Vermont Rivers Program (VRP) Policy on Wood and Structure Addition as a Restoration Strategy

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The purpose of this document is to outline the characteristics of wood addition projects that are supported by the VRP as a dynamic equilibrium-based restoration strategy. This document also provides guidance on eligibility of wood addition projects for Clean Water funding. It does not provide guidance on permitting requirements of wood addition projects or use of wood addition as a property protection strategy.

Policy

Through its regulatory policies, the Vermont Rivers Program supports river management practices that resolve conflicts between river processes and landuse expectations in a way that accommodates natural channel stability or dynamic equilibrium of the river system. River management practices implemented to restore ecological functions and values of a river system go beyond the goal of resolving landuse conflicts and must enhance the dynamic processes that drive self-sustaining river resiliency. Such restoration projects often focus on creating or enhancing the ability of the river to access its floodplain during a flood, enhancing riparian and channel boundary conditions through planting of natural woody riparian vegetation, and restoring in-channel structure that dissipates energy, anchors alluvium and forces creation of complex habitat, thereby increasing overall resiliency and moving the river system towards equilibrium.

The Role of River System Wood and Structure

Biogenic features such as beaver dams, large wood, and live vegetation are essential to the maintenance of complex stream ecosystems (Polluck et.al., 2014). Large Wood plays a vital role as instream and floodplain structure in maintaining an equilibrium condition and quality habitat of river systems. Wood's ability to trap sediment within the channel also serves to provide bed stability and withstand degradational processes, thereby promoting floodplain connection (Jeffries et al 2003, Sear et al 2010, Gurnell et al 2002, Cordova et al 2007). Wood helps to create a heterogenous channel condition through the processes of deposition and scour (Baillie et al 2008, Brooks et al 2004). The removal of large wood can cause river systems can enter an alternate, less complex and less productive state (B.D. Collins et al. / Geomorphology 139–140 (2012) 460–470).

The great majority of rivers in Vermont are lacking the structure provided by large wood due to a legacy of deforestation and direct removal of wood from stream ecosystems (Wohl, 2014; Tall Trees Tough Men). Only mature trees are large enough to resist mobilization and transport out of moderately sized rivers. Stable key pieces that initiate jams are generally large diameter, long pieces of wood, typically with an attached root ball derived from the largest valley bottom trees (B.D. Collins et al. / Geomorphology 139–140 (2012) 460–470). The process of forest maturation that will eventually lead to natural recruitment of stable key pieces in stream channels is a slow one that will take another fifty to two hundred years. The resiliency of Vermont's rivers and streams is severely diminished by their characteristic lack of large wood structure.

Restoring River System Wood and Structure

The common role of instream and floodplain structure, whether large wood, beaver dams or landslides, is to drive processes of scour and deposition that maintain river and floodplain connectivity and resilience, and diverse quality habitat. The restoration of structure, whether through the addition of large wood or structures that mimic the functions of beaver dams, is an important strategy for restoring a dynamic and resilient river as well as restoring floodplains and floodplain wetlands and projects that have the goal of restoring dynamic fluvial processes through the restoration of river structure are supported by the VRP. The use of wood can also be incorporated into property and infrastructure protection projects and may increase the ecological outcomes associated with the project. However, the use of wood in such projects does not in and of itself result in a project that restores dynamic fluvial processes. Those projects that have the primary goal of protecting property and infrastructure and/or prevent erosion, are not supported by this policy.

Common types of wood addition:

This list is not exhaustive of all types of wood addition but is meant to provide policy context for some of the most common practices. The key elements of a wood or structure addition project that meets the VRP policy are that it is appropriate for the geomorphic setting and condition and supports dynamic processes that promote an equilibrium condition.

1. Root-rap / Engineered Wood Accumulations:

Root-rap is a wood addition strategy where rootwads are keyed-in to an eroding stream bank with the root ball facing out. Engineered Debris Accumulations (EDA) are large wood structures created by locking wood together in front of and into the eroding bank. These are often applied on outside meander bends to slow erosion. To meet VRP policy on use of root-rap or EDA for an equilibrium restoration strategy, root-rap or EDA should only be installed when a meander bend has achieved a stable radius of curvature, as stabilizing the bank before the full meander amplitude is achieved will confine the channel artificially and force it into a steeper slope. The goal of the project must be to "buy time" to establish woody riparian buffer and have a bank protection lifespan expectancy of no longer than 15 years, at which time the expectation should be that channel migration may occur. The goal of the project can not be for long-term private property protection or an expectation of long-term static channel alignment or sediment reduction due to bank erosion. VRP will consider root rap and EDA projects within the context of the reach dynamics and project goals. Root rap / EDA projects to address bank stabilization along channels that have achieved a stable planform geometry, are near the outer limits of the River Corridor, and/or are part of a larger restoration project, where channel dynamics can be achieved, are strategies supported by VRP.

2. Chop and drop or "Strategic Wood Addition":

This is a wood addition technique that involves felling mature riparian trees directly into the river channel. These projects seek to mimic wood recruitment to the channel that would occur naturally in mature riparian forests. To meet VRP policy, the goal of these projects must be to enhance channel stability through the creation of scour and deposition features that contribute to floodplain reconnection and an equilibrium condition. Methods should follow the VT Fish and Wildlife Strategic

Wood Addition Handbook (Kratzer, 2020). The expectation should be that this type of wood addition will result in a dynamic river condition that will change and migrate within the river corridor over time. While the project may aim to add wood where it is likely to stay, some wood movement following installation should be expected and may even enhance the restoration benefits.

3. Micro wood addition, beaver dam analogues, and other process-based techniques:

Micro wood additions are a technique used in headwater streams (1st and 2nd order streams) where channel spanning obstructions are built directly in the channel (usually by hand) using wood branches and logs. These structures are sometimes referred to as beaver dam analogues and have multiple goals of reconnecting floodplain hydrology, restoring riparian wetlands and creating heterogeneous habitat features, similar to the benefits of a natural beaver dam (Wheaton et al 2019). Wood may also be added to bars or banks to initiate depositional or erosional processes to jumpstart lateral migration and support a channel evolution process. To meet VRP policy, these projects must have the goal of restoring dynamic equilibrium by facilitating dynamic stream processes and improving floodplain reconnection, be expected to behave in a dynamic way over time, be suited to the reference stream type, and not involve private property protection.

4. Floodplain wood addition:

Wood may be added to floodplains to enhance flood resilience by creating roughness and slowing floodwater velocity and creating scour and deposition features that enhance habitat conditions for aquatic and riparian organisms. To meet VRP policy, the project goal must be to enhance floodplain deposition and be expected to behave in a dynamic way over time.

<u>Wood Addition Design considerations:</u>

- Likelihood for downstream movement of wood / impacts to downstream infrastructure, and related considerations of how/if to anchor wood
- Channel straightening – if a channel is artificially straightened (transport regime) will wood features maintain/be effective?
- Sediment regime – is sediment load sufficient for wood to enhance depositional features
- River corridor constraints – is there sufficient space for the river to respond to the wood addition in a dynamic way?

<u>Permitting:</u>

Wood addition projects may require Stream Alteration Permits as well as other State and Federal permits and may need to meet additional standards not described in this document. A municipal floodplain permit may also be required. Permitting requirements are site and design specific and the project implementer must ensure all necessary permits are obtained.

Clean Water Funding Eligibility Criteria:

The Clean Water Fund has specific project eligibility criteria tied to the specific pollutant reduction of phosphorous (CWIP 2021). Therefore, for a wood addition project to be eligible for funding under the Clean Water Fund it must be demonstrated that the project will contribute to improved dynamic stream equilibrium and/or floodplain reconnection that will move a stream channel towards its least erosive form and enhance storage of sediments/phosphorous on the floodplain.

Information to provide for review:

The following is a list of minimum information that should be provided to the appropriate Regional River Scientist for review to determine if a project meets VRP's policy and CWF eligibility criteria:

- Statement of the goal and purpose of the project and description of proposed methods
- Description of how the project will support dynamic river processes and whether and how those processes will become self – sustaining
- Fluvial Geomorphic site context and any supporting stream geomorphic assessment data
- Site plan including a longitudinal profile and/or planform showing where wood would be incorporated
- The purpose of individual structures or complexes of structures
- Identification of wood source and if it would be replanted
- Size and diameter of wood, # of trees
- Description of whether/how wood will be held in place (cabling, wedging, purposely mobile etc.)
- Description of use of other materials involved (rock, earthwork etc.)

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