Paunnacussing Creek Assessment and Conceptual Design Ideas for Solebury Township, PA

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40 years of working on rivers and streams

Field Geology Services
Fluvial Geomorphology

Professional Biography

- BS w/ honors in Geology (VA Tech)
- MS and PhD in Geosciences (University of AZ)
- University/college professor in WA & VT for 8 yrs
- Consulting since 2002
- Work in 18 states and 11 other countries worldwide

Amochu River, Bhutan

Factors Controlling River Form and Behavior

Natural Conditions

- Bedrock geology
- Soils
- Watershed shape & relief
- Climate (floods/vegetation)
- Fluctuating sea/lake levels
- Tributary inputs

Human Activities

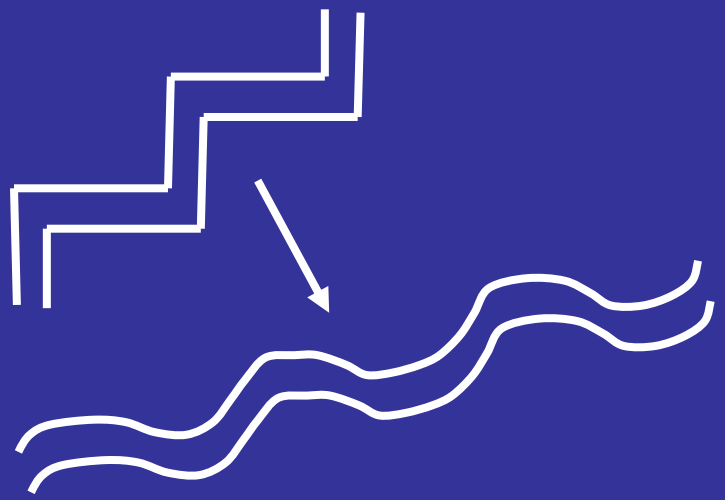
- Roads/railroad
- Levees and berms
- Floodplain development
- Bridges/culverts
- Bank armoring
- Channel straightening
- Dredging/gravel mining
- Land clearance
- Dams

Just keep in mind:

- Rivers don’t like fast changes
- Flowing water carries sediment

Rivers Don’t Like Fast Changes

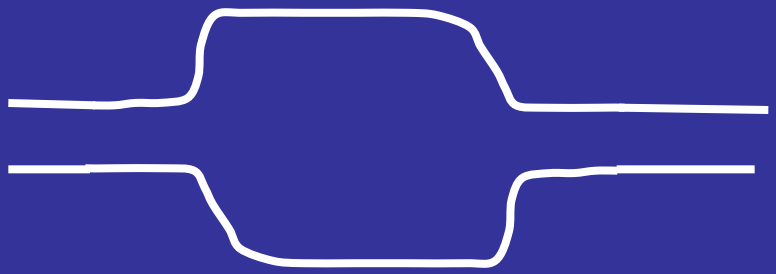
Rivers don’t have sharp bends like this…



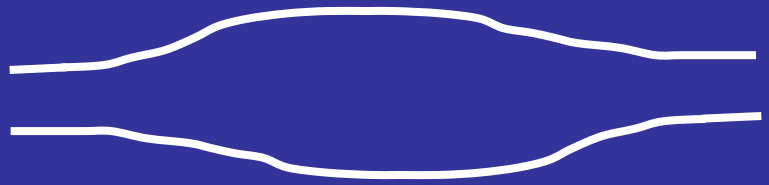
… they form smooth meanders like this to minimize turning at any one point

Rivers don’t have stepped longitudinal profiles like this …

… they form smooth concave up profiles like this to minimize slope change at any one point

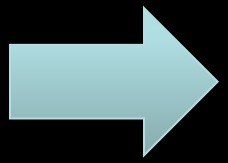


Rivers don’t change width like this…



… they minimize the rate of width change at any one point

Flowing Water Carries Sediment



Flowing water carries sediment!

Shelburne Falls, MA - 2011

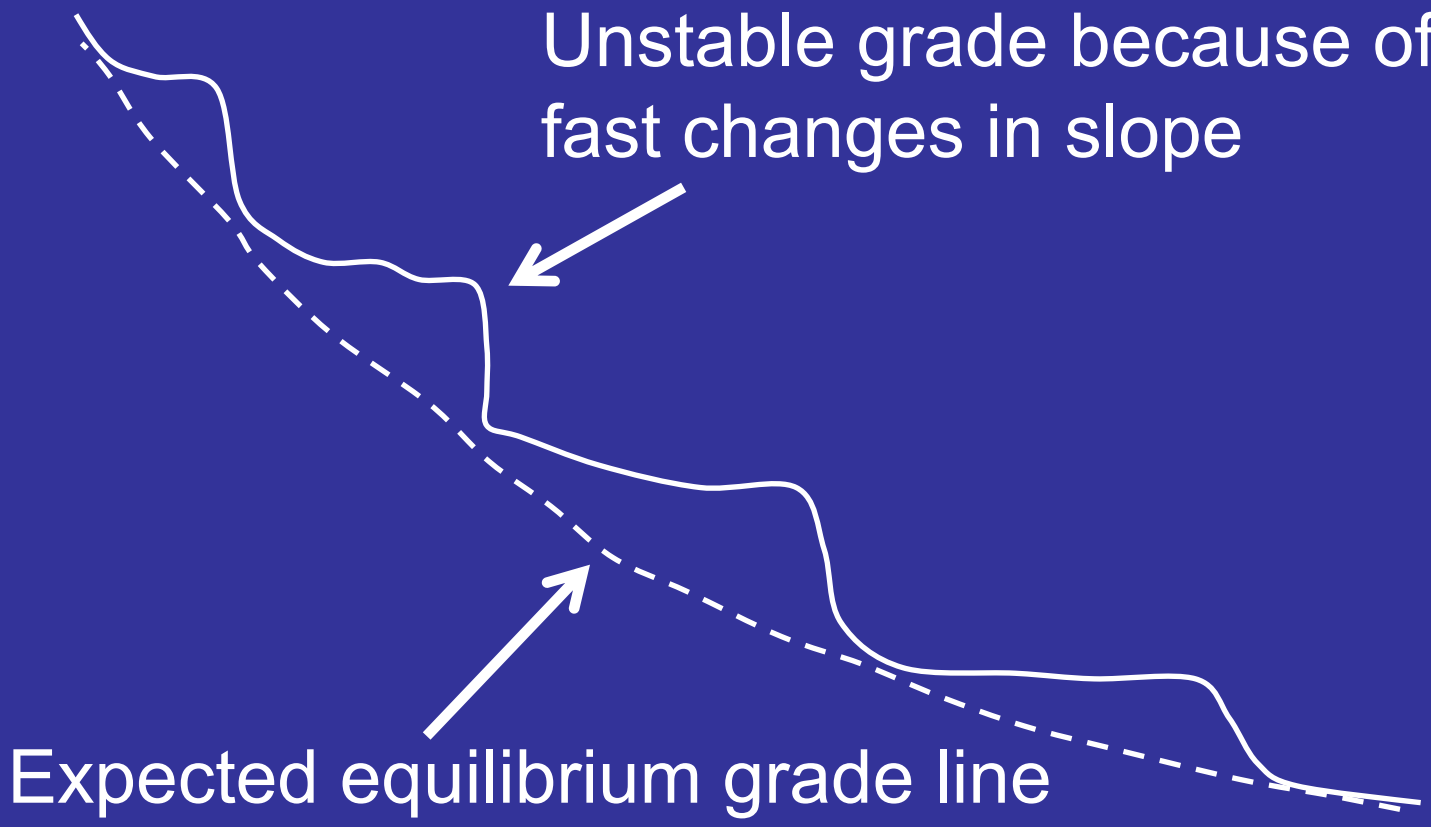
Rivers Don’t Like Fast Changes

and

Flowing Water Carries Sediment

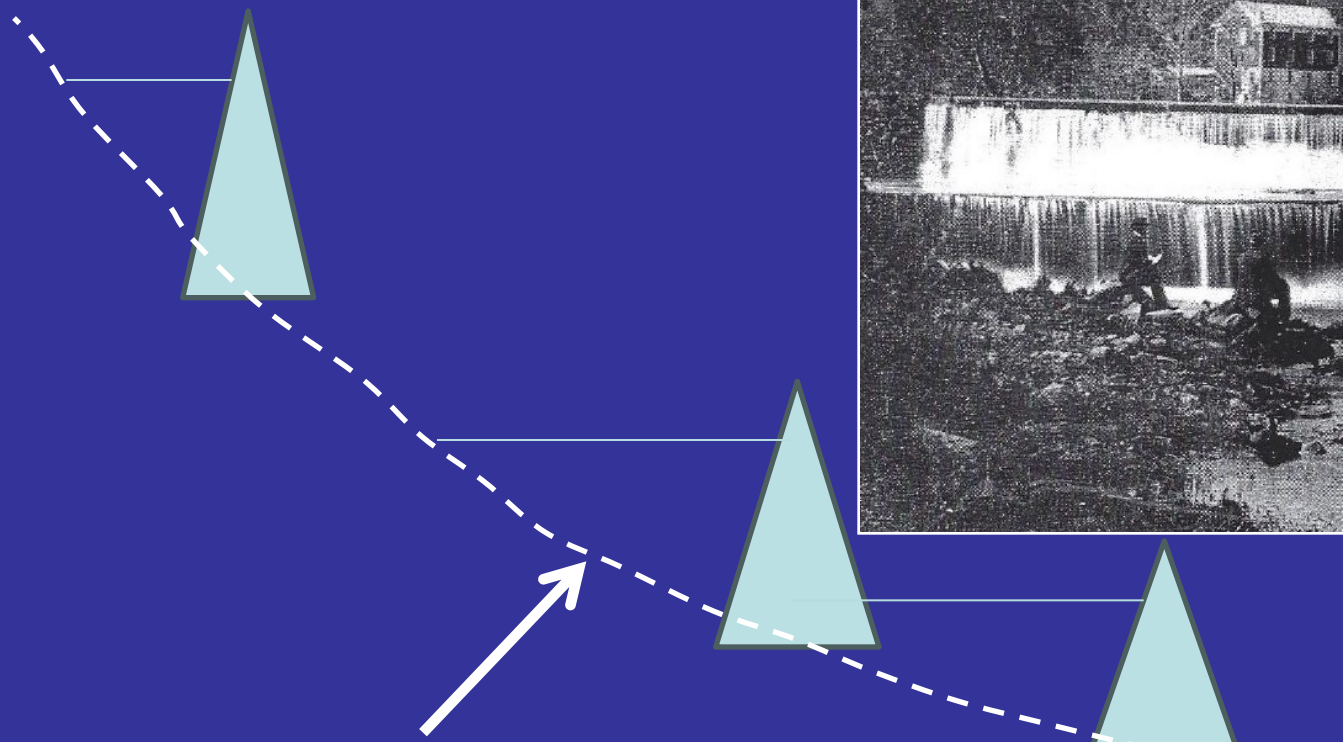
Niagra Falls, NY

Rivers don’t like fast changes



Dams on the Paunnacussing

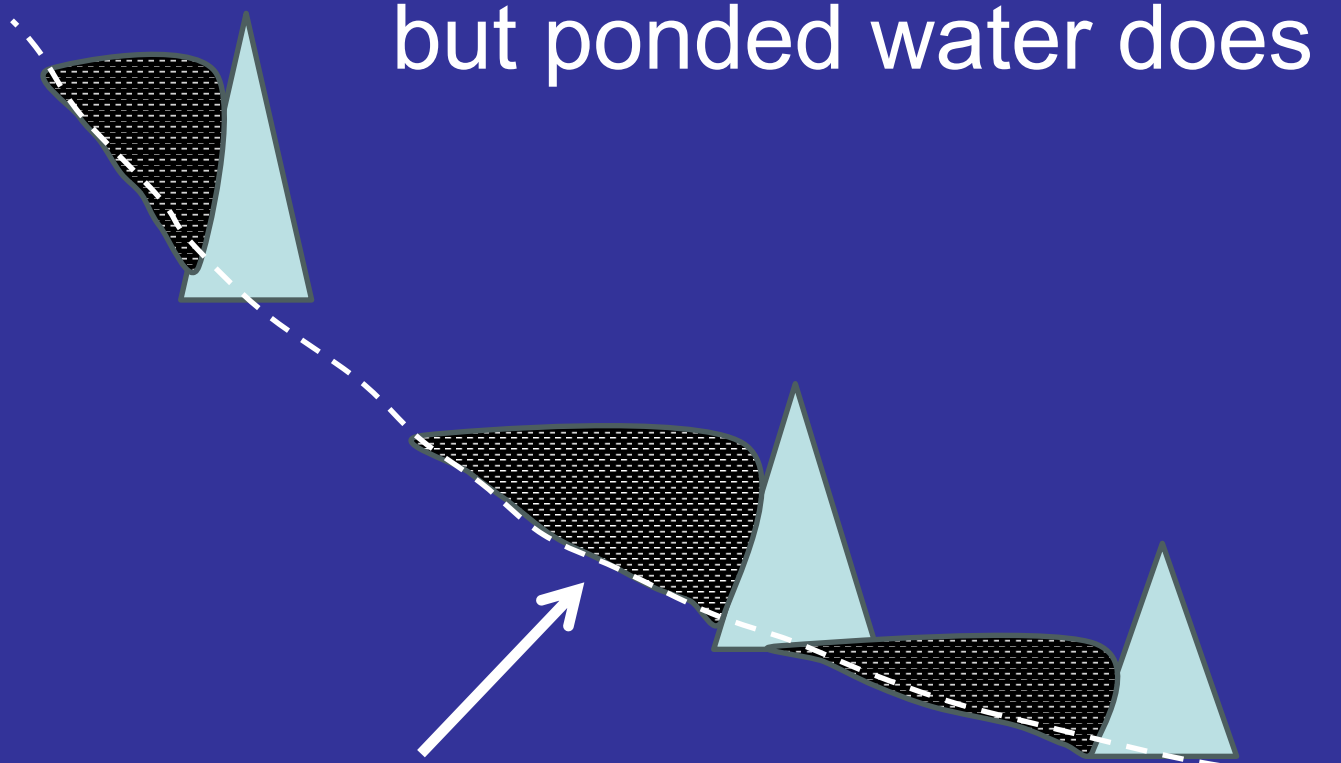
Wall Mill Dam



Schematic pre-Colonial grade of Paunnacussing Creek

Dams on the Paunnacussing

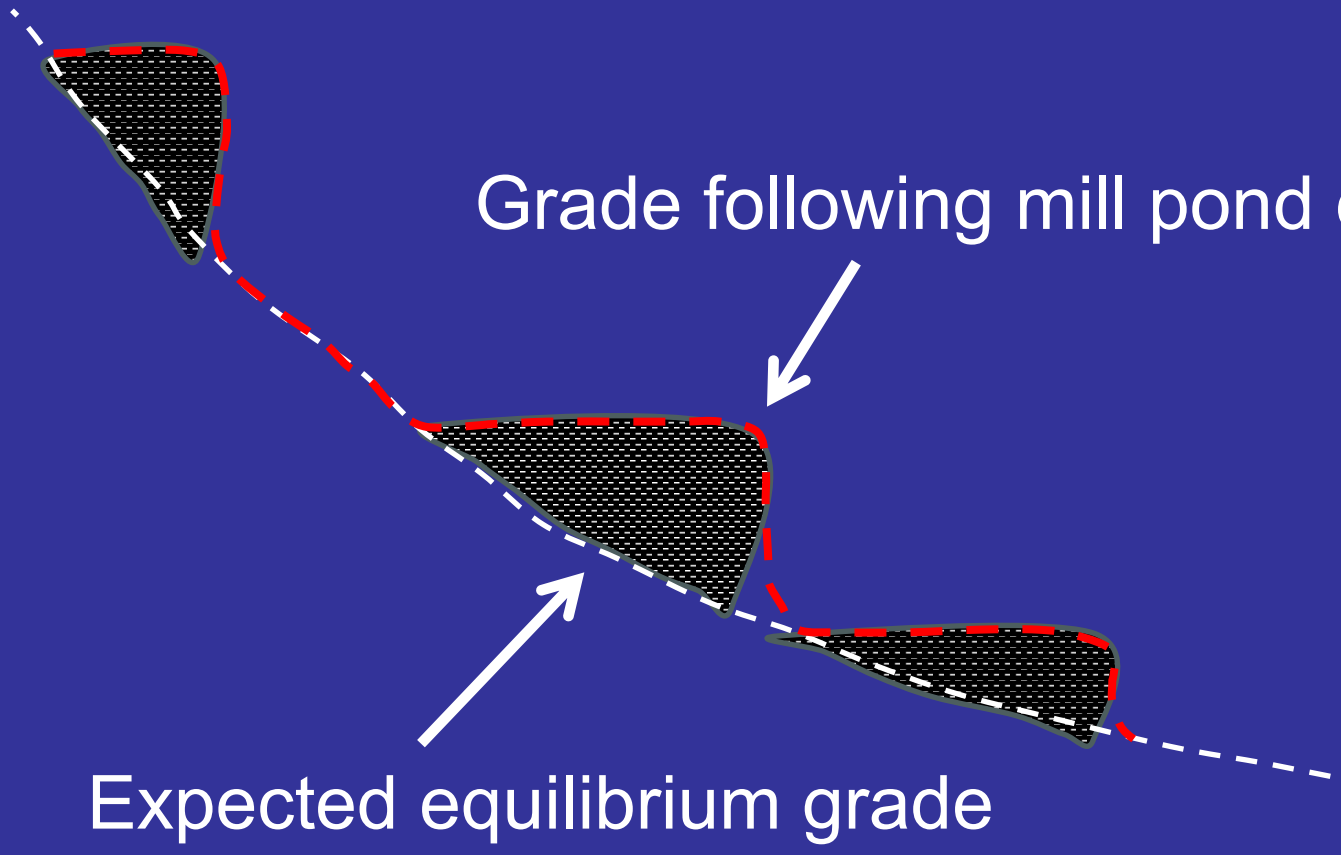
Flowing water carries sediment but ponded water does not



Schematic pre-Colonial grade of Paunnacussing Creek

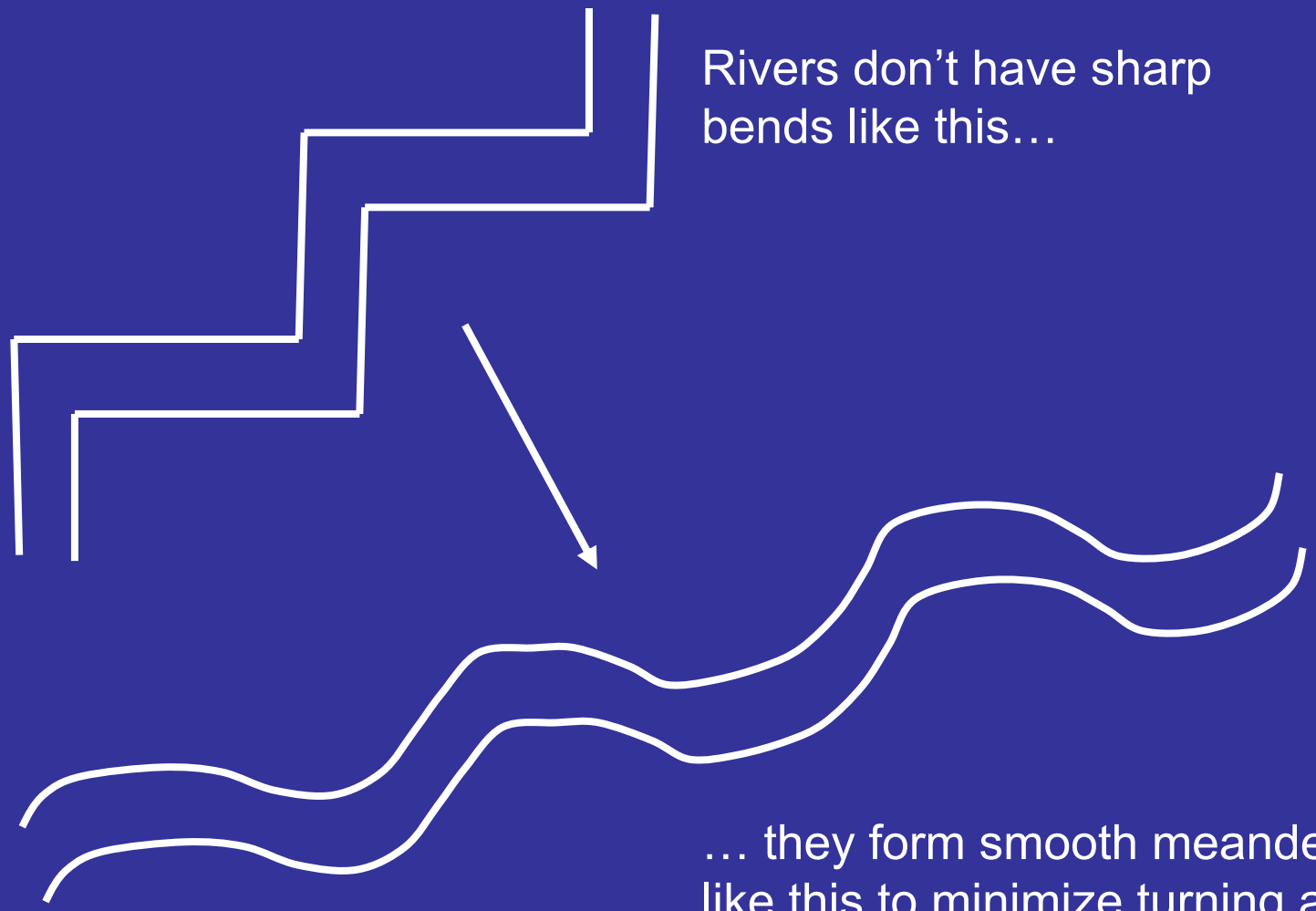
Dams on the Paunacussing

River profile becomes stepped with fast changes




1885 flood deposit?
Earlier mill pond sediments?

Rivers don’t like fast changes



Rivers don’t have sharp bends like this…

… they form smooth meanders like this to minimize turning at any one point


Fleecy Dale Rd
Old Carversville Rd
Old Carversville Rd

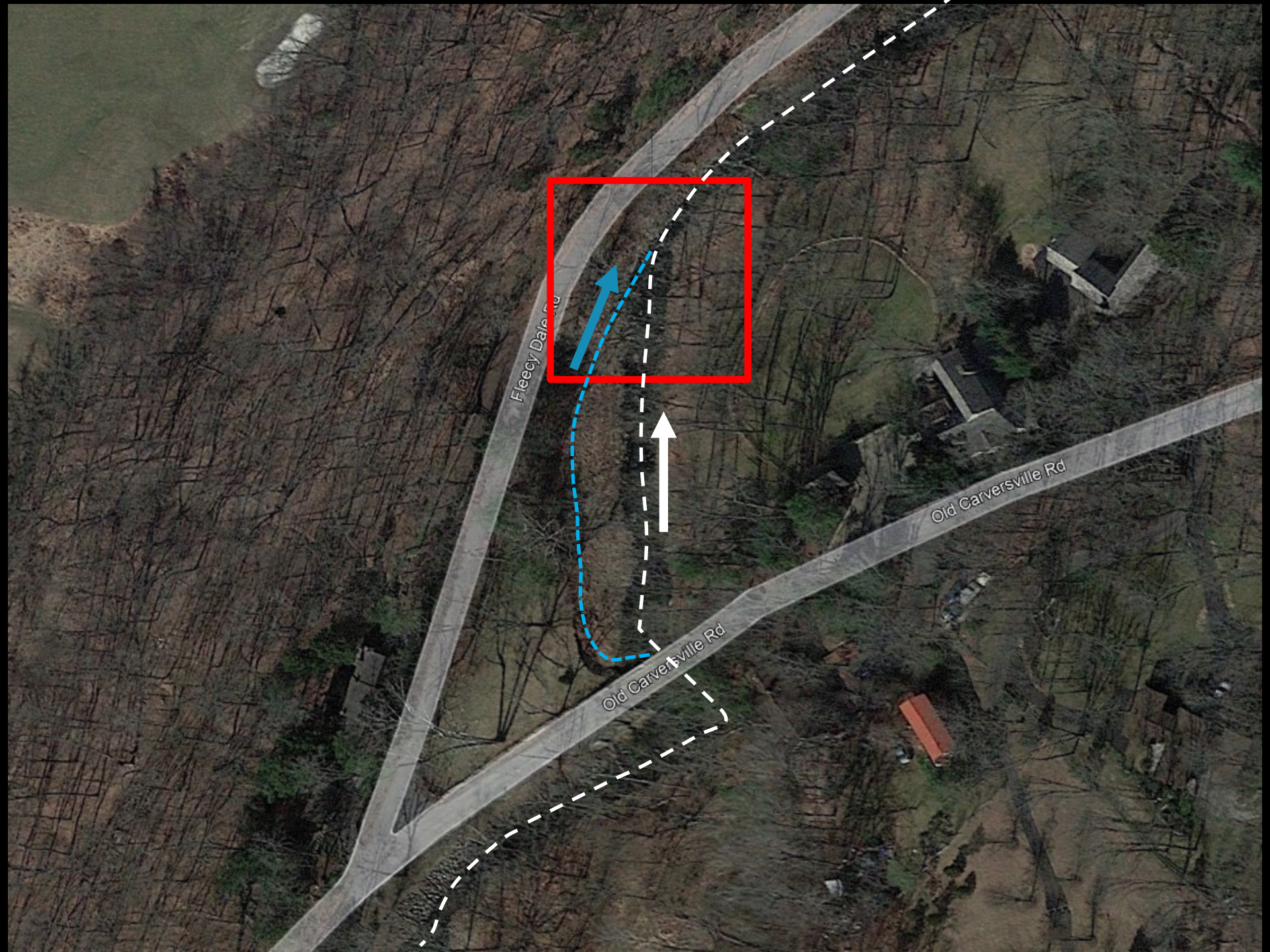

Old Carversville Rd
Old Carversville Rd


SPEED
LIMIT
25

Wilton, ME

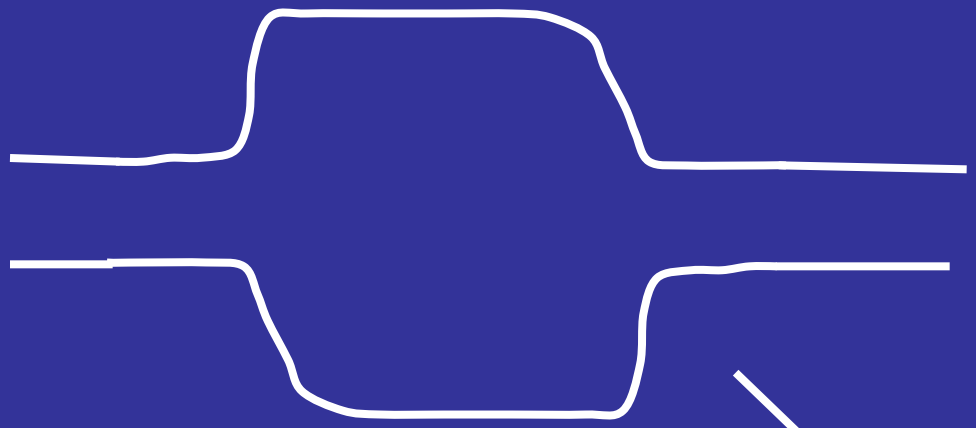

Old Carversville Rd
Old Carversville Rd

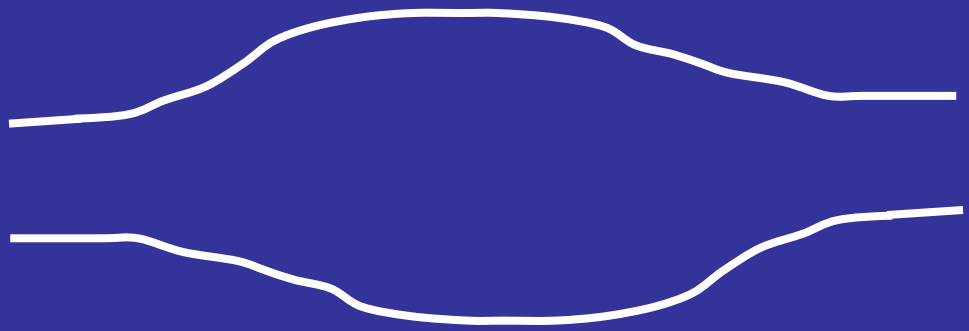

Old Carversville Rd
Old Carversville Rd


Old Carversville Rd
Old Carversville Rd

Rivers don’t like fast changes

Rivers don’t change width like this…





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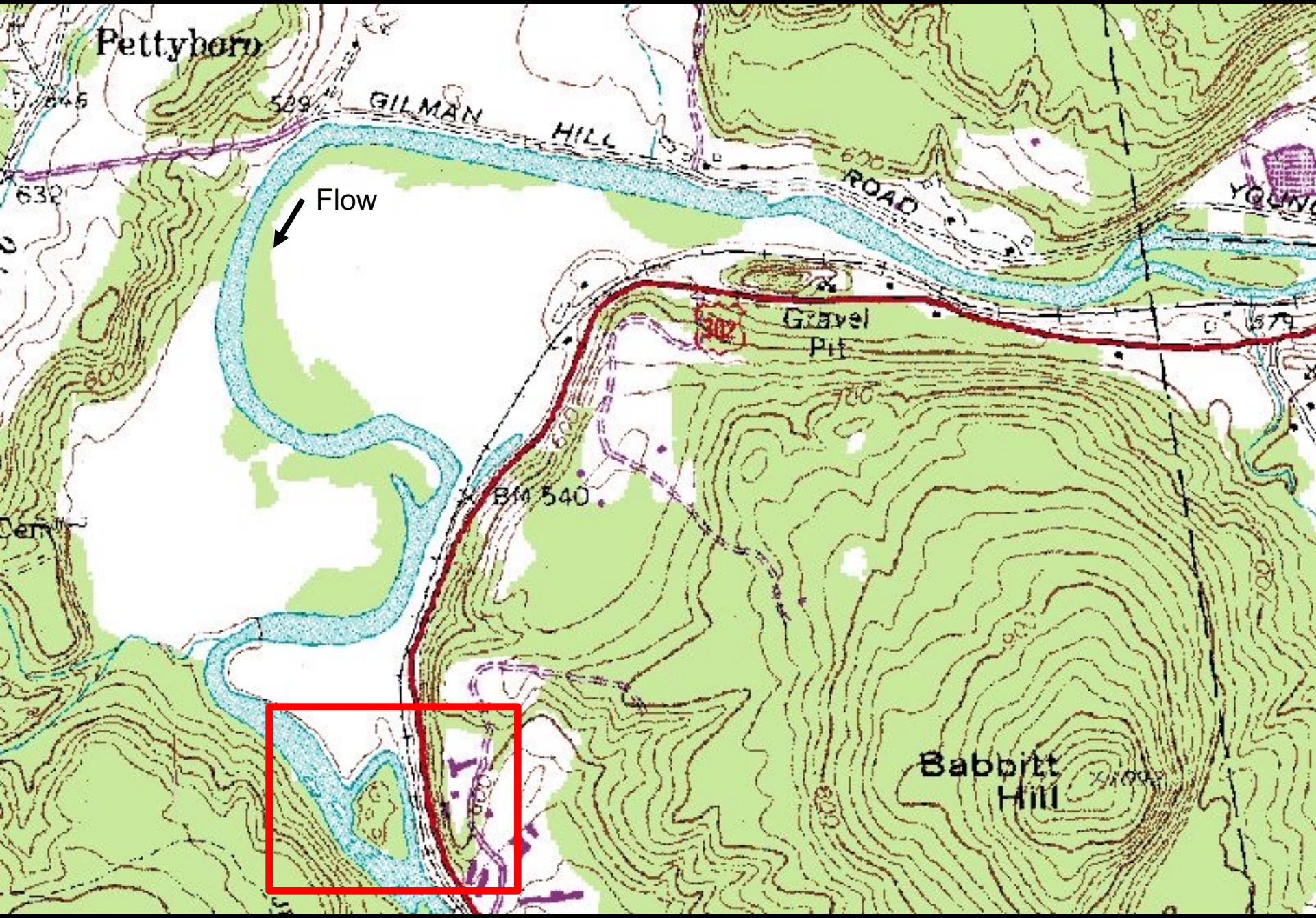
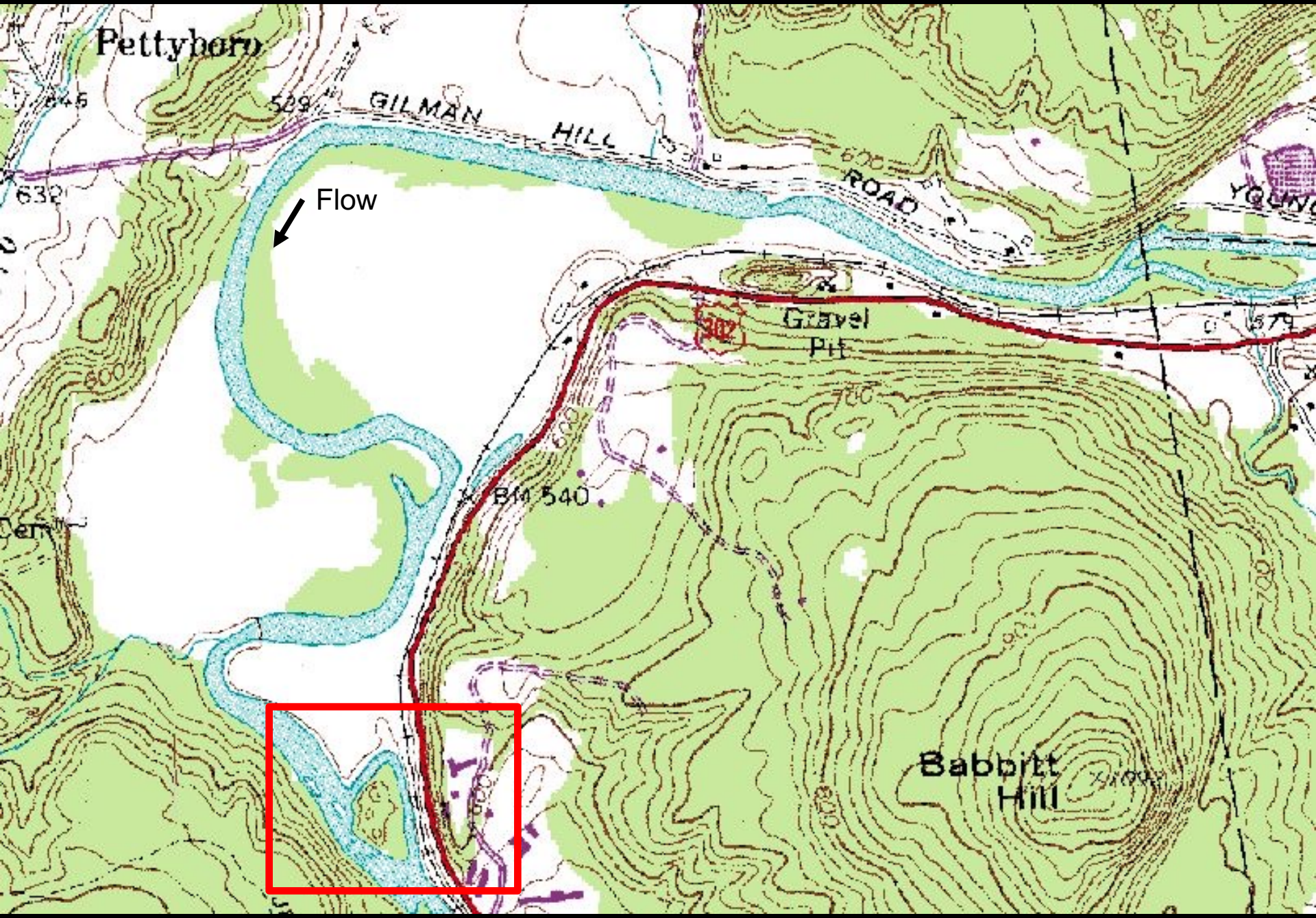

Pettyboro
GILMAN HILL ROAD
Flow
Gravel Pit
B14 540
Babbitt Hill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Deposition

Rivers Don’t Like Fast Changes

and

Flowing Water Carries Sediment


Deposition

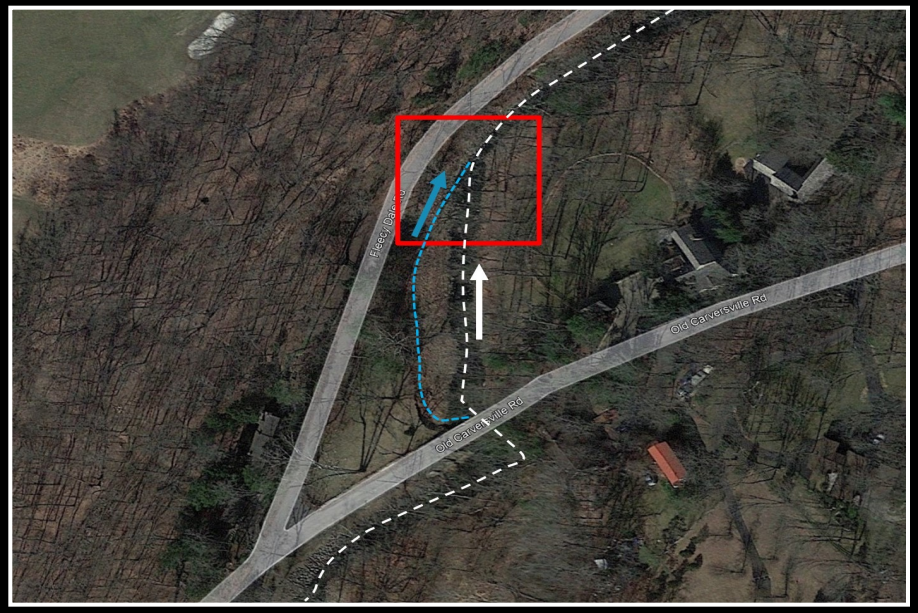

DEERE

Rivers Don’t Like Fast Changes

and

Flowing Water Carries Sediment

Avoid further constraints



Removing constraints

Resizing crossings

Technique	Priority*	Description	Benefit
Changes to infrastructure			
- Resizing crossings	2	Ensure single-span crossing matches width of channel; include also floodplain relief	Prevent deposition upstream and erosion downstream of structure
- Removing unused roads	3	Removal of damaged roads unlikely to be rebuilt due to high costs or other reasons	Provide additional space for flood flows and channel adjustments
- Relocating infrastructure	4	Relocate infrastructure so no longer in conflict with natural river processes	Provide additional space for flood flows and channel adjustments
Watershed management			
- Land conservation	1	Conserve riverside land through purchase or easements by working with land trusts, etc.	Provide control of lands to allow for removal of constraints
- Reforestation	6	Encourage growth of forests in currently open upland and riparian areas	Reduce flood peaks and sediment entering the river
- Remove impervious cover	8	Remove pavement and other impervious surfaces no longer in use	Reduce runoff to creek and provide space for vegetation
In-stream actions			
- Remove hard armor	5	Removal of rock, concrete, or steel used on banks but not protecting infrastructure	Allow for natural processes and reduce erosive forces elsewhere
- Remove channel blocks	7	Remove berms blocking side channels if no infratructure will be threatened	Allow for natural processes and reduce erosive forces elsewhere
- Bioengineering	9	Nature-based bank stabilization solutions to protect critical infrastrcture	Stabilize banks while improving habitat and minimizing impacts