

Roots of Change: The Power of Live Staking and Bioengineering

ANJEC 6/3/26





Open Space Stewardship Grant

- Cost of the materials provided by ANJEC supporters and the Candace McKee Ashum Memorial Fund.
- Technical and education provided by Rutgers Green Infrastructure Program.



Grant Goals

- Demonstrate low-cost streambank restoration
- Educate residents about stormwater impacts
- Show how nature-based solutions can work locally
- Create a replicable municipal stewardship model
- Build community involvement



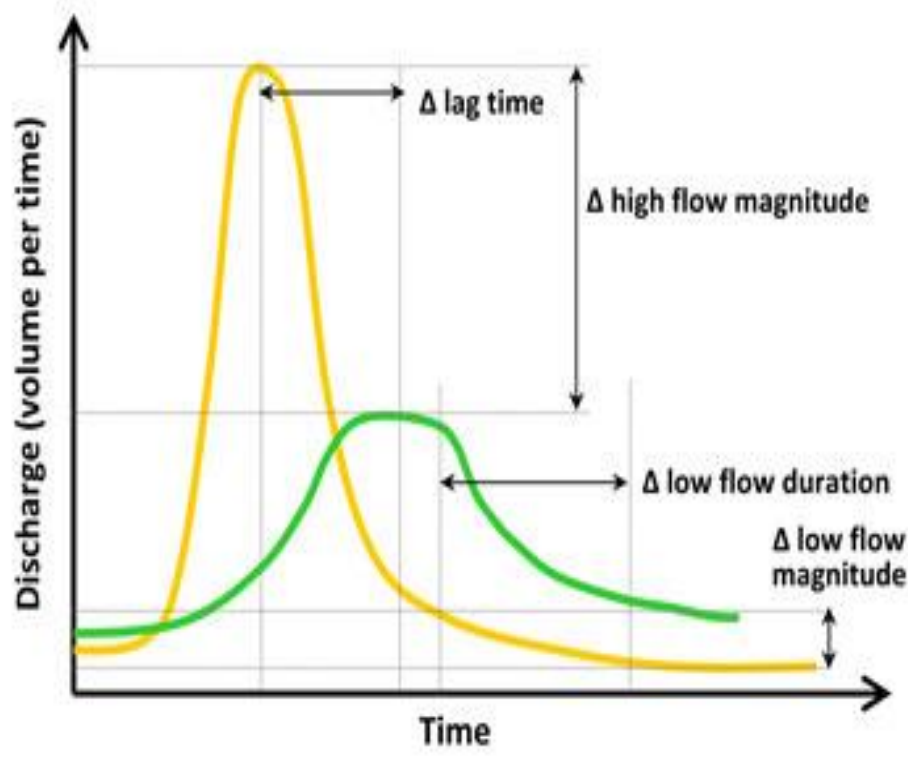
Problem



Problem



Causes



Increased precipitation due to climate change

Increased impervious surface due to development

More grey versus green infrastructure

Channelization of streams

Loss of Trees and vegetation

Poor soil controls during development

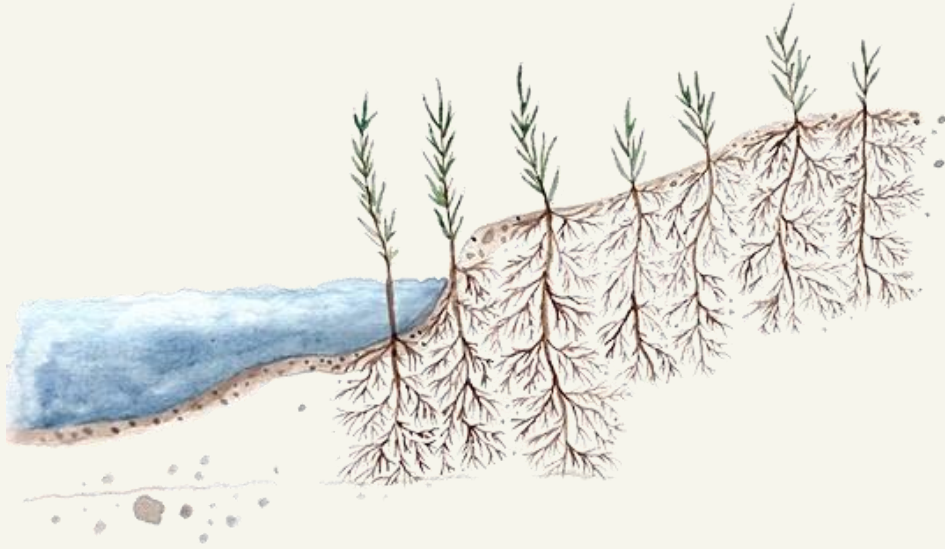
Increased velocity due to stormwater being managed for rate versus volume



Solution Bioengineering

**live and dead plant materials
in combination with natural
and synthetic support
materials for slope
stabilization, erosion
reduction, and vegetative
establishment.**

Why Nature-Based Infrastructure Matters



- Reduces erosion and sediment loading
- Helps slow and infiltrate stormwater
- Improves riparian habitat
- Lowers long-term maintenance costs
- Builds climate resilience
- Engages the community directly
- **Healthy riparian systems function as living infrastructure.**



Live Staking

Branch cuttings

Stabilizes banks

Restores riparian vegetation

Enhances wildlife

Scalable

Low cost

Community based

Minimal equipment required

Location

- Accessible
- Visible
- Not too unstable
- Moderate flow velocity
- Moist/wet soil



Materials



Dormant live stakes

Seeds (riparian native fast-blooming for visual impact, additional biodiversity)

Rebar for pilot holes

Mallets

Boots, gloves

Rakes/hoe/clippers

Volunteer Coordination

Stakes



Dormant Nov 1-April 30

Woody

Wet tolerant

Native Pioneer Species (Willows, shrubby dogwoods, alder, sycamore, spicebush, elderberry, buttonbush)

2-3 feet

5-7 nodes

Adventitious rooting

Organizing the Project

Municipal Approvals

Volunteer Recruitment

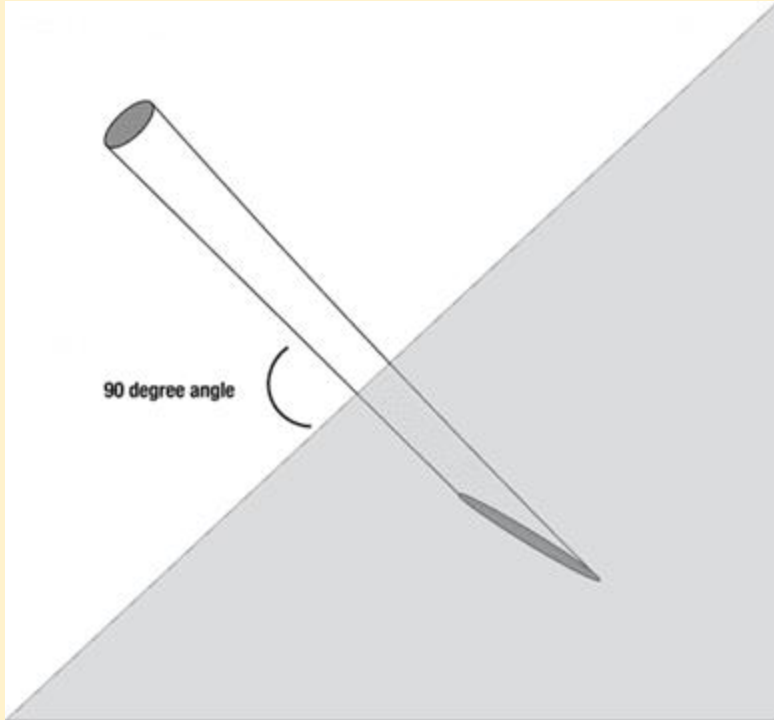
Public Education and Outreach

Liability Waivers

Photography & Documentation

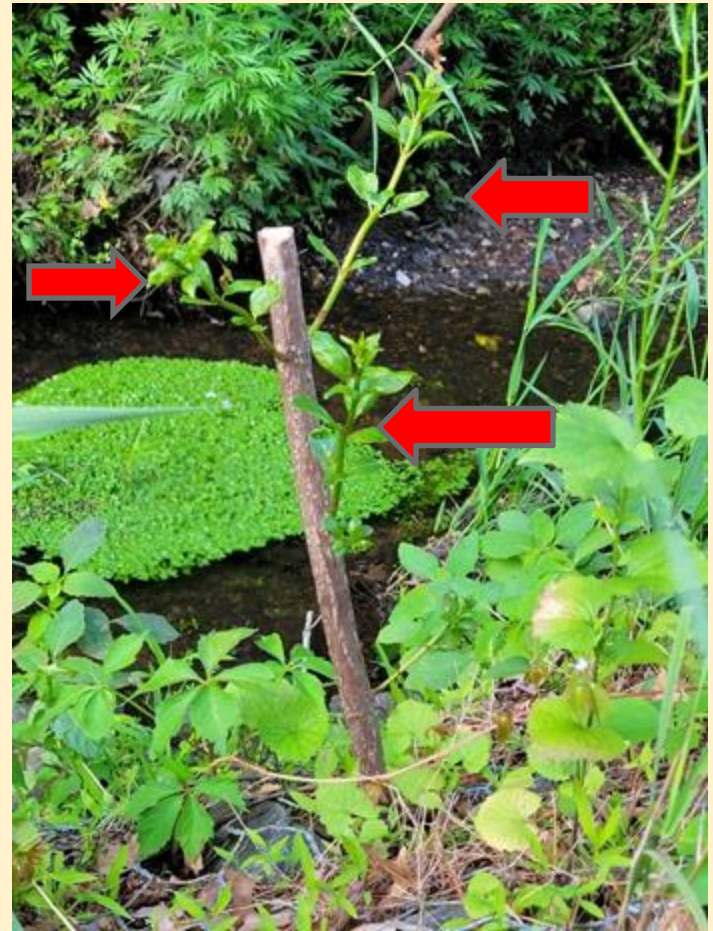


Do It



6 months Later...





One Year Later, Glenn Ave...



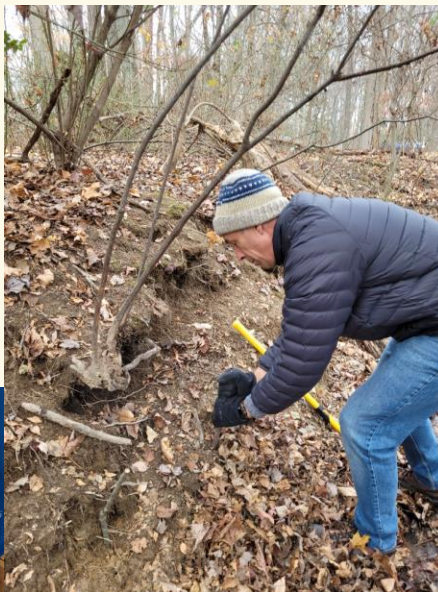
elderberry

Silky dogwood



elderberry

December, new site...



6 months later, new site...



← Row of stakes

← Budding stake



Visual assessment

- Increased vegetation establishment
- Reduced exposed soils
- Less visible scour and undercutting

Sediment & Water Quality

- Stabilized banks reduce sediment loading
- Reduced erosion supports stream health
- Supports municipal WIP/MS4 goals

$$\text{Sediment Prevented} = \frac{(L \times H \times R)}{27} \times \rho$$

Monitoring

- Water quality sampling

Evaluating Success



Water Quality and MS4

watershed-improvement-plan-project-selection-tool

10

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Projects	DO (BOD, COD)	E. Coli	Fecal Colifori	Flooding	Metals	PCBs	pH	TDI	Temperature	Total Nitrogen	Total Phosphorous	TSS	Turbidity	VOCs
1 Agricultural BMPs	x ¹⁹									x ^{3,8}	x ^{3,8}	x ^{3,8}	x ³	
2 Cluster and Concentrate				x ⁹						x ⁹	x ⁹	x ⁹		
3 Disconnect/Distribute/Decentralize				x ⁹					x ²²	x ⁹	x ⁹	x ⁹		
4 Green Parking					x ⁸					x ⁸	x ⁸	x ⁸		
5 Housekeeping Practices/Spill Prevention and Cleanup			x ¹⁸				x ^{22,23}	x ³			x ²²	x ^{2,22}	x ²²	
6 Illicit Connection/Dumping Controls			x ⁸		x ¹⁷					x ¹⁷		x ¹⁷		
7 Improved Source Control (Street Sweeping, Pet Waste, Fertilizer, Geese Management)	x ²⁰		x ⁸		x ^{8,22}	x ²⁵	x ²²			50% ⁹ , x ^{8,22}	85% ⁹ , x ⁸	85% ⁹ , x ^{8,22}	85% ⁹ , x ^{8,22}	
8 Pervious Paving			x ²	x ^{1,4,21,28}	98% ⁸ , x ^{2,17}		x ²³		x ^{2,13}	50-82% ^{1,8} , x ¹³	60-65% ^{1,8} , x ¹³	80-95% ^{1,8} , x ^{2,13}	x ¹³	
9 Protect Sensitive and Special Value Resources and Stream Bank Restoration				x ⁹						x ^{9,33,34,35}	x ^{9,33,34,35}	x ^{9,33,34,35}		
10 Public Education	x ¹⁶	x ¹⁶	x ¹⁶		x ¹⁶			x ⁵		x ¹⁶	x ¹⁶	x ¹⁶		
11 Rain Gardens/Rain Barrels				x ^{9,21}					x ¹³	100% ²¹ , x ^{8,13}	100% ²¹ , x ^{8,13}	100% ²¹ , x ^{8,13}	x ¹³	
12 Street/Storm Drain Maintenance						x ²³		x ³		x ⁸	x ⁸	x ^{3,8}		
13 Tree and Vegetative Planting				x ²⁹	40-54% ⁶				x ¹¹	38-65% ⁶ , x ¹³	50-80% ⁶ , x ¹³	80-90% ⁶ , x ¹³	x ¹³	
14 Bioretention Systems		x ²⁴	35% ³² , x ²	x ^{1,4,9}	40-90% ¹² , x ^{2,27}	x ²⁸				30-50% ^{1,2,12} , x ⁵	30-90% ^{1,2,12} , x ^{4,5}	80-90% ^{1,12}	x ²	x ²⁷
15 Blue Roofs				x ¹					x ¹⁰					
16 Extended Detention Basins	x ²²		<10% ¹² , x ¹	x ^{1,4,28}	30-50% ¹² , x ²	x ²⁸			x ²	15-50% ^{1,9,12}	10-40% ^{1,9,12}	40-60% ^{1,9,12} , x ^{2,22}	x ²²	
17 Grass Swales			x ²	x ²⁸	x ^{2,27}	x ²⁸				92% ²	83% ² , x ²²	50-93% ^{1,3,12} , x ^{2,22}	x ²²	x ²⁷
18 Green Roofs			x ²	x ^{1,9}	x ²				x ^{2,13}	x ¹³	x ¹³	80% ¹ , x ^{2,13}	x ¹³	
19 Infiltration Basins/Trenches	70-90% ²¹ , x ²²		90-100% ^{8,12,32} , x ²	x ^{1,4,9,21}	85%-99% ^{4,8,12,21} , x ²	x ²⁸			x ^{2,13}	30-70% ^{1,8,9,12,21} , x ^{8,13}	60-100% ^{1,8,9,12,21} , x ^{4,13}	80-85% ^{1,9,12} , x ^{2,13}	x ¹³	
20 Manufactured Treatment Devices (MTDs)					x ¹⁵					x ¹	x ¹	50-80% ¹ , x ¹⁵		
21											

Maintenance



Native Plant ID & Protection Guide – Streambank Restoration Zone

Department of Public Works

PDF to be laminated and distributed to field teams for quick reference during vegetation management

Vegetation Management Best Practices

Preventive Mowing — Avoid Frequent or Blanket Mowing

- When: Mow only 1–2 times per year, preferably:
 - Late Fall (Late Oct – Early Nov): After first frost, plants dormant, reduces seed spread
 - Early Spring (Late Mar – Early Apr): Before growing season, controls invasive plants
- Where: Narrow strips along access paths or problematic areas, not entire streambank
- How: Remove invasive/noxious plants, open sightlines, reduce tall weeds, leave native deep-rooted plants intact for bank stabilization
- Avoid mowing during active growth (late spring to summer) to protect wildlife and plant health

Additional Best Practices

- Maintain Native Vegetation Buffers: Preserve or restore native grasses, shrubs, trees for root structure, erosion control, habitat, and water quality
- Control Invasive Species: Use targeted removal (manual or spot herbicide as appropriate)
- Community Engagement: Educate residents on importance of vegetated streambanks for erosion control and ecosystem health

What Not to Cut or Remove

Seeded Live Stakes (DO NOT CUT or REMOVE)

Plant	Identification Features	Flag Color
Elderberry (<i>Sambucus canadensis</i>)	Opposite compound leaves; white summer flower clusters; soft stems; moist soils	Blue or Green tape

Plant	Identification Features	Flag Color
Buttonbush (<i>Cephalanthus occidentalis</i>)	Round white flower balls; glossy leaves; wet zones; excellent pollinator	Blue or Green tape
Silky Dogwood (<i>Cornus amomum</i>)	Red stems; opposite leaves; white flowers in spring; stabilizes streambanks	Blue or Green tape

Seeded Native Plant Mixes (DO NOT MOW or TRIM)

- **Riparian Buffer Mix (ERNMX-180):**
Elymus riparius (Riverbank wild rye), *Carex vulpinoidea* (Fox sedge), Verbena hastata (Blue vervain)
- **Floodplain Pollinator Mix (ERNMX-181):**
Asclepias incarnata (Swamp milkweed), Monarda fistulosa (Wild bergamot), Rudbeckia laciniata (Cutleaf coneflower)
- **Wetland Meadow Mix (FAWC):**
Carex stricta (Tussock sedge), Eupatorium maculatum (Joe-Pye weed), Lobelia cardinalis (Cardinal flower)

Other Plants Not to Cut

- Flowering native forbs (milkweed, vervain, coneflower)
- Native sedges and grasses
- Any seeded restoration zones marked on map or flagged

3. Visual ID Guide (Images for Reference)

NATIVE DO NOT REMOVE:



Button Bush



Silky Dogwood



Elderberry (flowering)



Elderberry (fruiting)

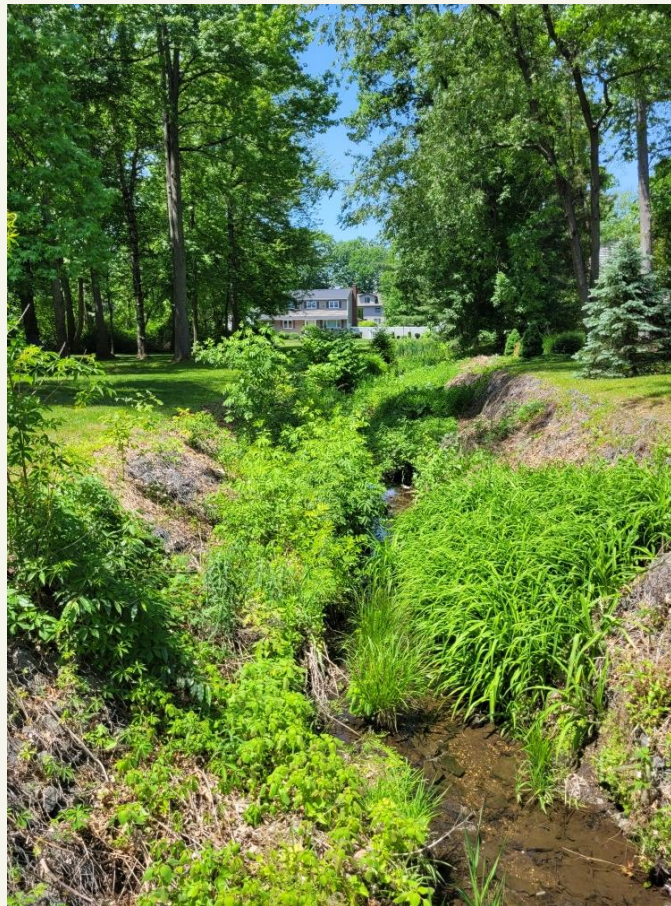
What Next



- Additional live staking projects
- Volunteer training
- Environmental Commission toolkit
- Continued monitoring
- Expanded watershed stewardship

Lessons Learned

- Start with a highly visible demonstration site
- Start small and build momentum
- Coordinate early with DPW and the municipal engineer
- Harvest stakes during dormancy
- Moist soils are critical for success
- Follow-up watering/maintenance matters
- Signage matters



Summary

- Live staking is a low-cost, scalable bioengineering technique
- Small projects can produce meaningful watershed benefits
- Community stewardship can support municipal restoration goals
- Native vegetation helps stabilize streambanks and improve habitat
- Small projects become powerful when repeated across watersheds
- Part of overall strategy: update stormwater regulations, increase trees and vegetation, protect floodplains and buffers.



Resources

<https://www.ernstseed.com/>

<https://directives.nrcs.usda.gov/sites/default/files2/1712930924/31800.pdf>

<https://extension.psu.edu/live-staking-for-stream-restoration>

<https://www.allianceforthebay.org/2019/03/live-staking-a-trusty-technique-for-planting-trees-and-shrubs-on-the-cheap/>

<http://water.rutgers.edu/>

(Microsoft Word - EPD Web Version Streambank and Shoreline Stabilization Docu\205)

<https://dep.nj.gov/stormwater/>

Live Staking Student Interview:

<https://www.youtube.com/watch?v=raRvzSmYylc>

A River Runs Through It:

<https://www.youtube.com/watch?v=ELS3ez7rb4s&t=162s>

Watershed Institute Stream Restoration:

<https://www.youtube.com/watch?v=xLLkVUp5hJM&t=7s>

Title 210 – National Engineering Handbook



Part 650 Hydrology National Engineering Handbook

Chapter 16 Soil Bioengineering for Streambank and Shoreline Protection



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