Stream Restoration Approaches: A Contractor's Perspective

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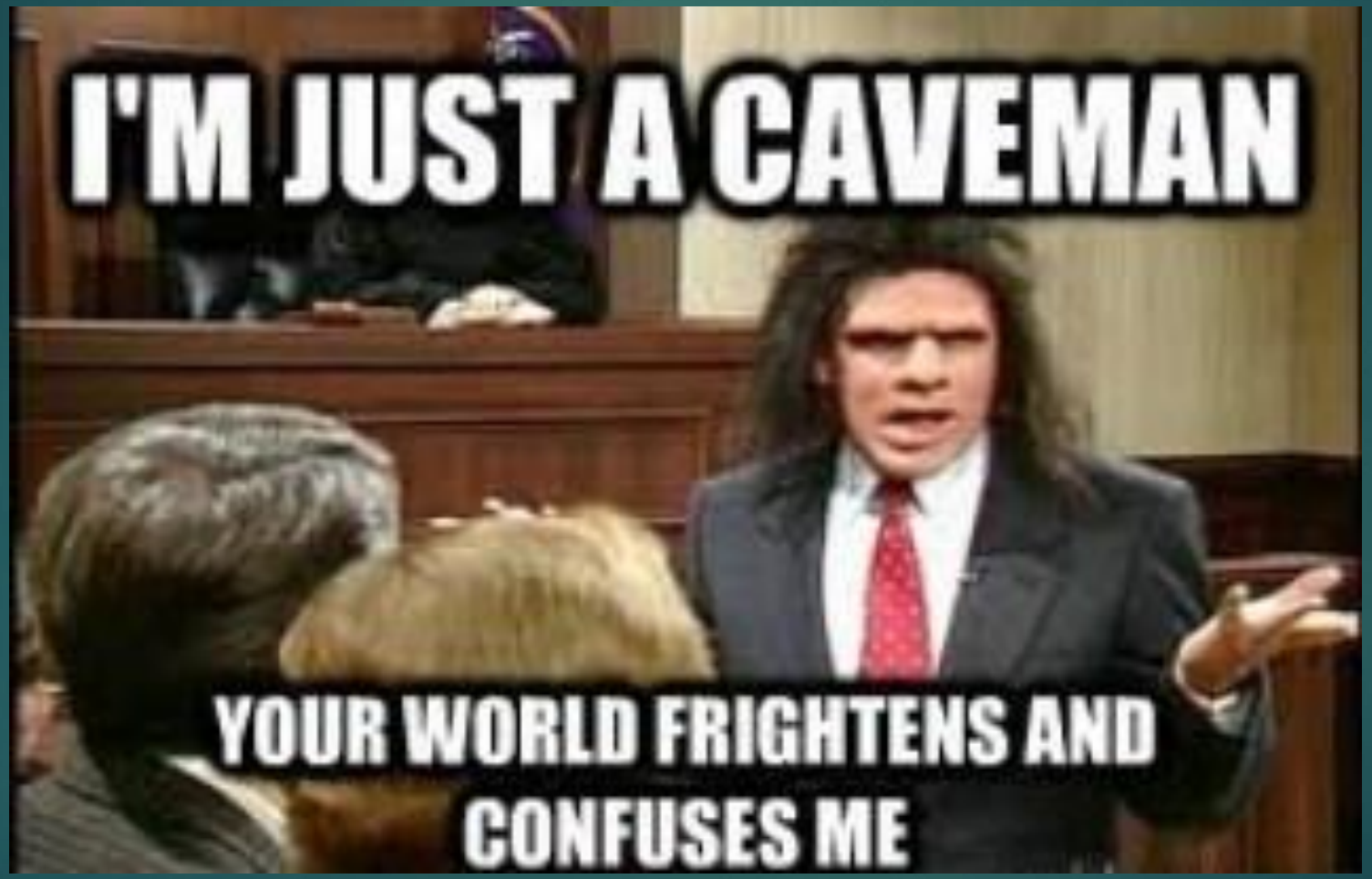
Why a Contractor's Perspective?



Workshop Flowpath:

Who is EQR?

What is stream restoration?

Why are we doing it?

How are streams restored?

What are the approaches?

Discussion of each approach: What, why, how, pros and cons?

What's next?

Who is EQR?

Stream and wetland restoration contractor in business for over 27 years.

Services:

Stream and Wetland Restoration, Native Vegetation, Reforestation, LID/Bioretention, Green Roofs, SWM and Living Shorelines.

Over 200 employees. All construction—NO DESIGN!

What is Stream Restoration?

- Stream restoration is the practice of improving the health of degraded, damaged, or destroyed riparian ecosystems through human intervention.
- Two types: Passive and Active
- Misnomer?

Stream Restoration Today

The modern stream restoration industry is:

New!

Few established traditions, norms, and scientific consensuses.

Big!

Employs 126,000 people across the country.

Local!

In the Mid-Atlantic, the ecological restoration industry employs thousands.

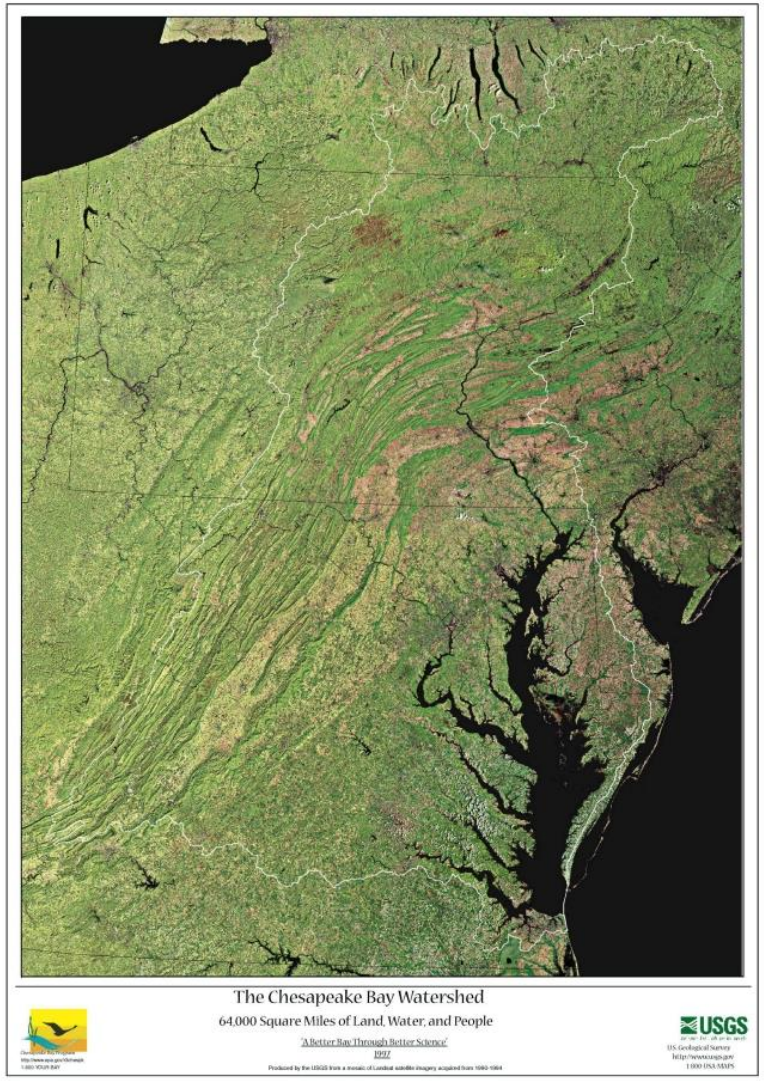
Fluid!

Continuously evolving design and contracting practices.

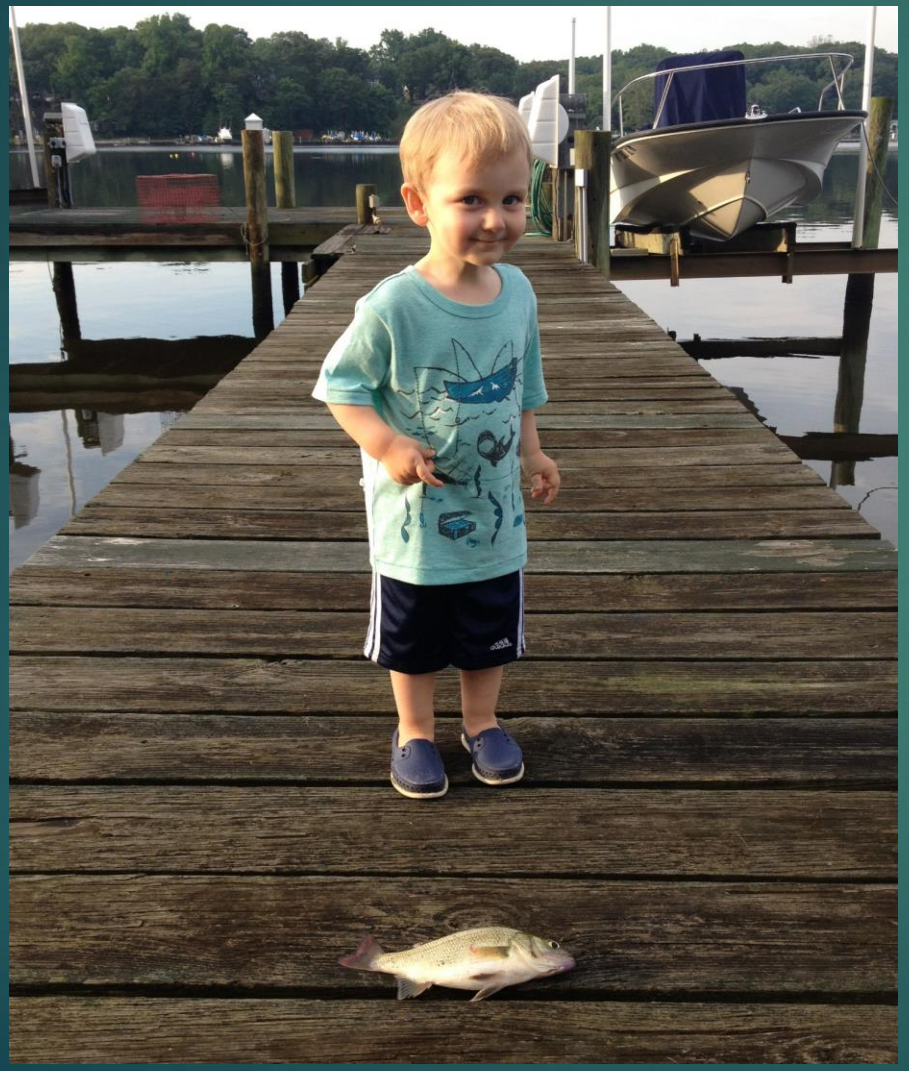
Stream Restoration: Why?

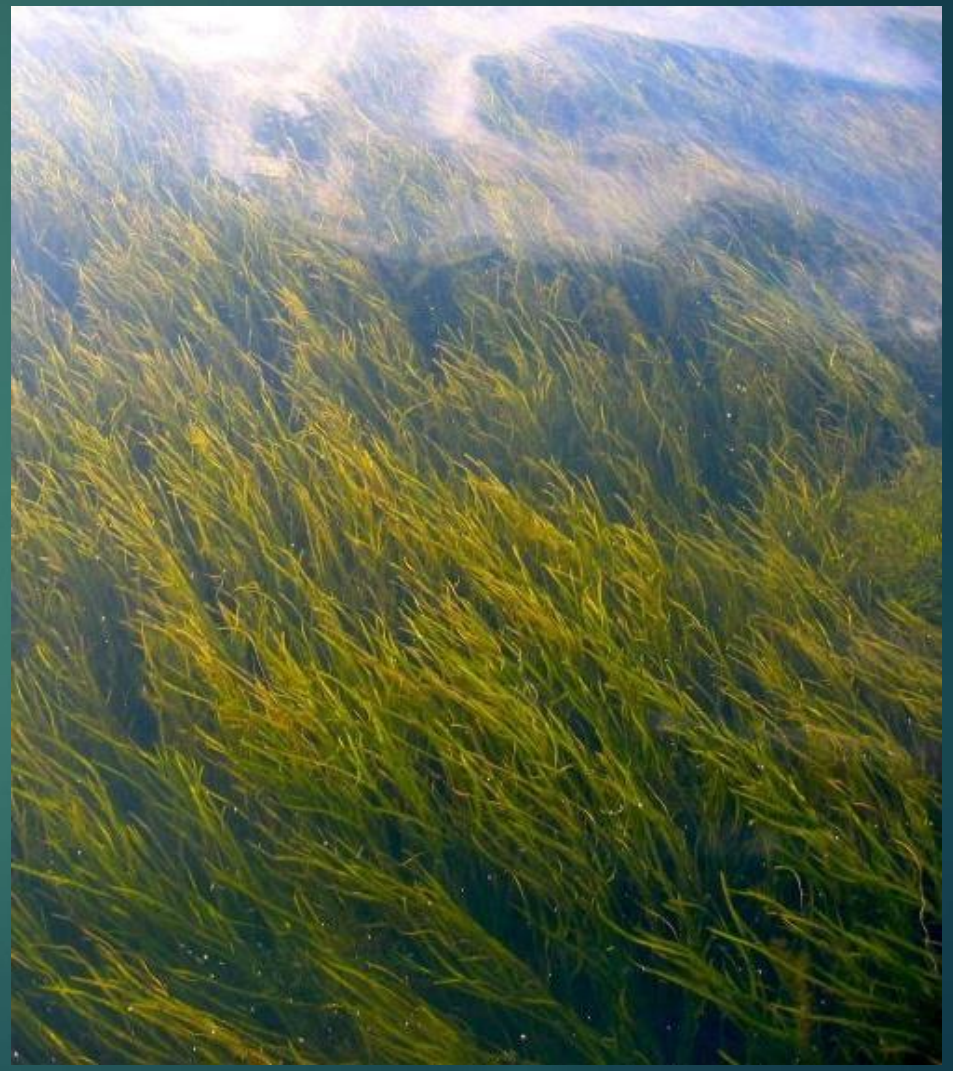



WHY? : THE BAY WATERSHED (OUR BACKYARD)



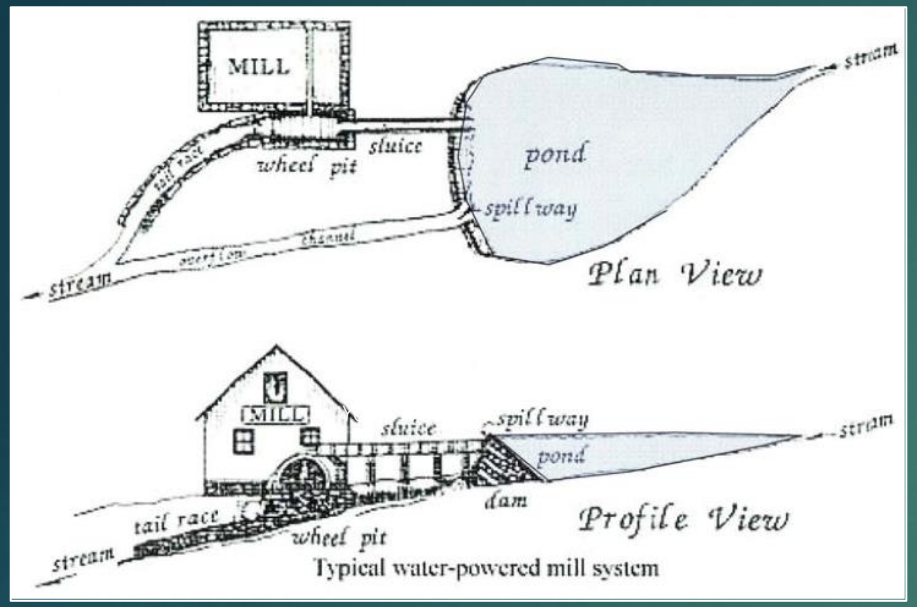
Why?: We have to try!

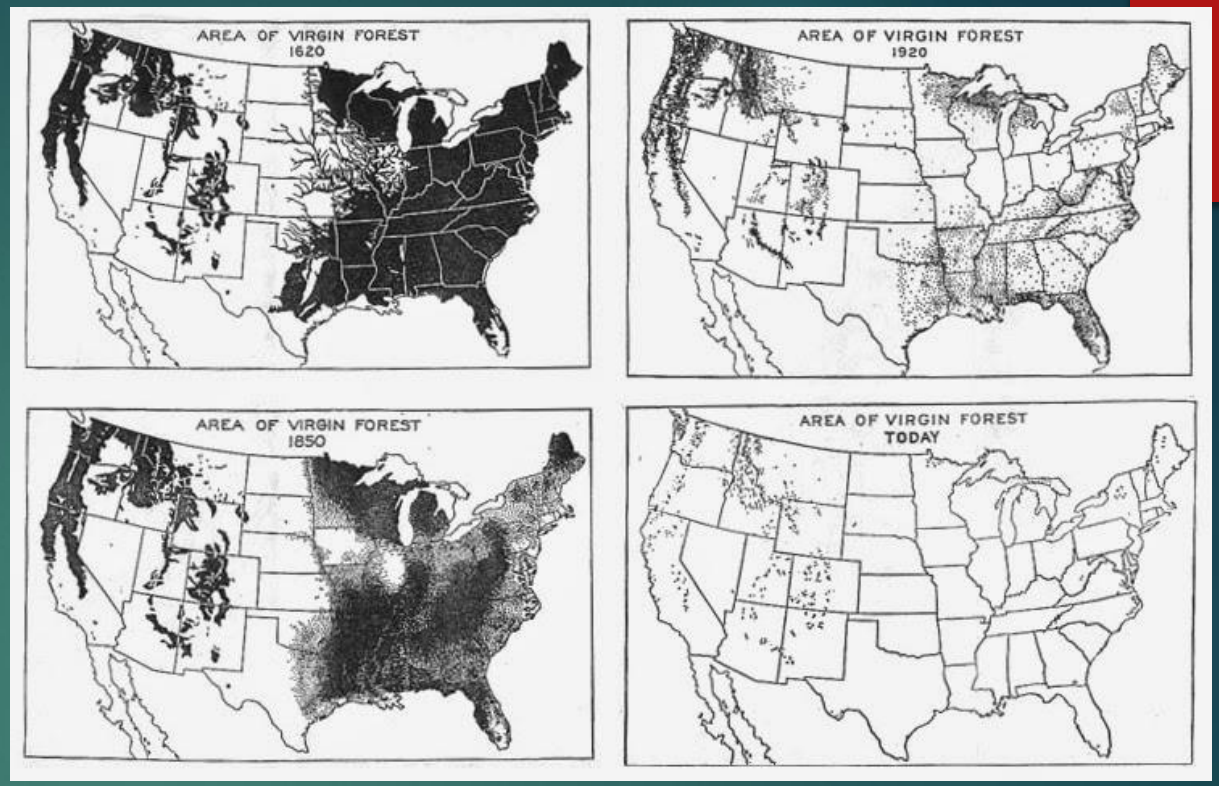


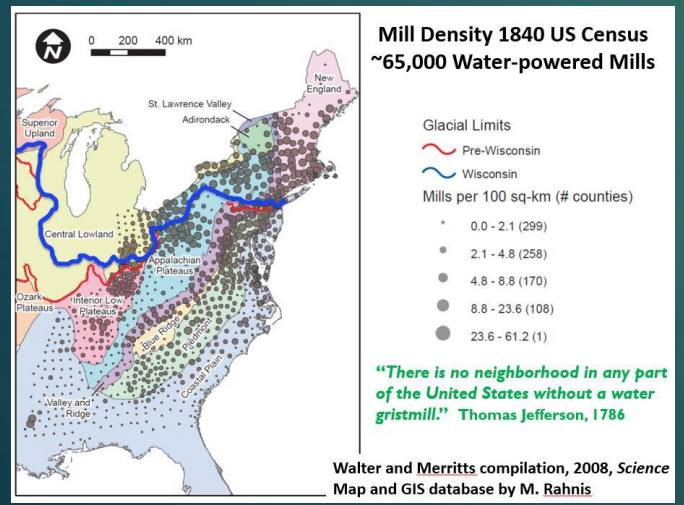


How did we get here?: A two-part destruction

Watershed Ruination: OLD







Mill Density 1840 US Census
~65,000 Water-powered Mills

Glacial Limits
Pre-Wisconsin
Wisconsin

Mills per 100 sq-km (# counties)
0.0 - 2.1 (299)
2.1 - 4.8 (258)
4.8 - 8.8 (170)
8.8 - 23.6 (108)
23.6 - 61.2 (1)

"There is no neighborhood in any part of the United States without a water gristmill." **Thomas Jefferson, 1786**

Walter and Merritts compilation, 2008, *Science*
Map and GIS database by M. Rahnis

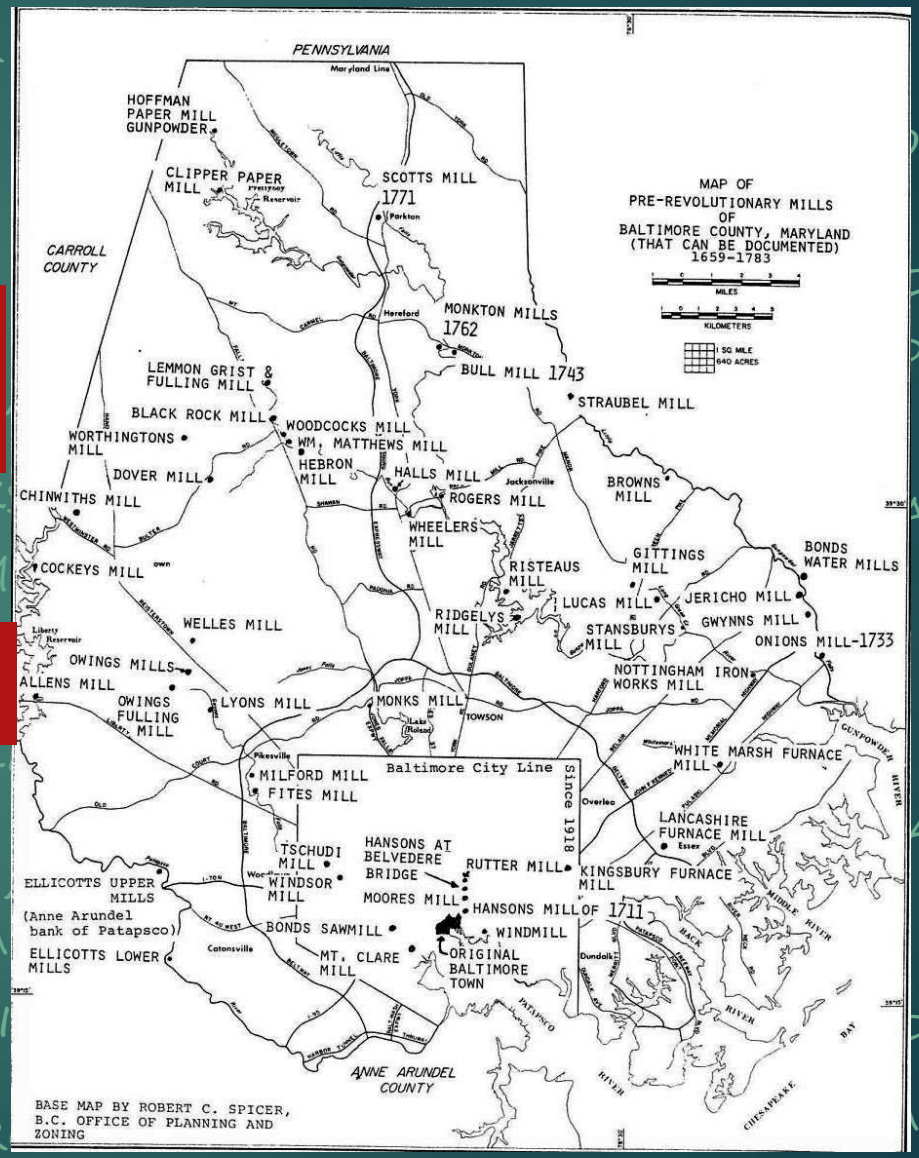
Images courtesy of JMT

Watershed Ruination: OLD- Mills Everywhere

365 Mills in & around Baltimore in 1820

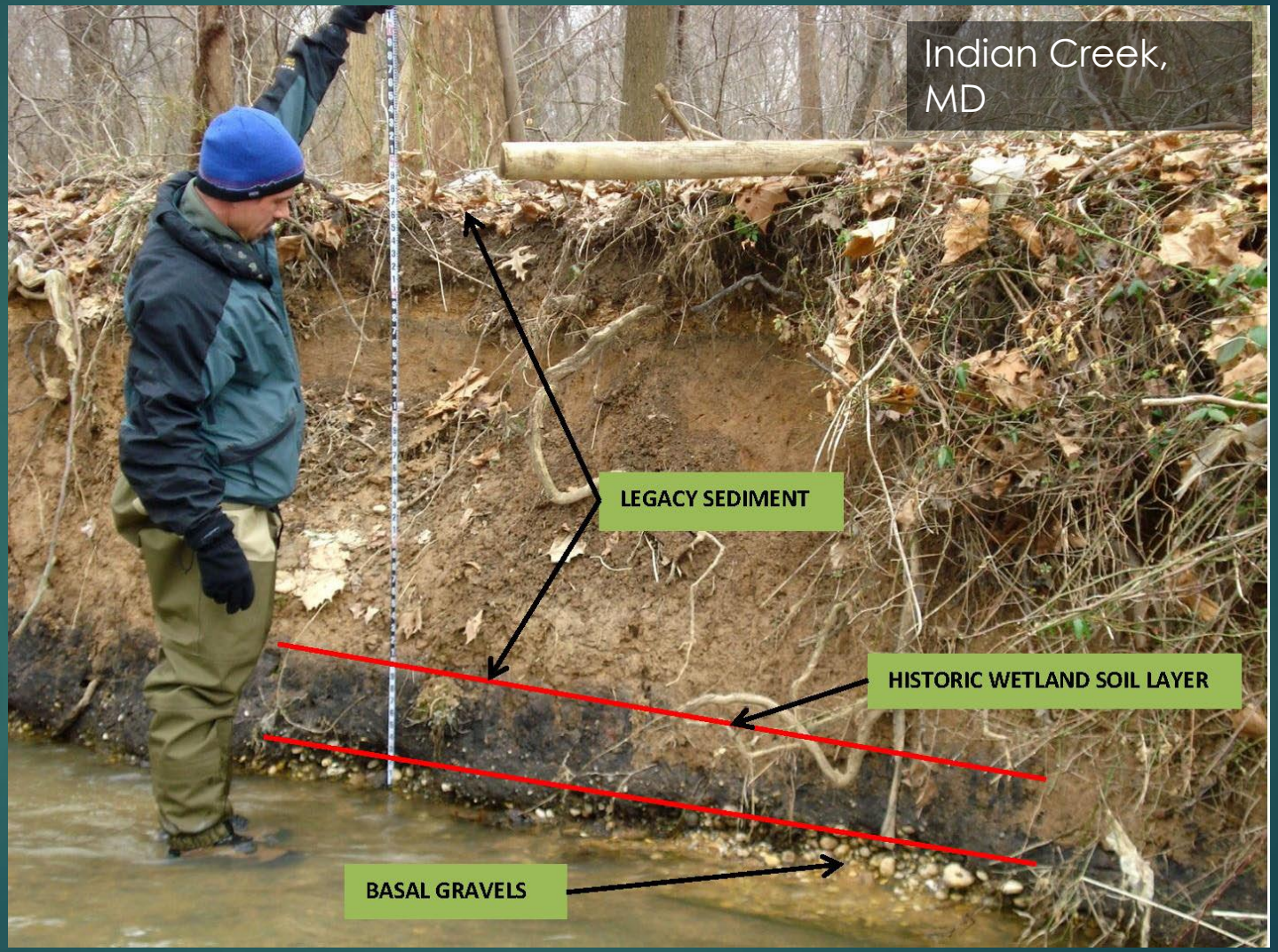
(John Scarf's, History of Baltimore City and Baltimore County)

Leading Flour Milling City in the World in 1820.



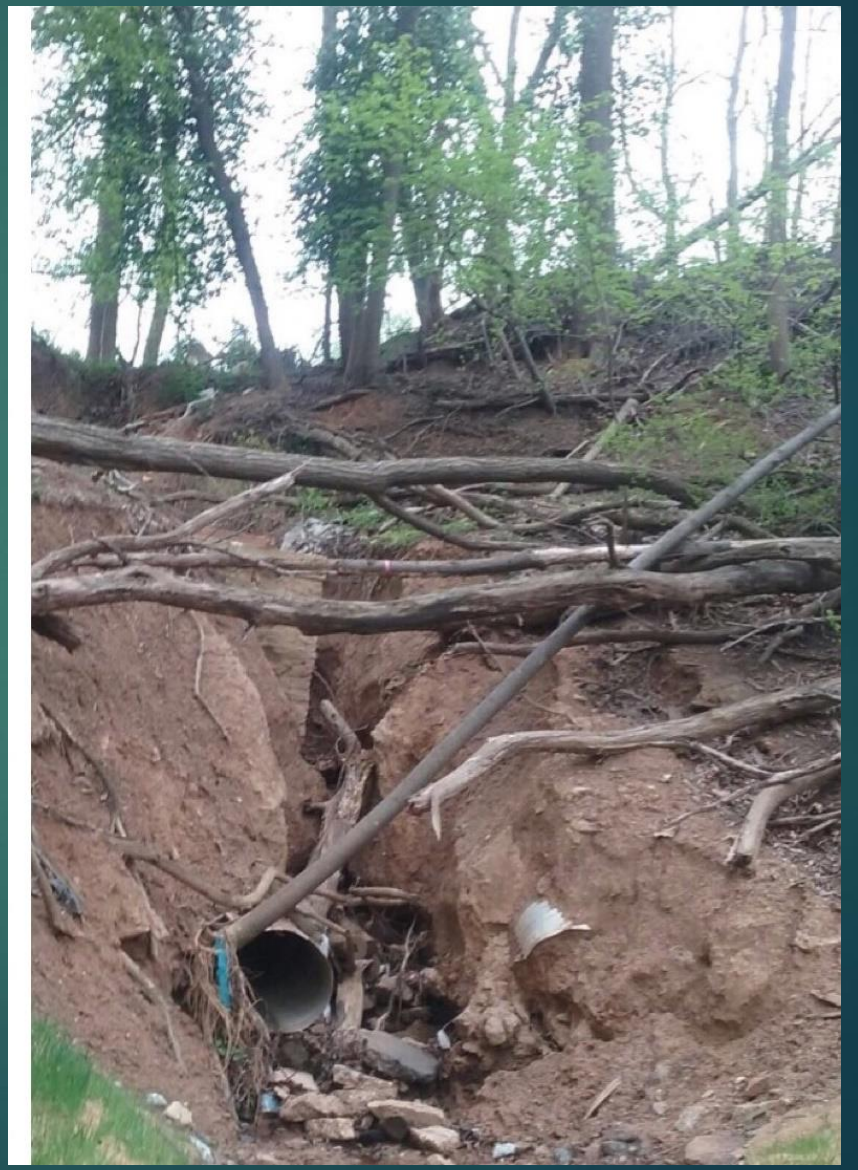
Images courtesy of JMT

Degradation- OLD

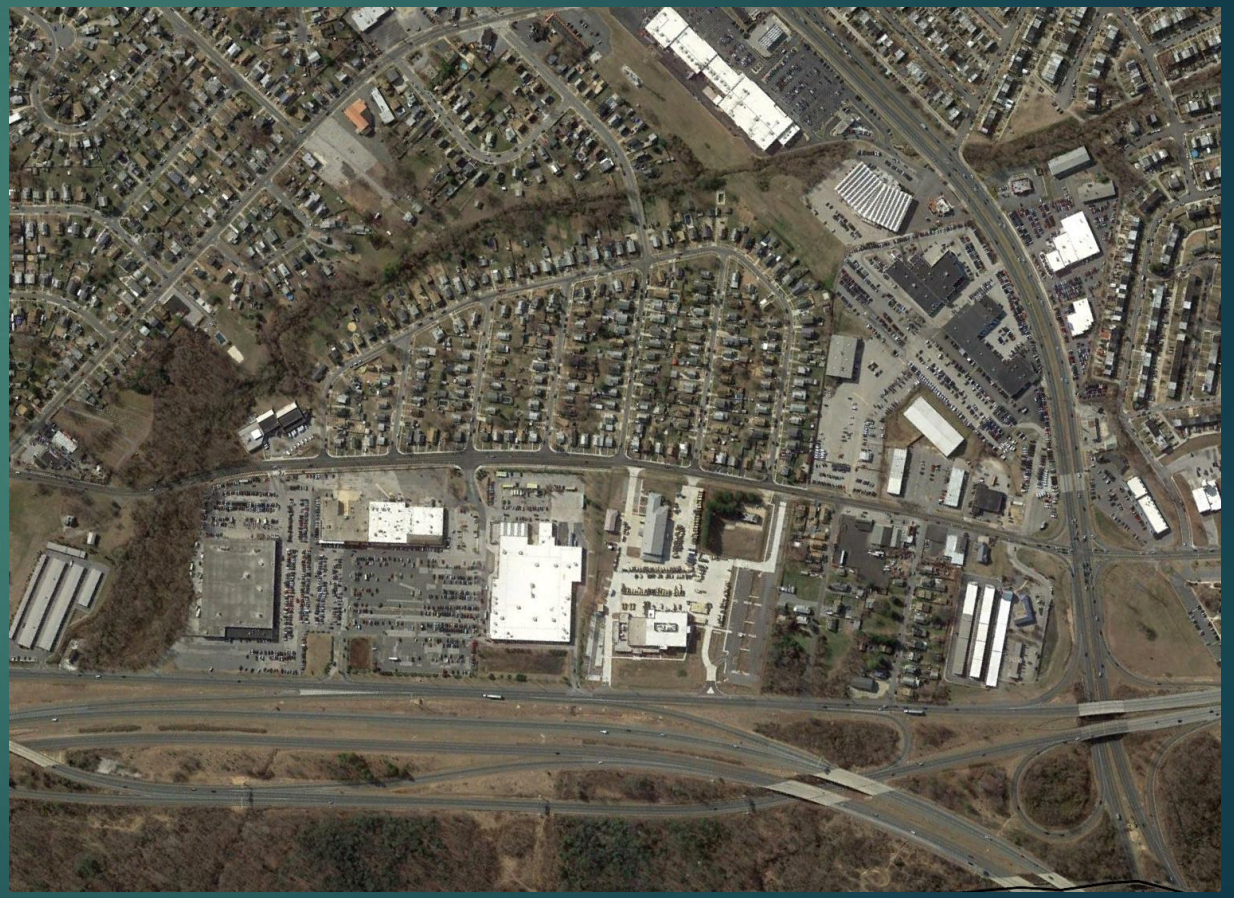


Images courtesy of JMT

Degradation- NEW: Urbanization



Deforestation (Round 2) and Watershed Hardening

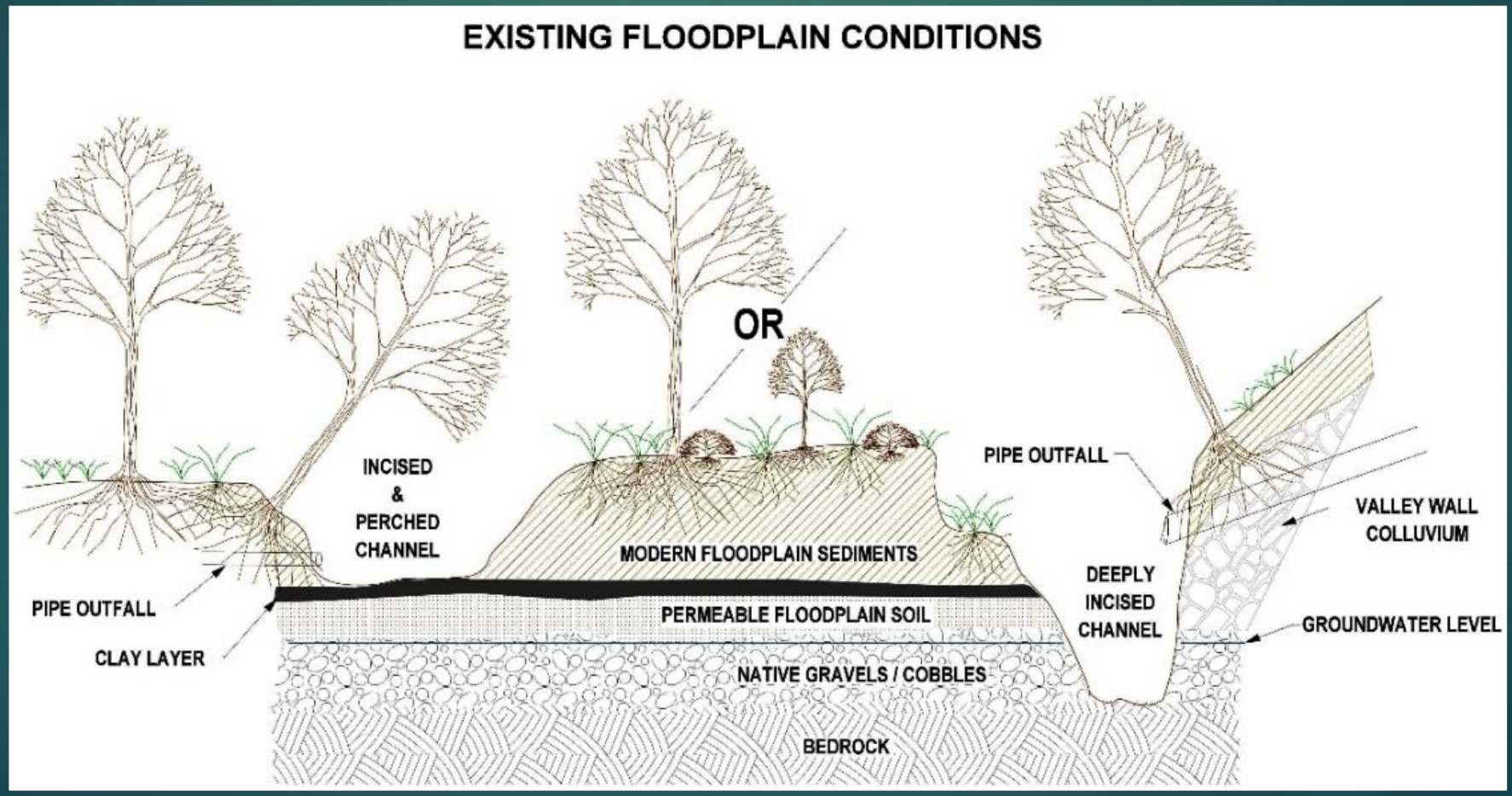


Unsustainable Land Management

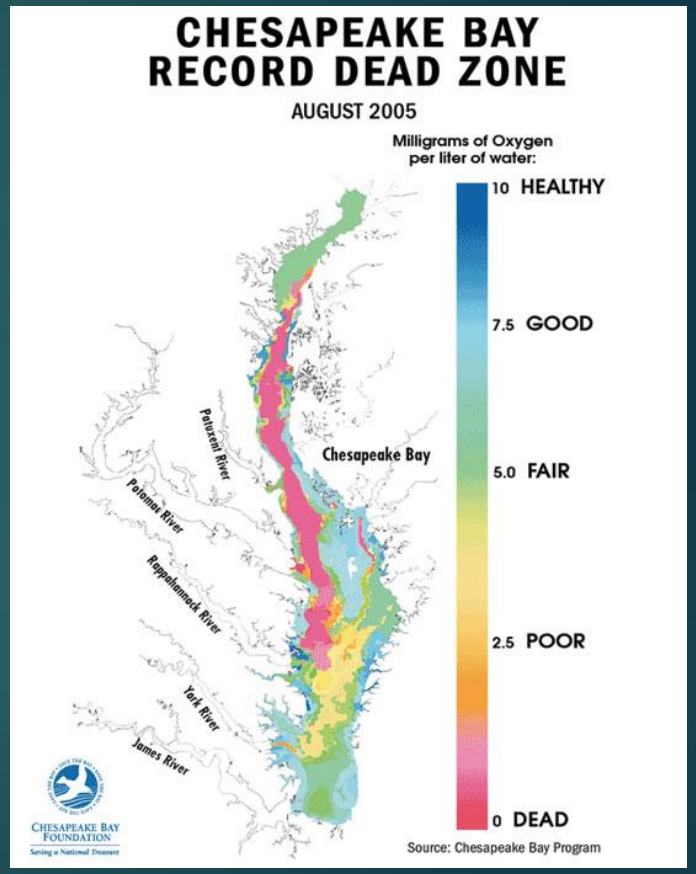
The Result?: Streams Don't Function

The Result?: Streams Don't Function

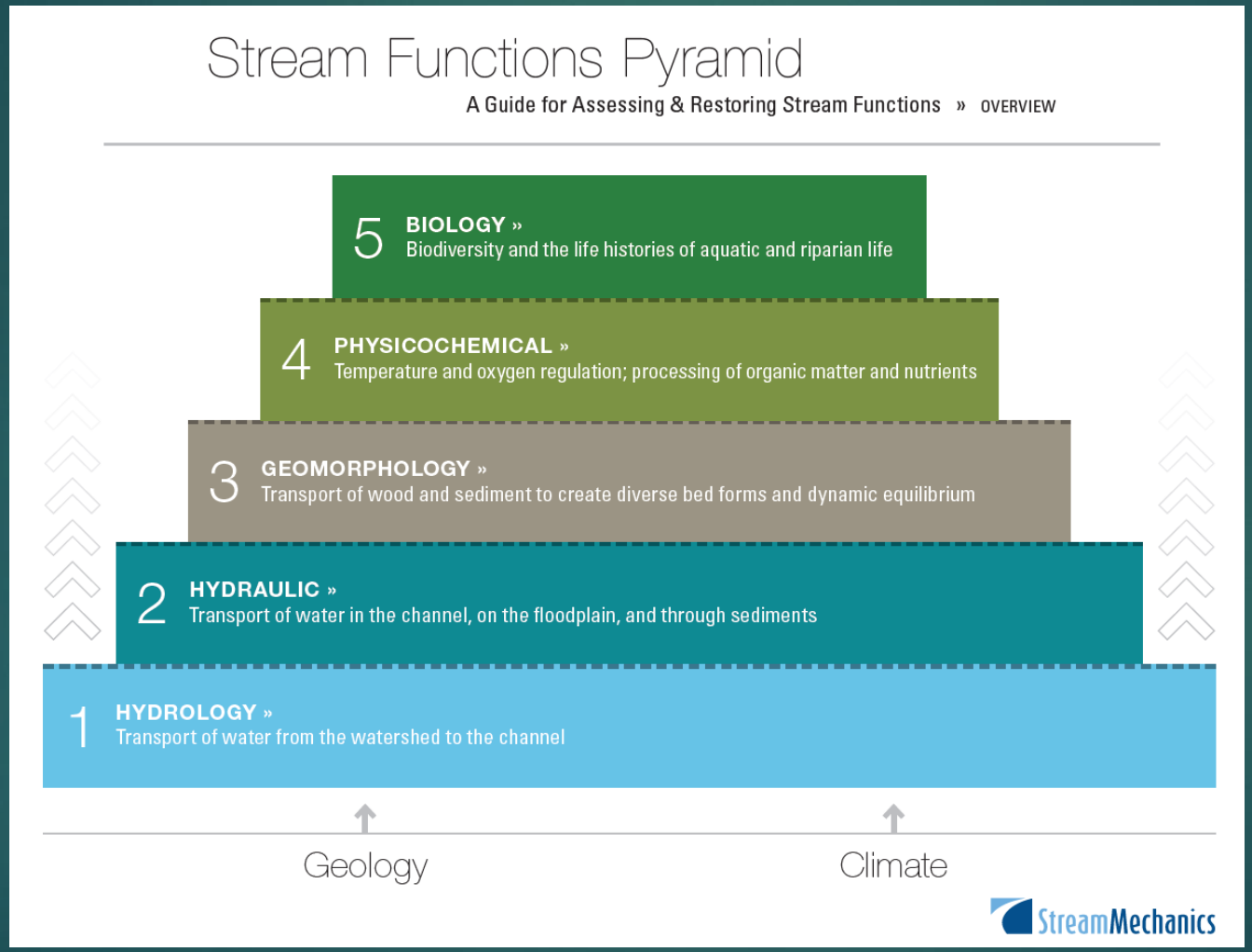
Floodplain Abandonment



The Result: The Bay Doesn't Function



How?: Stream Restoration Goals



Types of Restoration: Passive and Active

- Passive: Passive restoration involves use of minimalist methods to allow the stream channel and riparian corridor to repair itself (i.e. changing land management techniques to focus on improved stream ecology).
- Active: Active restoration is high impact channel and riparian corridor manipulation in attempt to create and maintain stable channel morphology.

Passive Stream Restoration Approaches:

- Exclusion of livestock
- Riparian corridor protection which allows for re-establishment
- Reforestation and buffer establishment
- Beaver Dam Analogues (BDAs)/ Beaver Recruitment

Beaver Dam Analogues (BDAs)

- Commonly employed in the PNW
- Mimicry of beaver dams to simulate hydrologic conditions
- Logs and Sticks!
- Requires recruitment of beaver OR constant human maintenance to sustain.

Beaver Dam Analogues (BDAs): Pros

- Rodent Labor is CHEAP!
- Minimal initial disturbance
- Very easy to build
- Can promote beneficial hydrologic conditions and increase adjacent wetlands.

Beaver Dam Analogues (BDAs): Cons

- Rodent Labor is FICKLE!
- Not stable long term- requires human or rodent maintenance
- Human Conflicts
- Infrastructure conflicts
- Doesn't address underlying conditions

Active Approaches: Back to humans

- Natural Channel Design/Rosgen (NCD)
- Regenerative Stormwater Conveyance (RSC)
- Valley Restoration/Legacy Sediment Removal (LSR)

Natural Channel Design (NCD) / Rosgen

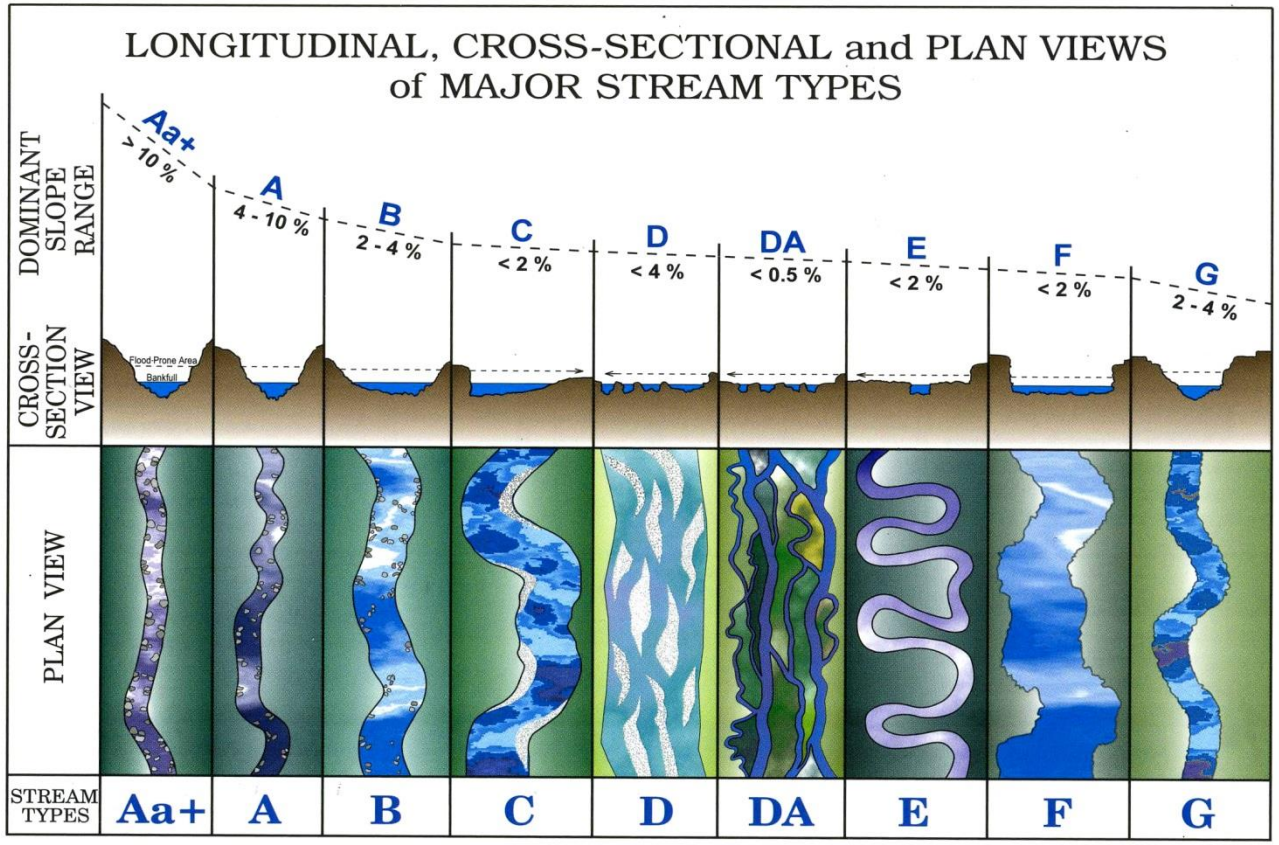


Figure 1-1. Broad-level stream classification delineation showing longitudinal, cross-sectional and plan views of major stream types (Rosgen, 1994, 1996).

- Stream Classification System
- Assessment and Predication System
- Focus on key stream characteristics:
  - Width/depth ration
  - Slope
  - Entrenchment
  - Sinuosity
  - Channel Material
- Toolkit of engineered structures:
  - Cross Vanes
  - J-hooks
  - Toe-wood
  - Log Vanes

NCD/Rosgen in Action

NCD
In Action

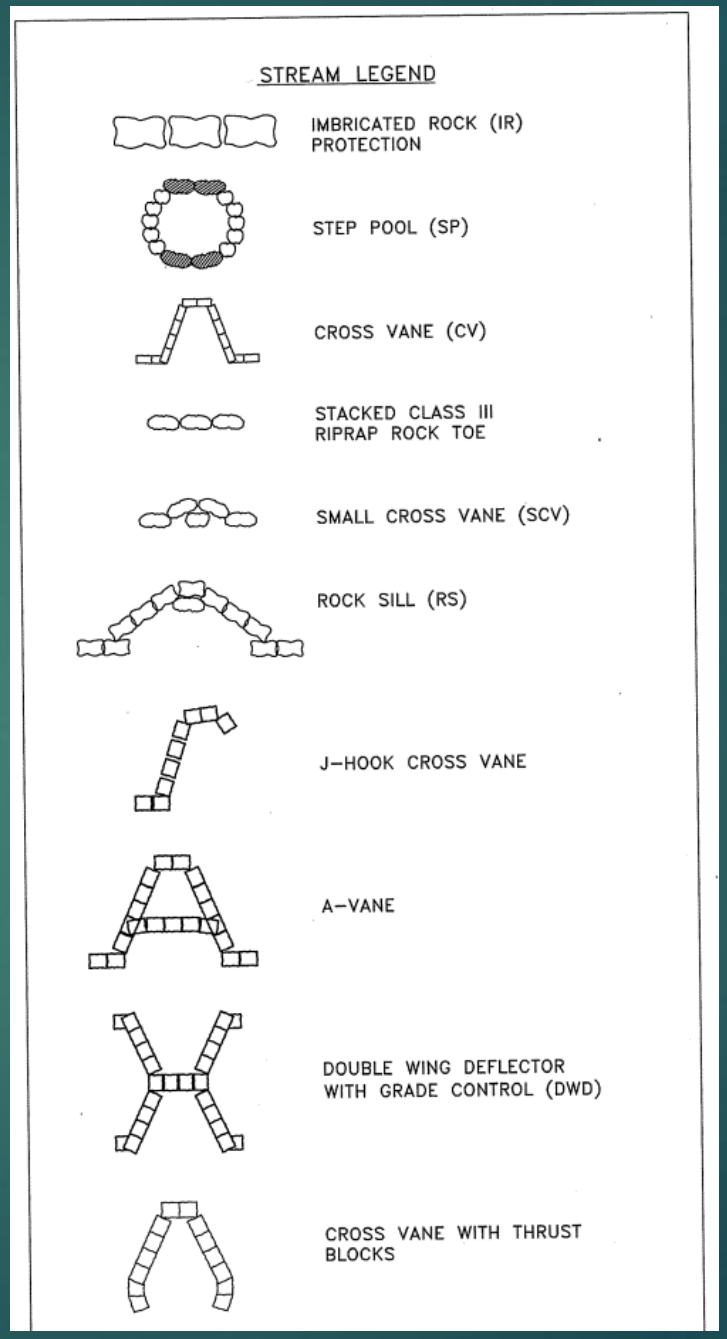
NCD
In Action

Pros:

- Solid framework for classification of streams and tools for restoration
- Stability of structures, tried and true methods
- Most widespread (national) consensus

Cons:

- Misunderstood?
- Overreliance on bankfull calculation?
- Constructibility in urban environments.
- Can lead to excessive stone use– expensive!

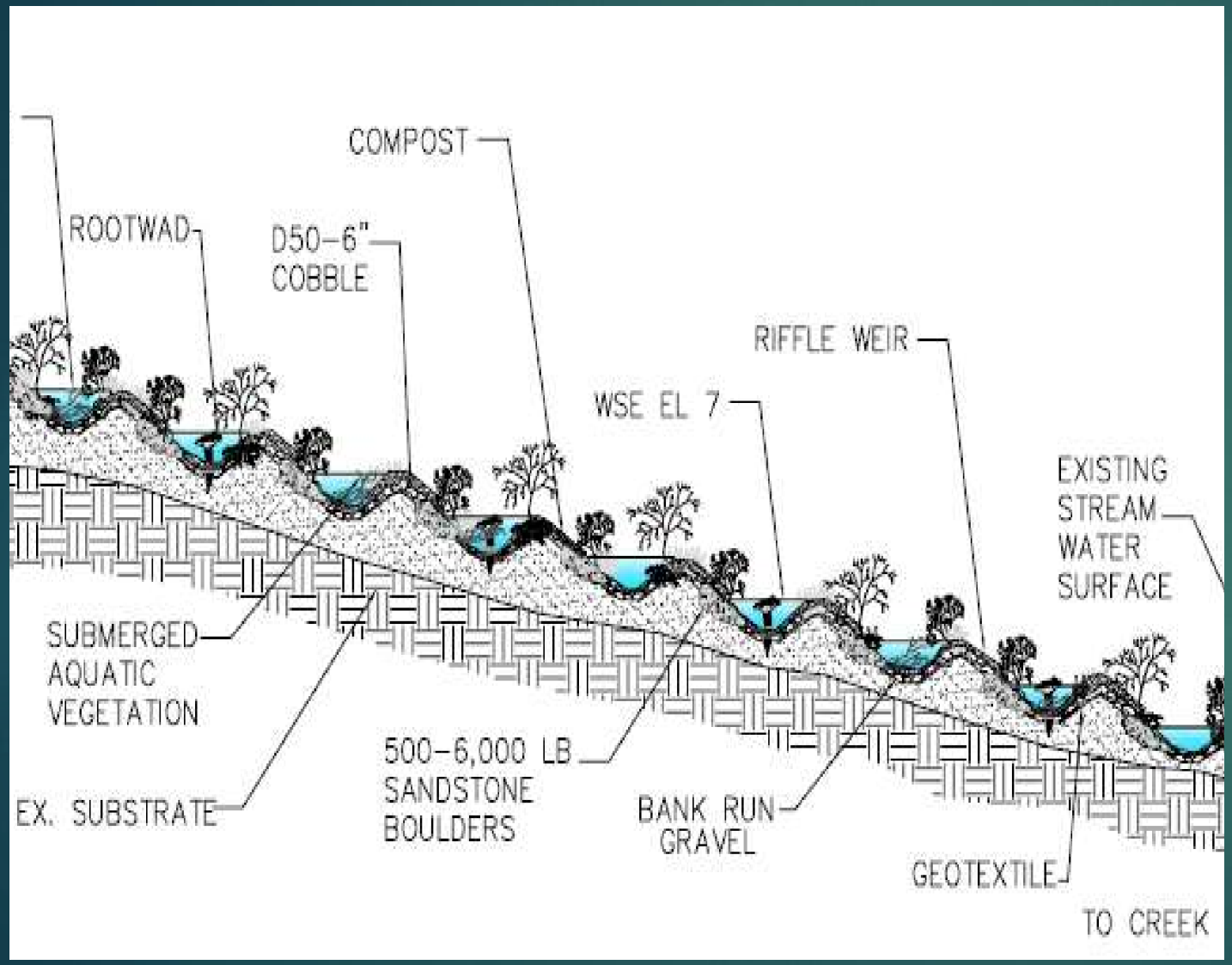


Regenerative Stormwater Conveyance (RSC)

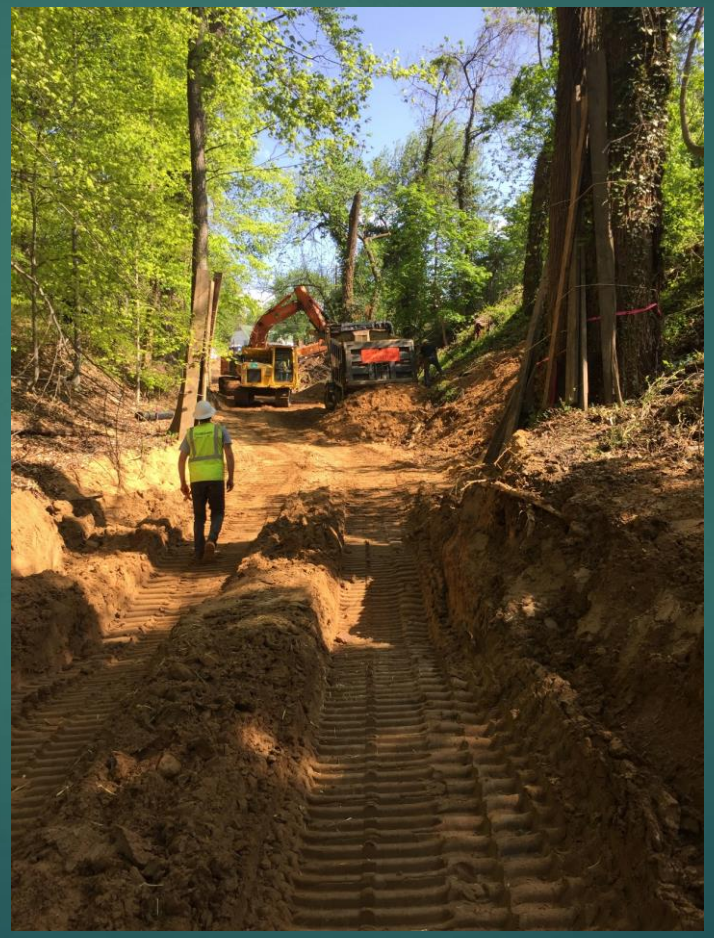
Regenerative Stormwater Conveyance (RSC)

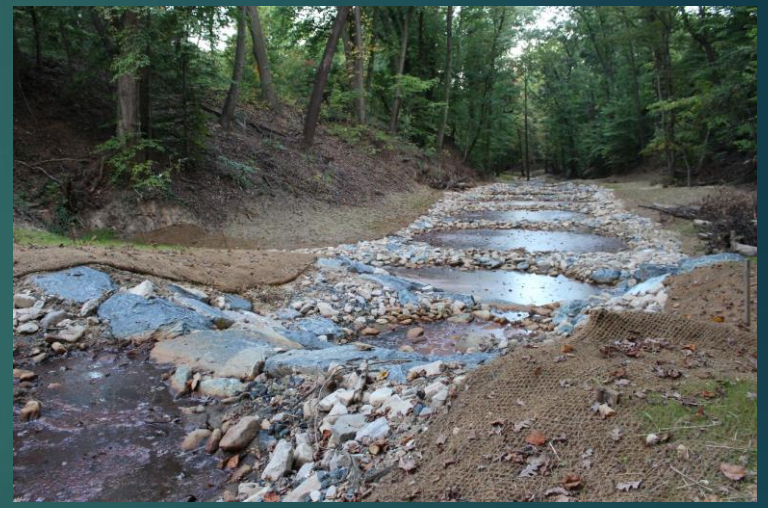
- Homegrown Restoration Approach!
- Focus on groundwater connectivity:
  - Continuous Sand/Woodchip Seam
  - Weir/Pool Sequence
  - Sand Berms
  - Elevate the water table
- Toolkit:
  - Sand fill
  - Riffle/Pool Sequences
  - Cascade Sequences
  - Heavy Organics: Wood chips, Rootwads, Compost

RSC: Riffle/Pool Sequence



RSC: Construction





Pros:

- Ephemeral Gully Solution
- Constructability
- Native Materials
- Aesthetically Pleasing
- Instant Gratification!

Cons:

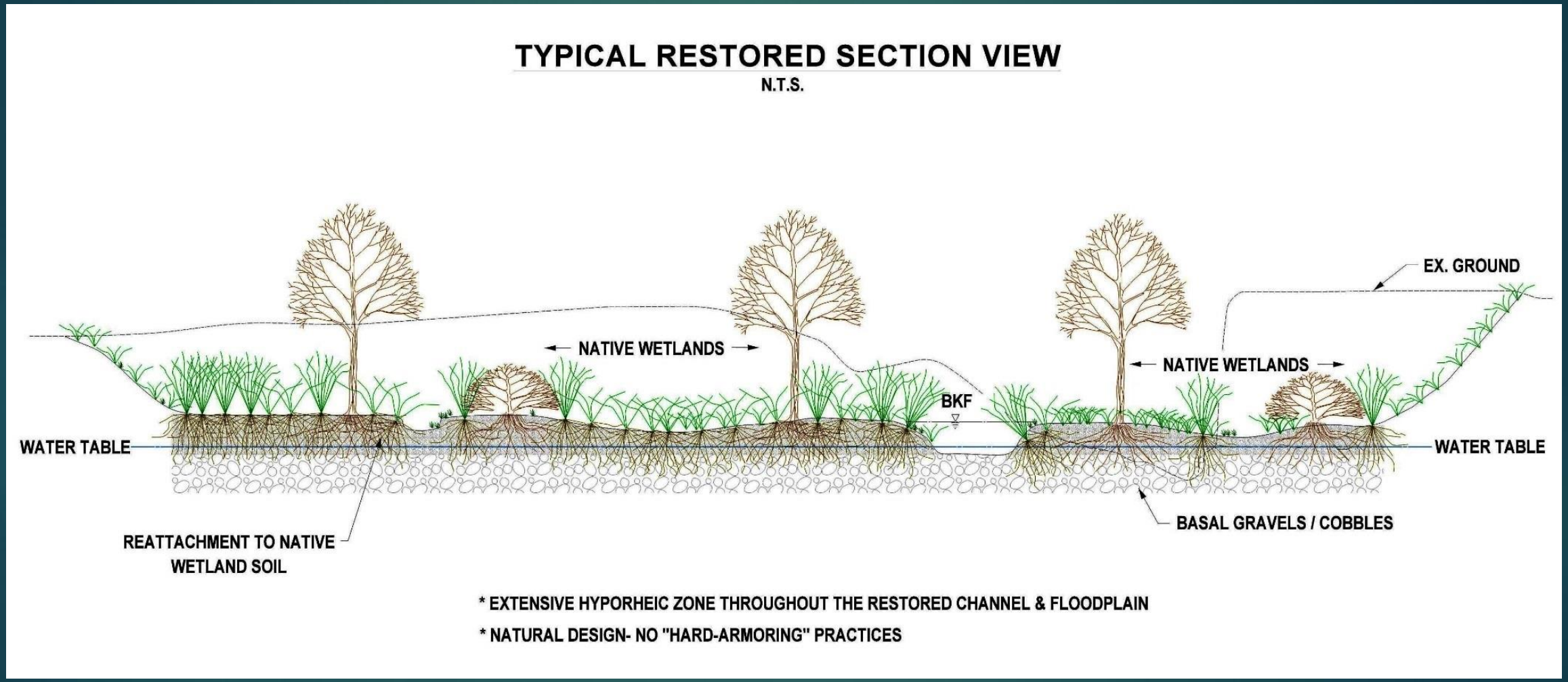
- Sand is erosive!
- Dewatering in High Flows
- Collateral Tree Loss
- Material Availability
- Long-term stability?

Legacy Sediment Removal (LSR) / Valley Restoration

Legacy Sediment Removal (LSR)

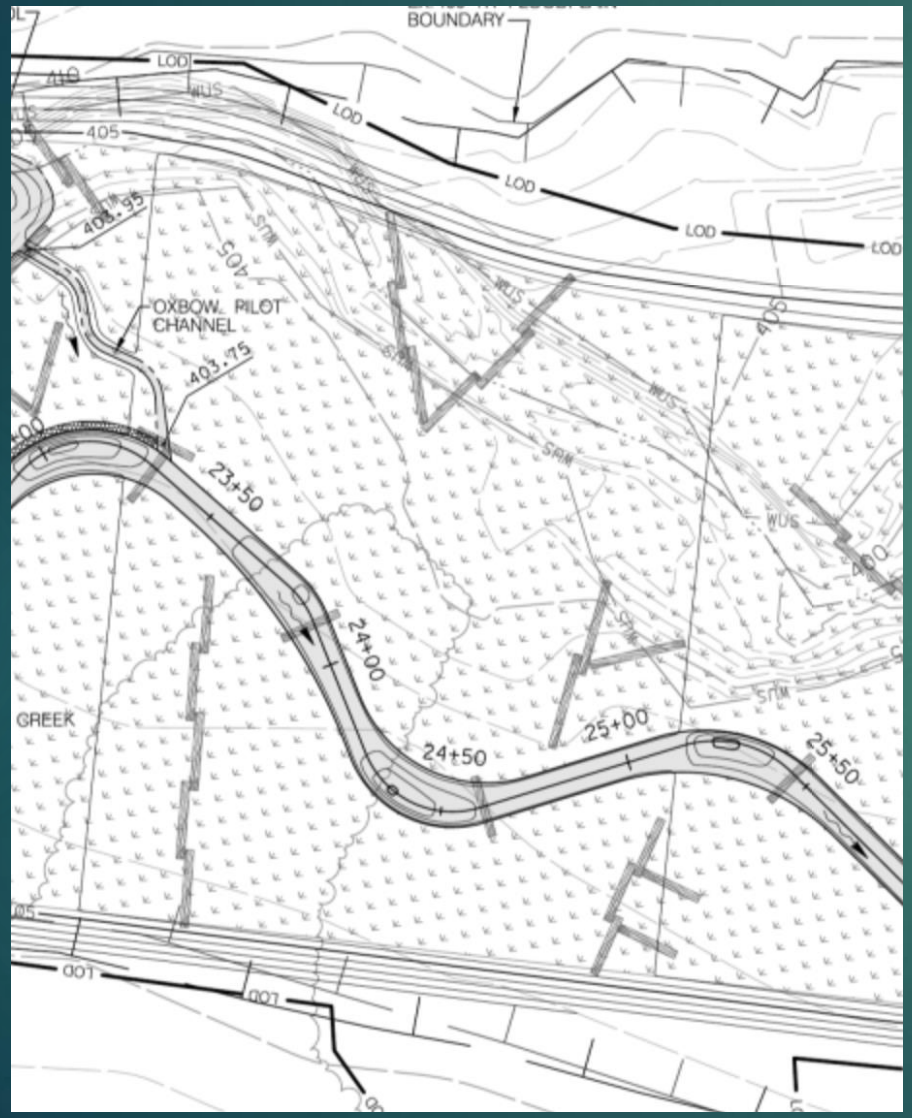
- The only true restoration?
- Focus on returning valleys to pre-colonial state:
  - Removal of Legacy Sediments (duh)
  - Multi-threaded channels
  - Minimal in-stream structure
  - Brings floodplain back down to the flow
- Toolkit:
  - HUGE grading activities
  - Exposure of Remnant Peat Layer
  - Heavy Structural Log Use

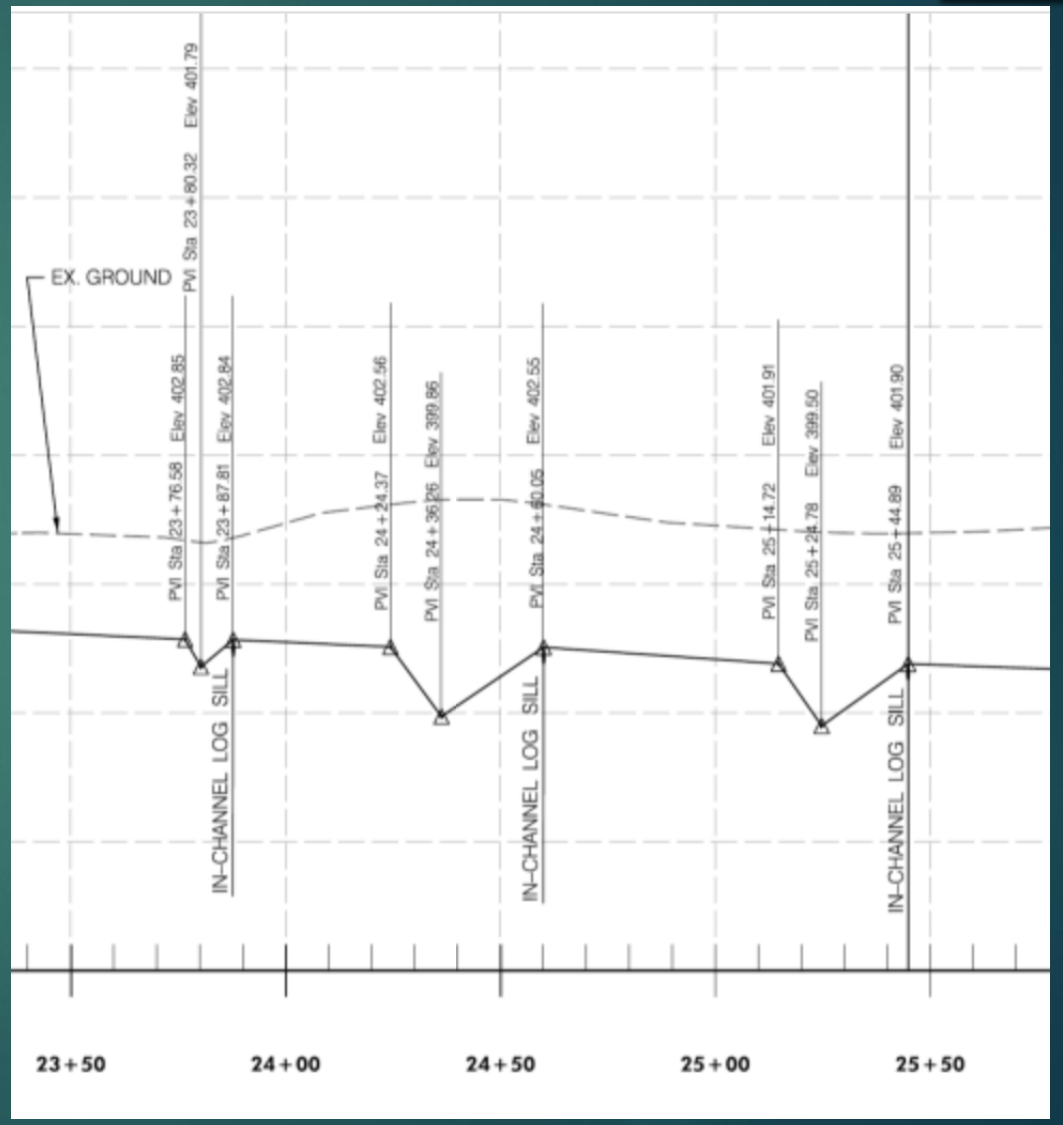
LSR: Valley Section



LSR: Floodplain reconnection

LSR: Big Cuts!


BOUNDARY
LOD
WUS
STM
405
408.95
OXBOW PILOT CHANNEL
403.75
23+50
24+00
24+50
25+00
25+50
GREEK


EX. GROUND
PVI Sta 23+76.58
Elev 402.85
PVI Sta 23+80.32
Elev 401.79
PVI Sta 23+87.81
Elev 402.84
PVI Sta 24+24.37
Elev 402.56
PVI Sta 24+36.26
Elev 399.86
PVI Sta 24+50.05
Elev 402.55
PVI Sta 25+14.72
Elev 401.91
PVI Sta 25+28.78
Elev 399.50
PVI Sta 25+44.89
Elev 401.90
IN-CHANNEL LOG SILL
IN-CHANNEL LOG SILL
IN-CHANNEL LOG SILL
23+50
24+00
24+50
25+00
25+50

Pros:

- Time Machine!
- Great for Native Veg
- Adaptable
- Maximal Floodplain Access
- Simple Design- No Complex Structures
- Will only improve with time

Cons:

- Massive Dirt Export = $$$
- Tree Loss
- Requires a wide LOD
- Earthwork in floodplain = MUD
- Takes years to mature

What's next in Stream Restoration?

Evolution: combination of approaches

Selecting the best approach for the reach.

Innovation in science, engineering AND construction.

Discussion?

Many Thanks to:
- Joe Berg (BioHabitats)
- Frank Bubczyk and Jim Morris (JMT)
- Scott Lowe (McCormick Taylor)