Woody Debris Management

Description

History tells us that rivers and streams contained numerous boulders, large fallen trees, logs and drift jams prior to settlement. In the first decades of colonization, pioneers saw fit to "improve" streams and rivers by clearing away debris and obstacles to allow for transportation, logging, mills, and the draining of floodplain forest to create pasture. In recent years, we have come to recognize the importance of large woody debris in river channels and the contribution it makes to channel function and fish habitat. This gives rise to the understanding that there are good log-jams and then there are bad log jams. Differentiating between the two requires knowledge of what instigated the problem from a watershed perspective, typical channel characteristics within the specific reach and the social and biological impacts at the local site level. The risk of severe flooding, erosion or fragmentation of aquatic habitats are concerns that are raised when instream woody debris causes channel obstructions.

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Natural accumulations of large woody debris are very important as they provide a variety of cover habitats for fish, aquatic insects, and wildlife. They also maintain, to a significant degree, the stability of the channel by trapping sediment and organic matter while also redirecting flow that scours pools and exposes larger substrates. The diameter, length, and the degree of being imbedded into the channel will indicate debris stability in the stream and whether it needs to be removed or repositioned. The width of the stream also dictates the typical orientation, with perpendicular logs common in small streams. Larger rivers typically force woody debris into a parallel direction with the current.

Purpose

Large debris dams caused by changes in adjacent land use practices can have a devastating impact on fish migration, sediment transport, channel stability and increase the threat of flooding. When social values are at risk or some form of serious biological impact is identified, the obstructions should be removed in order to restore channel function and reduce possible harm. Otherwise, natural woody debris should be left alone because it's important to the stream ecosystem. If it is not natural debris - the usual urban garbage of shopping carts and plastic bags - feel free to remove those.

Application

Recognizing the importance, identifying stable forms, and evaluating the function of large woody debris are fundamentals to determining which material should be removed or retained. For the most part, removal of debris obstructions will focus on instream material that has potential to increase ice jamming, flooding and erosion or present impassable barriers to fish migration. Debris removal, as a stream rehabilitation technique, is applied in cases where the watercourse or watershed has been significantly altered in terms of forest removal, catastrophic events, drastic changes in hydrology (increased stormwater runoff volume and frequency) or channelization. It is important to recognize early in the assessment that the actual removal should be the last resort.

Steep slope streams, such as this B channel on the West Credit River, benefit from large woody debris because it creates pools and spawning areas.

Having a knowledge of channel slope, width, entrenchment, sinuosity and substrate combined with the length and diameter of the logs in the obstruction will provide the basis for determining whether the woody debris can be salvaged for creating log sills, deflectors, cover habitat, or, if it should be removed from the floodplain. Channel width will indicate the size of woody material that can be considered stable in the stream and the manner in which it can be positioned in relation to the flow. Slope, entrenchment, sinuosity and substrate will define the A, B, and C channel forms that accommodate woody structures. In general, those streams and rivers are known for their ability to sustain large woody debris based on the stable nature of the channel and limited sediment supply. Caution should be exercised in gravel, sand and silt-based C-type streams where bank-placed large wood debris can aggravate erosion on the opposite bank. Generally, high gradient streams have an increased need for wood debris whereas low gradient streams are more likely to benefit from selective removal of woody debris. In addition, small streams might benefit from selected woody debris removal and larger streams benefit from adding wood debris.

Small streams of less than seven metres in width can support a larger amount of wood debris with a variety of diameters and lengths. In this case, most logs will orient perpendicularly or downstream to the flow. Those logs will create stable plunge pools, bank-side log jams, deflectors and instream cover when firmly anchored to the bank or bed. Hazardous debris jams are not a common concern in this situation. Larger streams and rivers, greater than 7 metres in width, typically transport debris smaller than 10 metres in length to areas of accumulation such as log-jams. Logs and trees greater than 10 metres in length will orient parallel to the high discharge flow and maintain a stable position if firmly anchored to the river or bank. Hazardous drift dams are more common in larger streams and rivers.

Removal Guidelines

As with most other stream rehabilitation projects, we encourage you to look and learn before you leap. In most cases, woody debris in a stream is not a concern, but in a few cases, the flow impediment, sediment accumulation and habitat fragmentation related to the log-jam might prompt the need for action. This guideline has been created as a step-by-step process on the path of developing a removal plan based on consultation, assessment, restoring channel function, and creating cover habitat. Prior to embarking on a debris removal project, there are three important steps to be followed toward establishing agreement in principle:

1. Ownership

- find out who owns the property at risk
- ask if they share a similar concern regarding the obstruction
- ask if they concur with the need for removal.

2. Consultation

- meet with your local MNR district office and/or conservation authority on site
- ask for their thoughts on your proposal. An application process and permit might apply.
- find out when the least amount of impact is likely to occur as a result of debris removal. Correct timing will help mitigate biological impacts.
- ask what is expected in terms of sediment control and removal of woody debris.

3. Agreement

- if consensus is reached with the approval agencies and land owner that a serious flooding, erosion or biological impact exists, request their assistance in designing an obstruction removal project.

Once the principle of obstruction removal has been established, you will then develop a detailed plan of action. As a general rule of thumb, the larger the channel, the more assessment and forethought required. You will need to document existing conditions related to typical channel characteristics and the nature of the obstruction:

4. Draw

- a plan-view sketch of the reach of stream indicating the location of the debris obstruction, thalweg, pool and riffles, access options
- take photographs

5. Measure

- channel widths on 10 metre increments for the reach and determine typical channel width, total length of reach and debris obstruction

- the drop in vertical head of the water level from one end of the debris jam to the other using a surveying scope or line level
- average slope of reach with survey scope or line level
- the length and diameter of a representative sample of wood debris

6. Determine

- if the debris is consolidated in sediment or not
- the nature of the sediment stored upstream of the obstruction - is it silt, sand, gravel, or organic
- if the blockage provides grade control and whether removal would accelerate erosion
- the predominate substrate for a typical section within the reach
- limits of the active floodplain

Once this information has been documented, you will have the knowledge to proceed with developing the removal plan in consultation with the regulatory agencies and landowner. The measurements provide an understanding of the obstruction size and damming effect as well as the characteristics of the channel in a typical section. Determining the nature of accumulated sediment, degree of debris consolidation, typical substrate composition, and extent of floodplain will help you develop answers to questions such as:

- what should the channel look like in the location of the obstruction?
- how is this debris to be removed?
- is a partial removal sufficient to address the concern?
- who or what is going to remove it?
- when is it to be removed?
- how long will it take, given the resources available?
- is there a sufficient volume of stored sediment to warrant a phased removal over several weeks or months?
- what is the closest access?
- where is the debris to go once removed?
- is the debris large enough to create instream cover habitat nearby or better suited for floodplain brush piles for wildlife?
- what kind of habitat structures are suitable for this type of channel?

Documented explanations should be carefully thought out because they form the basis of your removal plan. Once you have achieved a level of confidence with these answers, the removal plan should illustrate the proposed channel form through the affected section, the points of access, the location for debris piles outside of the active floodplain, and the location and type of any prescribed sediment controls. You should also include the types and locations of rehabilitation structures such as bankside cabled log-jams, sweeps, floating log cover, log sills, or deflectors.

Keep in mind that streams and rivers narrower than seven metres will accommodate more wood debris than larger channels. In this case, most large wood salvaged from drift dams should be secured to the bed or back of the channel such that it is perpendicular to the flow or oriented downstream. Generally, expect to accommodate 18 to 20 pieces of large woody debris in a 100 metre section. Rivers wider than 10 metres usually deposit the debris in the floodplain or cause it to accumulate on the outside of bends, on top of large anchored logs and boulders. In their natural state, large logs are anchored at one or both ends in parallel with the flow. If you are trying to mimic this condition, it is suggested that 70% of the length of the log be anchored into the bank and the orientation of the log into the flow of the river should be 30 degrees or less. Alternative uses of salvaged large woody debris include construction of log deflectors, sweepers or bankside cabled log-jams.

Building a cabled log-jam with the woody debris removed from a safety hazard can create beneficial habitat for fish and stabilize eroding shorelines. (CVC photo)

Materials

You will need the following tools for removing woody debris:

- 50 metre measuring tape
- survey scope and metred stick or line level and string
- bow saws, shovels
- chain saw and personal safety gear
- land based winch
- rope

For securing relocated logs to the channel you will need:

- aircraft cable, crimps and crimping tool
- cable cutting tool
- 2 metre "T" bar posts
- 25 cm galvanized ardox spikes
- sledge hammer

Cost and Maintenance Needs

Under most circumstances, the expense of removing debris obstructions is limited to the cost of the crew and hand tools. Costs can escalate where heavy machinery is needed. For larger log-jams, the phased approach might be required to reduce the amount of impact

from sediment release. It is best to start at the downstream end and work upstream. Frequent monitoring of the area within the first year is needed to ensure that the removal has not aggravated erosion. Sediment scour will reveal buried debris that might require removal as well.

Integration

Debris removal can be integrated into other stream rehabilitation projects such as:

- cabled log-jams
- floating log cover
- sweepers
- deflectors
- log sills

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Demonstrations

This type of channel restoration has been applied in the following demonstration projects:

- Project #41, Devil's Creek
- Project #43, Hanlon Creek
- Project #66, Purpleville Creek Rehabilitation Project
- Project #67, East Humber River Rehabilitation Project
- Project #87, Anderson's Creek
- Project #86, St. Helen's Creek
- Project #123, Rocky Saugeen Silt Spill Rehabilitation Project
- Project #140, Young's Creek Rehabilitation

For More Information

Please refer to the following authors and their respective publications located in the bibliography:

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