River Corridor Protection

Reducing Fluvial Erosion Hazards and Restoring Healthy River Conditions in Vermont
Functions/Values of Healthy Floodplains

- Flood Storage and Conveyance
- Water Quality Maintenance
- Water Absorption, Groundwater Recharge, and Discharge
- Biologic Resources, Functions
- Community Resources
- Economic Resources
Functions/Values of Healthy Streams

- Flood mitigation
- Water supply
- Water quality
- Sediment storage and transport
- Habitat
- Recreation
- Transportation
- Aesthetic qualities
Flooding

- VT’s Most common type of natural disaster
- Caused by:
  - Rain
  - Melting Snow
  - Ice Jams
  - Debris jams
Flood Damages can occur due to:

- **Inundation**
  - Roaring Brook, Underhill, 1998
  - Passumpsic River, Lyndonville, 2002

- **Erosion**
  - Lilliesville Brook, Bethel 1997
  - Unnamed Tributary, White River, 2007
In Vermont, most flood damages are caused by Fluvial Erosion

- VT Geography/Climate
  - Mountainous, Narrow valleys
  - Steep/powerful streams
  - Intense rainstorms/deep snows
  - Destructive Ice jams

- Historic Patterns of Human Settlement, Stream Alteration

Rowell Brook, Bradford, 1998

Kate Brook, Hardwick, 1995
Present-day channel adjustments date back to watershed changes associated with early settlement
...and the modification of channels and floodplains.
Major Floods

THE ANSWER

BETHEL, VT.
Traditional Approach to River Management:
Contain flows within the straightened channel
Result

High flows result in high erosive power kept in the channel,

instead of allowing the energy of the water to flow onto floodplain
Structural Mitigation Still Dominates
Armor to Withstand Increased Stream Power
Channel adjustments during floods can have devastating consequences.

Private Property
Lilliesville Brook, Bethel 1997

Public Investments
Jones Road, Wolcott 1995

Great Brook, Plainfield, 1990
Greatest Damage is to Transportation Systems

Unnamed tributary, Braintree 2007
07/16/2007

Jay Branch, Jay, 1991

Burgess Branch, Lowell, 1997

07/13/2007
Five Floods in ’90s
Resulting in Over $60 Million in Damages

Gihon River, Eden, 1997
Tyler Branch, Enosburg, 1997
Trout River, Montgomery, 1997
West Hill Brook, Montgomery, 1997
National Flood Insurance Program maps focus on *inundation* risks

Roaring Brook, Underhill, 1998
Effects of Floodplain Encroachment – May Exacerbate Flood Hazards

- Filling reduces floodplain’s ability to store water
- Floodwaters rise to higher levels causing properties that were once flood-free to now be flood-prone
- Rise in floodwaters increases velocity of flood waters and therefore increases the potential to erode stream banks
- Encroachment may prevent river from reaching equilibrium
Many flood risks to investments are **NOT** identified by NFIP floodway delineations

- Not all rivers have been mapped
- Not all rivers have been mapped accurately
- Streams may have moved
- NFIP maps do not consider erosion hazards
- NFIP maps do not account for effects of urbanization on future flood levels
Elevation to avoid inundation is often ineffective in protecting structures from flood damage

Mad River, Warren, 1998
Not in the NFIP Floodplain

Home built 100 ft from NFIP Floodway and 8 ft Above Q100; Channel Adjustment Occurred Overnight
Proof that Minimum FEMA Standards are not Effective Enough to Protect Public Safety and Minimize Losses
Exposure to flood events is increasing due to:

- Greater land development in susceptible areas
- Channels are enlarging due to stormwater conveyance
- Potential global climate shifts or cycles

Photo courtesy of Smart Growth Vermont
Riverine Erosion Hazards - a National Concern

- 1/3 of the Nation’s Streams Experience Severe Erosion (National Research Council, 1999)
- Catastrophic Erosion Costs $595 Million/year (2008 dollars)
How Can We Mitigate These Impacts?

Honey Brook, Barre, 2007

Cold River, Shrewsbury, 2000

Miller Run, Sheffield, 1990

Sucker Brook, Williston, 2005
Cycle of Escalating Costs, Risks, and Ecosystem Degradation

Chasing the river
Creating new problems downstream

Floods and Property Damage

Encroachment

Dredge, Berm and Armor
Channel Equilibrium

Sediment Load

- Sediment size
  - coarse
  - fine

- Sediment Supply (volume)

Transport Capacity

- Width, Depth, Roughness
  - stream slope
  - flat
  - steep

- Discharge (water volume over time)

Lane (1955)
Channel Evolution

- Caused by changes to:
  - Flow regime
  - Sediment regime
  - Slope
  - Cross section
  - Boundary condition
  - Channel Roughness
  
  Stormwater runoff
  Berming, Straightening, channelizing
What is a River Corridor?

- A River Corridor includes the meander belt of a stream or river (in red) and a buffer of 50 feet (in orange).

- The meander belt width is the lateral extent of room the river requires to adjust, restore, and maintain stable, equilibrium conditions. It’s the “wiggle room” a river needs to find its most stable path down the valley, while efficiently moving and storing its sediment load.

- Within a river corridor, existing infrastructure and improved property may be at a heightened risk from erosion and be more likely to require river management to protect over time.
What is the Statewide River Corridor?

- The Statewide River Corridor (SRC) was made available late in 2014 and is posted on the Natural Resource Atlas.

- It includes rivers and streams with watersheds over two square miles.

- For small streams, with watersheds less than two square miles, the extent of the River Corridor is defined as fifty (50) feet from the top of the stream bank.

- Regulates development not subject to municipal jurisdiction – Act 250 and Section 248 proceedings
What is an FEH or a RCPA?

- Fluvial Erosion Hazard Areas (FEH) have been delineated for some communities based on studies of particular stream and river reaches.

- An FEH is essentially equivalent to a River Corridor Protection Area (RCPA). Both delineate the extent of the meander belt.

- A River Corridor includes the meander belt (in red) and the area to maintain a riparian buffer (in orange).
Breaking the Cycle Through Corridor Protection

- **Avoids** Land Use Constraints Which Prevent Maintenance or Achievement of the Equilibrium Condition
- Provides Low Cost Solution
- Enhances Public Safety
- Minimizes Economic Losses
- Manages towards Sustainable Healthy Stream Conditions
Additional Benefits of Corridor Protection

Reduce taxpayer burden in the event of flooding by increasing the Town’s Emergency Relief and Assistance Fund (ERAF) rate from 12.5% to 17.5%

ERAF – *what is it?* The supplemental funding towns receive from the State to repair critical infrastructure when flooding occurs. The Federal government pays 75% of the cost to rebuild; the remaining 25% comes from “supplemental sources”.

Elmore’s current ERAF rate is 12.5%

Elmore’s funding would increase to State’s *maximum level* of 17.5% by adopting River Corridor Protection bylaw

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<th>7.5% ERAF RATE</th>
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### DEC Model Flood Hazard Regulations

<table>
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<tr>
<th>Models</th>
<th>NFIP Compliant?</th>
<th>Use</th>
<th>Address Erosion Hazards?</th>
<th>Cumulative Benefits / Cost for Town</th>
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For Word .doc versions of the models please contact ned.swanberg@state.vt.us

http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm#Regulating_Development
FEH Overlay District
(Proposed)
Next Steps

If Elmore chooses to pursue some level of river corridor protection, then:

• Extent of protection – FEH or River Corridor?
• Review model language and adapt as needed
• Review River Corridor maps – work with LCPC and DEC Rivers Program to update/amend maps as needed
• Adoption process – see next slide
Adoption Process

*Multiple meetings may be held by PC and Selectboard

Bylaw Adoption Processes

See statute details:
24 VSA §§ 4441-4442
For More Information...

Flood Hazard Management
http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm#Regulating_Development

Publications on River Corridors
http://www.watershedmanagement.vt.gov/rivers/htm/rv_educationalresources.htm

Resources: River Science and Policy
http://floodready.vermont.gov/get_help/resources#science