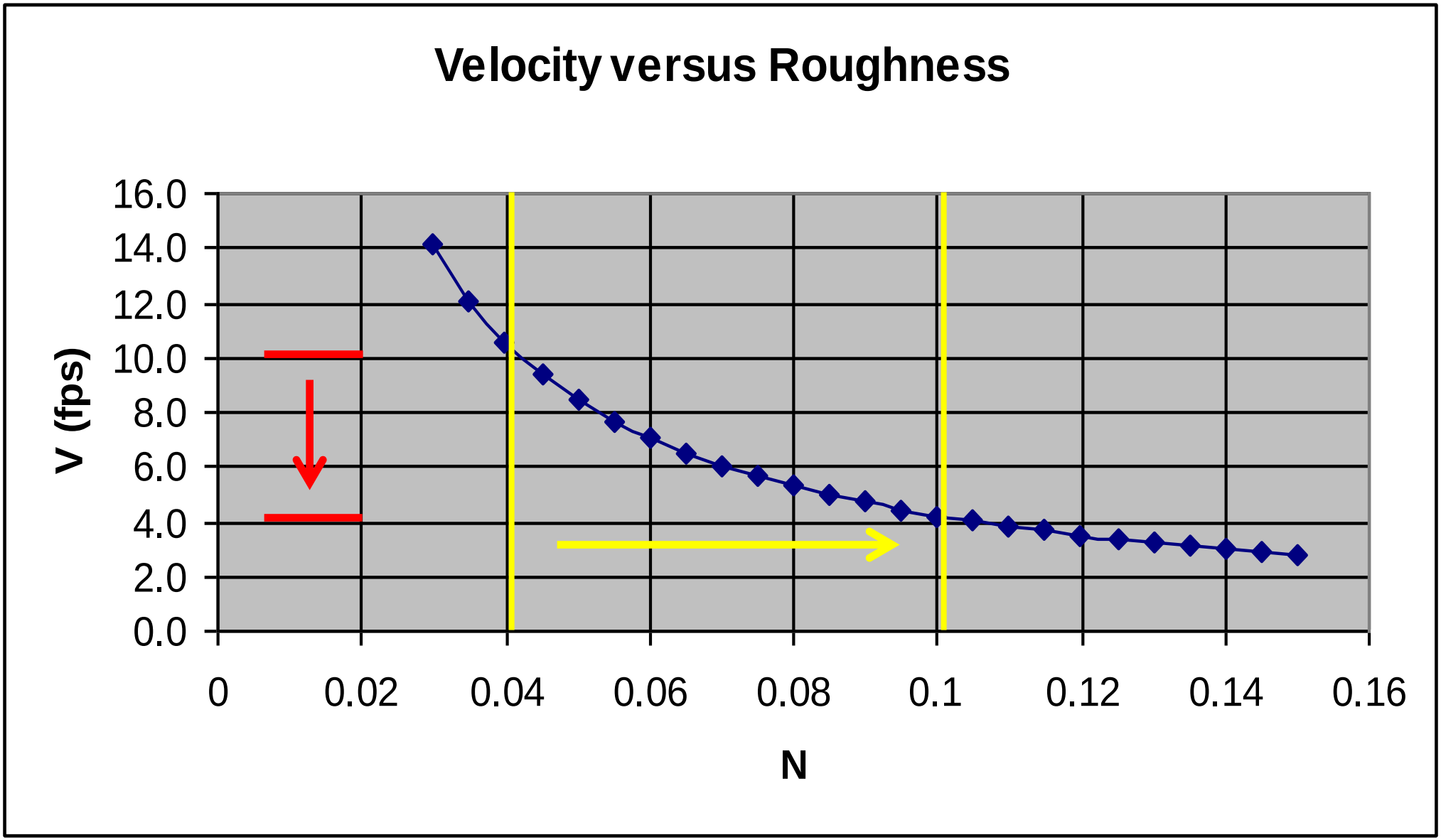
At 3 of 7 restored sites

In 2 years, we saw the deposition of:

1,419 cu. yd. of sediment
1.3 metric tonnes of total phosphorus

Vermont River Management – Managing toward equilibrium conditions (least erosive—least cost—naturally maintained)

- Seek an even distribution of stream power to reduce extreme erosion and maximize storage of water and sediments.
- Meanders, functioning floodplains, coarse bed sediments, and woody vegetation/debris all increase roughness (N), decrease velocity and stream power, and facilitate storage of sediments and nutrients
- Bottom line is the protection of public safety by minimizing activities and practices that increase fluvial erosion hazards
- S.49 "stabilization of streambanks on a farm" would remain exempt from ANR regulation as long the practice worked to reduce erosion hazards at the site without increasing erosion upstream or downstream.



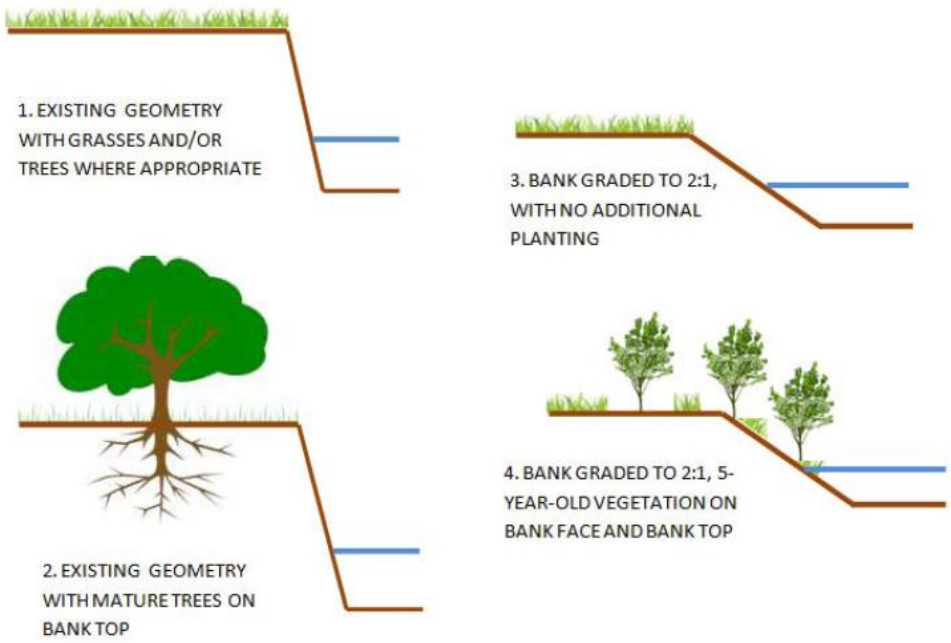
Technical and regulatory guidance for all of these practices are provided in the:

Stream Alteration Rules

Stream Alteration General Permit

Standard River Management Principles and Practices

Since 2006, the ANR has works with dozens of farmers in Vermont to purchase River Corridor Easements – at high deposition locations where the farmer has an intractable conflict with the river processes and the surrounding lands and community would benefit from the river having the ability to expend energy and store sediment at this particular location, the ANR will work with the land trust to purchase an easement from the landowner who can continue to farm the river corridor, but as a guest of the river. The cash helps the farmer make investments to make up for any lost production in the corridor and the river continues through the evolution process. Floodplain are created, erosion is reduces, and fine sediments/nutrients are stored.



Bank grading with planting will yield far greater sediment / nutrient load reductions compared to grading / no planting OR planting / no grading.

Local Flood Resiliency Case Studies

For the past 10 years Vermont ANR has been providing incentives in the form of technical and financial assistance to communities working on hazard mitigation plans and implementing hazard avoidance and mitigation projects. Vermont communities serving as case studies to explain how this work is being implementation would include:

Jeffersonville – Hazard mitigation planning and floodplain protection

Bristol – River corridor easement

Ripton – land use bylaw adoption, floodplain easements, river band and bed stabilization, and flood chute restoration

Bennington – land use bylaw adoption, major floodplain reconstruction with armored setback berms, stormwater remediation

1 to 2 page write-ups of these projects are provided as attachments to this testimony.