Opportunities for Cold Water Fisheries Habitat Enhancement Associated with Forestry Operations in Maine

Placing Large Wood in Streams

Wood addition project on Cook's Brook in Lyman

Maine Department of Agriculture, Conservation and Forestry
Maine Forest Service
April, 2013

Adapted from Oregon Guide to Placement of Wood, Boulders and Gravel for Habitat Restoration, Oregon Department of Forestry 2010. And a Supplemental Guide for Large Wood Additions to Streams to Enhance Stream Function and Fish Habitat with Particular Focus in Downeast Maine, Ben Naumann 2011

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Introduction

This guide is intended to be used by forest managers and others to aid with the implementation of wood addition habitat enhancement projects in Maine. This guide should be considered a living document that will be updated as new information becomes available.

Until recently, the role of large wood in forming and maintaining fish habitat in Maine's streams was not well understood. In fact, in the past, guidance provided to landowners was often to remove wood from streams. We now understand that large wood in streams plays an important role in providing habitat for many of Maine's important fish species including brook trout and Atlantic salmon.

As settlement and development increased over the past three plus centuries so did the removal of large wood from the state's waterways. In many streams, dams were built to drive logs to mills. Opening of the dams resulted in a large torrent of logs and water that scoured the streambed and removed wood, boulders, gravel, and other material from the stream channel and riparian areas. Historic logging and agricultural practices also removed trees to the edge of the stream, limiting wood input to the stream. In some cases, streams were cleared of wood and boulders to improve navigation or facilitate the driving of logs. Over time these activities resulted in depletion of habitat for Maine's cold-water fish, including brook trout and Atlantic salmon. The removal of in-stream features often altered channel form, stream flow, and how wood, boulders, rock and gravel moved through the river system.

Figure 1. Birch River Eagle lake TWP 1954. Historic log driving practices included bulldozing stream channels. This led to simplification of stream habitat. Photo from Frost et al. 2004.

Figure 2. 35 Brook, Narraguagus River drainage. Note the over widened stream, lack of habitat complexity and lack of large wood. Photo Credit Ben Naumann.

We have since learned that large wood is an important part of the forest-stream ecosystem and is important for the survival of trout and salmon that inhabit the streams. Large wood diverts water flow, changes water velocity to trap sediment, creates pools and provides cover for juvenile fish.

Since natural stream processes have been altered in many areas, aquatic habitat restoration activities are an important method for reintroducing necessary structure to stream channels. Stream habitat restoration includes a multitude of approaches, from the simple to complex. The purpose of this guide is to highlight the unique opportunity that exists during timber harvesting to place large wood back into streams to enhance fish habitat. During a timber harvest, equipment and trained personnel capable of placing wood into streams are already on site, presenting a logical opportunity to accomplish fish habitat enhancement through wood addition.

To streamline the process for accomplishing wood addition treatments in streams, the Maine Forest Service (MFS) has developed standards in MFS rule chapter 25 for wood addition that allow projects to be completed without a permit or fee if conducted in accordance with the rule. For a copy of the rules see Appendix D.

Activities covered in this guide are meant to supplement the information in the Chapter 25 rule. In case of discrepancies the rule shall always govern.

Activities in this guide cover the addition of wood to increase the amount of pools, habitat complexity, and cover available to fish. Specifically the treatments covered in this guide:

- Rely on the size of wood for stability;
- Exclude artificial anchoring such as cabling;
- Mimic patterns of large wood that occur from natural riparian processes over time;
- Do not rely on constructed habitat structures;
- Will be conducted in coordination with the Maine Department of Inland Fisheries and Wildlife and/or Maine Department of Marine Resources and
- Are consistent with MFS Rule Chapter 25.

Other activities such as bank stabilization, narrowing over widened stream channels, anchoring wood, and placing boulders back into streams are more complex and beyond the scope of this guide. These practices may also require permitting. If you wish to undertake these other activities you must seek additional assistance.

Figure 3. Pool formation in a headwater stream following large wood addition treatment. Note variety of wood sizes used in the treatment including large logs that span the channel and smaller pieces that collect to form a logjam. Photo Credit Jay Milot.

Identifying Candidate Streams **(See Appendix A for decision tree)**

Types of Streams to Consider

The potential effectiveness in changing the stream shape by large wood placement varies with the stream's slope and width. In very steep streams (>5%

slope) with very large boulders and rocks, log placement will have less impact to changes in stream bottom because the substrate is usually immovable except during extreme flow events. In low gradient or very small streams, the force of the water may not be enough to move sediment to change the shape of the stream. Figure 4 outlines a “sweet spot” where the combination of the streams width and slope mean that large wood would have the greatest impact on the physical habitat for fish. Streams measurements that are within this “sweet spot” have enough slope and width to scour and deposit substrate material, yet probably still contain smaller material, which can be moved around when large wood placement changes flow paths.

In larger streams, large wood placement can provide a benefit, but logs will likely need to be stabilized to prevent excessive movement or be placed only partly into the water along the edge of the stream. Larger and steeper streams, that exceed the parameters identified in Figure 4, have more stream flow or power that can lift and move large wood. This makes large wood placement more complex and may require alternative techniques. Projects in these types of streams require additional review and design by qualified individuals and are beyond the scope of this guide.

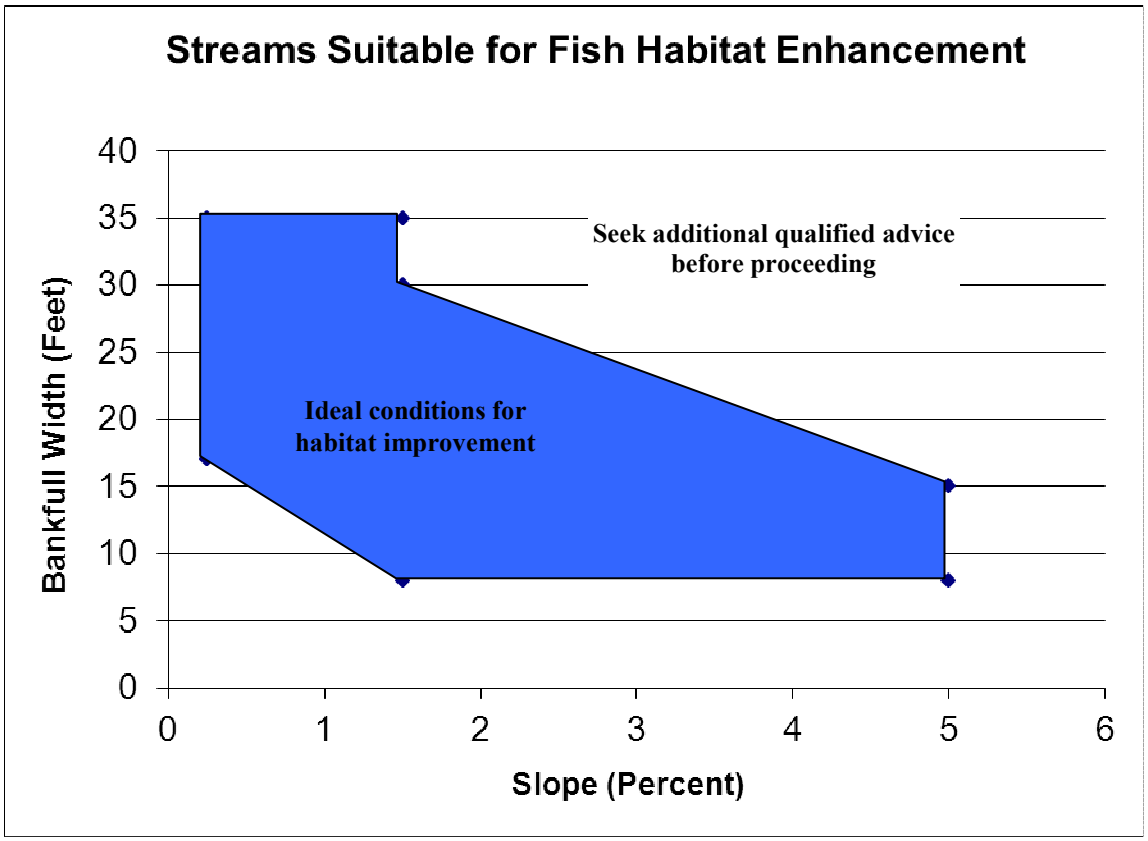


Figure 4. Stream characteristics necessary for fish habitat enhancement. The shaded region shows the stream slope and bankfull width which, evaluated together indicate the ideal fish habitat enhancement opportunity. Other streams outside this are may be effectively treated but additional advice must be sought before proceeding. (Adapted from Guide to Placement of Wood, Boulders and Gravel for Habitat Restoration. Oregon DOF 2010)

Determining Stream Slope

Stream slope is determined by the change in elevation over a horizontal distance (rise over run). This can be determined by several methods, such as use of a clinometer, bubble level and string, surveying equipment or by GIS analysis. If the slope is at the borderline for acceptable conditions, more accuracy may be required to determine the effective restoration technique.

Determining Bankfull Width

Bankfull width (also called an active channel width, ordinary high water or high water mark) is the width of the stream at bankfull flow that occurs every 1 or 2 years. This is the point where water starts to leave the channel and flow into the floodplain. In lower gradient streams and in wider valleys where the stream has not cut down below the surrounding land (incised), the bankfull mark usually is where the bank slope changes from steeper to more gentle or even flat (see figure 5).

Many small streams that are candidates for placement work are either incised or confined by side slopes. This is often seen as the stream channel forming a cross section shaped like a V or a U. In those cases look for clues such as an abrupt change in vegetation, material deposited on the bank or on overhanging branches during high flows. Changes in rock color or an abrupt change in texture of the bed or bank material may also be used to determine bankfull width.

Bankfull width is measured from one side bank mark to the other (Figure 5). The width of large islands that would be dry even under bankfull conditions should be subtracted from the bank-to-bank measurement. To get an accurate bankfull width measure at least 10 points along the part of the stream where the work will be done. The measurements should be at least 1 or 2 channel widths apart covering the length of the project area.

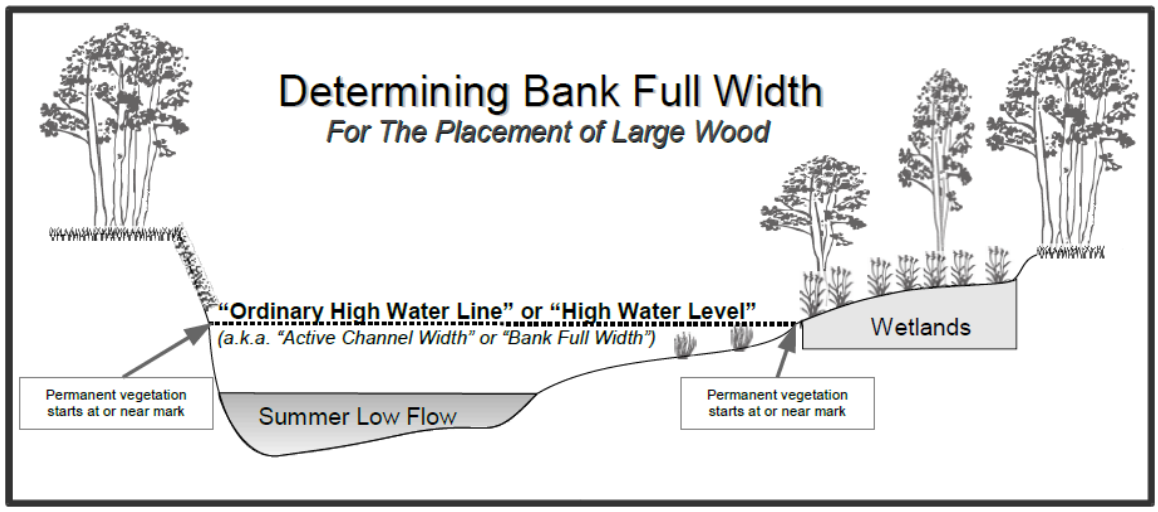


Figure 5. Cross section of a stream with normal and bankfull flow levels indicated. Area above Bankfull would be considered floodplain (Oregon DOF 2010).

Determining Wood Loading

Prior to implementing a large wood placement project, it is important to evaluate the existing reach conditions, as it is possible a given stream already has enough wood in it to create multiple functional logjams. In this case, the addition of more wood may be of limited resource benefit. Estimates of how much wood is enough vary, but for Northern New England values of 100 to 230 pieces > 6" in diameter per mile is generally considered adequate to produce the desired habitat conditions. Undertaking a simple tally of existing pieces of large wood before treating a reach will give an indication of how much wood needs to be added.

Determining Current Pool Habitat

Pools over 3'deep are a critical habitat element that is often missing from streams that have an insufficient amount of large wood. Making a rough of estimate stream area that is made up of pools >3' deep area while tallying existing large wood will be helpful in determining the potential benefit of adding wood. Having 30% of stream area be quality pool habitat is considered ideal for brook trout.

Downstream Infrastructure

Even small streams can exert tremendous energy on in stream wood when under flood conditions. Movement of wood must be planned for when downstream infrastructure is present, particularly road crossings. Oregon's Guide to Placement of Wood, Boulders and Gravel of Habitat Restoration (Oregon DOF 2010) recommends having at least two meander bends between the last wood placement and any road crossing. Play it safe, if you suspect downstream infrastructure might be put at risk by a large wood project choose another site!

Project Implementation

Coordination with Resource Agencies

Projects must have input from Department of Inland Fisheries and Wildlife regional fisheries biologists and, where appropriate, Department of Marine Resources salmon biologists to assure treatments are installed in appropriate locations. Coordination with the Department of Marine Resources MUST occur when working in designated critical habitat for sea-run Atlantic salmon. Coordination is also required to be sure that large wood additions do not conflict with other fisheries management goals, for example presenting barriers to smelt spawning runs. Coordinating directly with the resources agencies will also simplify or eliminate the permitting process.

Project Timing

Wood can be effectively placed at any time of the year, but late summer provides the added benefit of hardwoods having the leaves on, which increases organic matter inputs. This will also increase the catch of leaves from fall leaf drop.

Permitting

Wood addition projects that are consistent with the standards in MFS rule Chapter 25 do not require permitting. Projects that deviate from the standards in this rule (for example artificially anchoring wood or adding boulders) may require permits from agencies such as the Maine Department of Environmental Protection, Army Corps, etc.

Tree Selection

Timber value

Tree selection should consider current and potential timber value. Choose low quality timber trees for use in treatments. Trees that are crooked, excessively limby, or are considered lower value timber species, such as hemlock or cedar, will satisfy the goals of the large wood treatments and minimize the financial impact to the landowner.

Diameter

The key to establishing a logjam to create pool habitat is utilizing larger diameter wood that resists decay. These pieces of wood are often called “key pieces,” and serve as the anchors for the logjam structure. Conifers (spruce, hemlock, cedar, etc.) have the potential to last longer than hardwoods (maple, aspen, ash etc.) given the same diameter and conditions. Therefore, conifers are preferred as the key pieces of wood. The combination of conifers and hardwoods increases the complexity of the structure and the hardwoods serve other functions. Since hardwoods break down more rapidly, they serve as feeding platforms for a variety of insects increasing biological diversity. Some hardwoods also are structurally weaker so during flood events the hardwood pieces will break allowing water pressure to be reduced through the new open area. The smaller pieces move down stream and can be accumulated on the next structure.

Wood can improve fish habitat only if the wood can stay in place, influence flow patterns, and sediment sorting. Larger diameter wood retains its size longer as abrasion and decay occurs over the years. Larger diameter wood is more effective in creating pools and complex channels that improve fish populations. The minimum diameter required for a key piece of wood depends on the bankfull width of the stream is found in Table 1.

Bankfull Width* Feet	**Minimum Diameter* Inches**
0 to 10	10
10 to 20	16
20 to 32	18
Over 32	22
*This table was taken from the 1995 A Guide to Placement of Large Wood in Streams.	

Table 1. Bankfull widths and minimum diameter of logs to be considered key pieces.

Length

The length of the wood is also important to stability. A piece that is longer than the stream is wide is less likely to be carried away when the water is high. To be considered a key piece a log with a rootwad still attached should be at least one and one-half times (1.5X) the bankfull width or a log without a rootwad should be twice (2X) the length of the stream's bankfull width. As the best fish habitat is formed around jams composed of 3 to7 logs, at least 2 key pieces should be used at each structure. These log lengths require a larger storm event to move them to a new location and have a higher probability of becoming stable at the next meander bend or obstruction. Leaving limbs and branches on the logs also increases stability and provides additional cover for fish. Hardwood logs or smaller trees with branches can be can be added to the structure to accelerate the development of a functional logjam.

Effective Wood Placement

Whenever possible rootwads should remain attached. The roots also add to the stability of the structure over a wider range of stream flows. In windthrows small material is often pinned under the larger trees so small (6-10" diameter) material should be included in the project.

The first few upstream structures capture most of the natural small wood floating downstream and matures quickly, so the addition of small wood and leaf litter is very important for the downstream structures to become fully functional.

Large Wood Placement Methods

Large wood can be placed in streams either by cutting trees and felling them directly into the stream, a technique known as "chop and drop" or pushing or winching whole trees using forestry equipment. Each technique has advantages and disadvantages.

Chop and drop

The chop and drop technique severs trees and fells them directly into the stream channel, usually using a chain saw. Wood added to streams using this technique tends to be less stable than trees that enter the stream with the rootwads still attached, so more wood movement should be expected. Because of this, the technique should be used with extra caution on larger streams and streams with high gradient, especially when there is downstream infrastructure present. This technique may also be slower to promote the desired changes to the stream channel than trees with rootwads. A major advantage is this technique can be easily applied in areas not appropriate to access with forestry equipment, such as sensitive riparian soils and steep slopes. The chop and drop technique is also a quick, low cost way to get wood into the stream.

Pushing or winching

Trees can also be pushed or winched into streams using forestry equipment. This technique can leave the rootwad attached to the tree leading to greater stability of the wood in the stream and more rapid changes in the stream channel characteristics. If rootwads enter the stream they also provide increased cover and habitat for small fish. The major disadvantage is the greater potential for disturbance to the stream banks and riparian areas that can be caused by equipment. Care must be taken to identify areas where soils and other conditions are appropriate to operate equipment. If not used carefully, large equipment may also create larger canopy openings than is desirable. If equipment is used, water quality Best Management Practices (BMPs) described in the Maine Forest Service BMP manual should be followed to prevent untended impacts to the waterbody. Techniques have also been developed for winching trees into streams using hand equipment. Naumann describes these techniques in detail (See references).

Regardless of the technique used, to achieve the desired results the large wood needs to be within the bankfull width both horizontally and vertically to promote changes to the stream channel. The majority of changes to the channel takes place during high water/bankfull flows with large wood being located within the bankfull channel (Figure 6). If the felled large wood is within the bankfull width the stream will be forced to flow over, under, or disperse around the obstruction (Figure 7). Dispersal flow is not desired due to the erosion along the stream banks that is creates. To minimize impacts of dispersal flow reinforce the bankfull sides by felling small large wood (i.e. smaller trees less than 6 inches in diameter) before the large wood is felled to protect banks from excessive erosion (Figure 8). It is recommended that the smaller large wood be conifers because they will collect the leaf litter in the fall which will case the flow to concentrate into the middle of the channel.

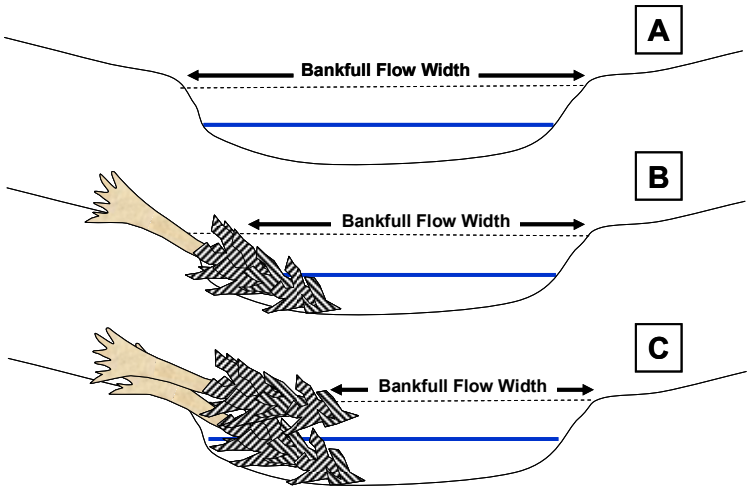


Figure 6. A) Stream cross section with bankfull flow unrestricted by large wood during bankfull flows. B) Bankfull flow marginally restricted by large wood during bankfull flows, little stream geomorphologic change will take place due to the inability of the bankfull flow to be redirected. C) Bankfull flow is restricted by large wood during bankfull flows redirecting the flow, promoting geomorphologic change. (Naumann 2011).

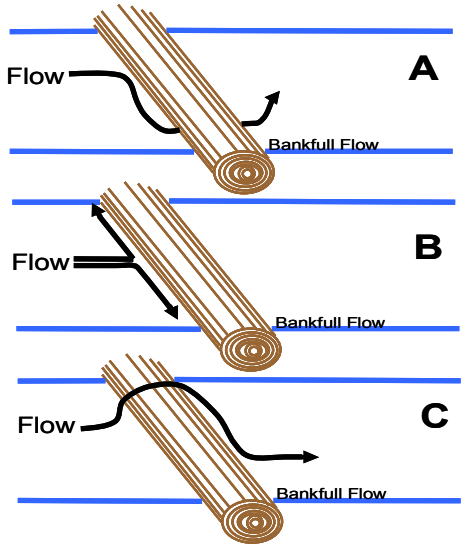


Figure 7. Types of flows that can be created when large wood is felled across the stream. The type of flow created by the large wood will be dependent on where the large wood is felled related to the bankfull width. If only the bottom of the large wood is within bankfull, flow will be forced under the log as shown in A. If the large wood is directly within bankfull, flow will be forced away from the large wood as shown in B. If the large wood is in or just above the summer average wetted channel bankfull flows will flow over the large wood as shown in C. (Naumann 2011)

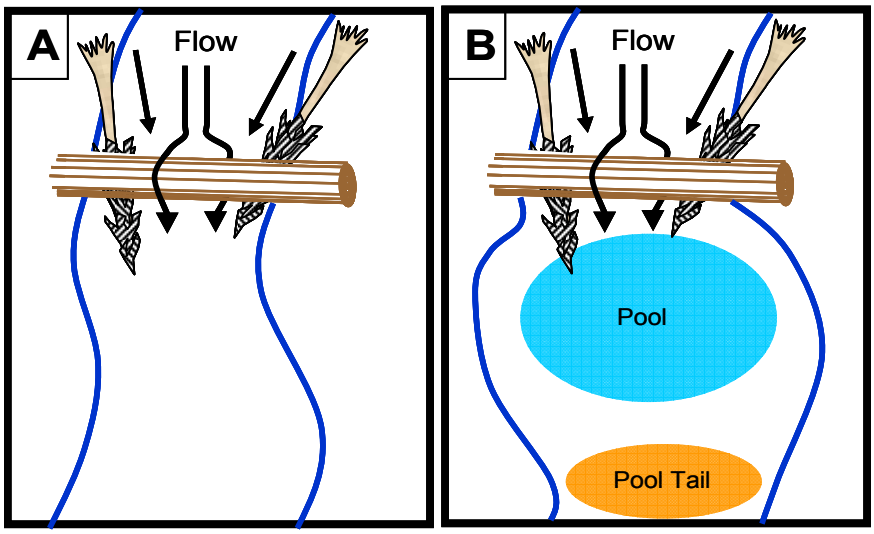


Figure 8. A) Adding smaller wood on each side of the stream to concentrate flow over or under the large wood. B) Over time a pool will form with the material moving down stream to form a pool tail/riffle habitat. Note this type of stream is specifically for a stream with an over widened channel (Naumann 2011).

Windthrow Emulation

One of the keys to a successful wood placement project is to mimic natural processes. One such option is to mimic the deposit of wood that occurs during windstorms. Windthrow emulation duplicates the result of a tree or group of trees becoming up rooted during a storm and landing in the stream. In a natural process, trees may have only part of the tree in the active channel often with

some of the trunk still on the stream bank. The weight of the log on the bank increases the stability and reduces downstream movement. The orientation of the wood is not important because the length and diameter of the wood along with the stream forces will position the wood to form a stable structure. Equipment can manipulate the logs to increase their stability by placing the wood between 2 standing trees that will lock the log in place by creating a pivot and stop point (Figure 9, panel A). In addition, one log can be placed on top of another so the weight of the top tree can pin the second tree (Figure 9, panel B). This is a simple windstorm emulation that allows the wood to adjust to the stream flow. Complex structures with multiple logs with interlocking pieces of wood provide better habitat and mimic wood accumulation over time. Figure 10 provides some ideas on the configuration of the key pieces of wood in a restoration structure.

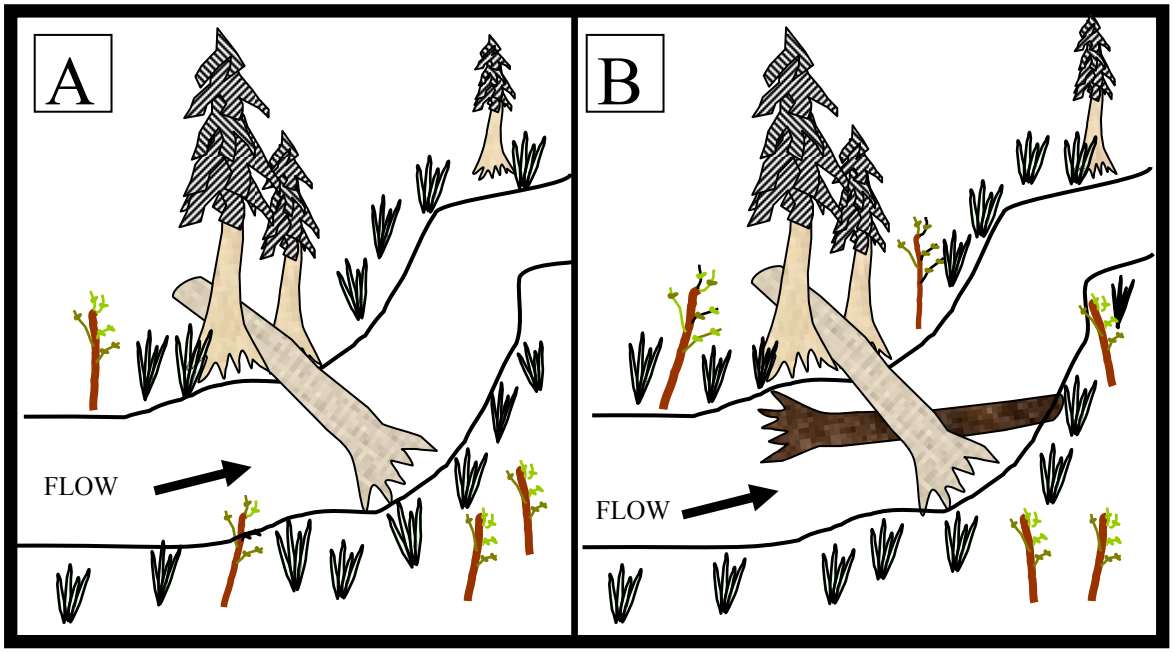
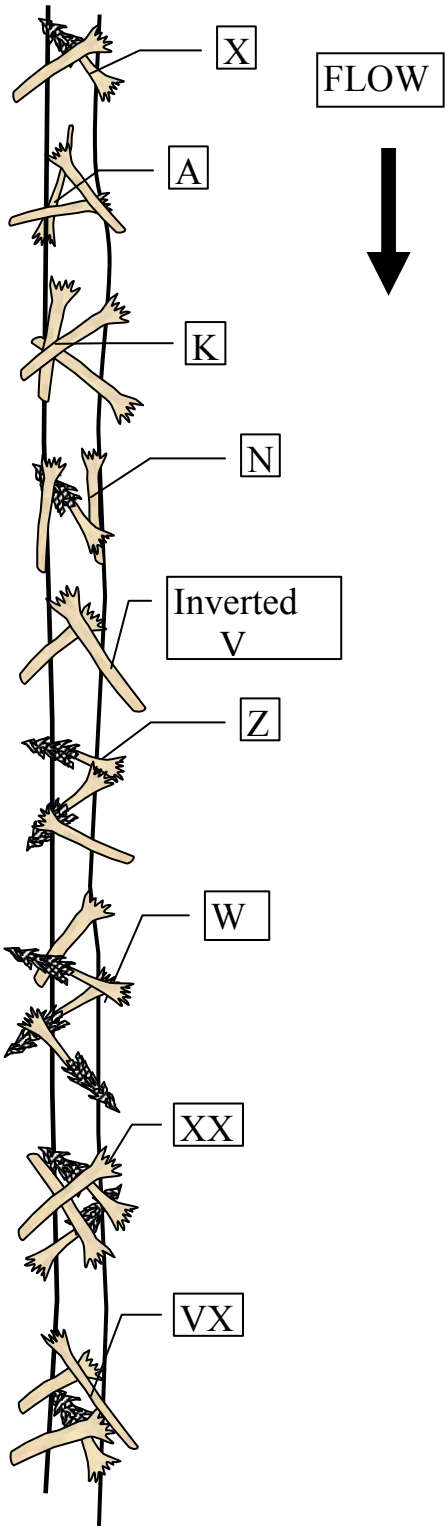


Figure 9. Panel A is single log placed between two standing trees to create a pivot and lock point. Panel B is an X pattern where the weight of the top log pins the bottom log to reduce the movement. Not shown are limbs that will create better habitat (Oregon DOF 2010).



Large wood may be positioned in the stream in various configurations. The examples to the left are some patterns that can be used.

For stability, 2 of the logs should be twice the bankfull width if they do not have the rootwads attached or 1.5 times the bankfull width if the roots are attached and meet the tree diameter criteria in the guidelines.

The large wood can be placed between standing trees to increase the stability by preventing the logs from rotating downstream.

To increase hiding areas for juvenile fish, it is recommended that the limbs be in contact with the summer flow channel. Coarse wood can be added to the structure if the tree does not have roots wads or limbs.

Simple patterns can be combined to form complex structures of 3-7 logs.

Figure 10. Showing typical plan view wood configurations and alphabet codes for use in describing them (Oregon DOF 2010).

Other Considerations

Aesthetics

A freshly implemented wood addition project has the potential to negatively impact aesthetics. Aesthetics should be considered when deciding where to implement projects.

Other Riparian Functions

Riparian forests and individual riparian trees can have many important ecological functions. Consider of the effects of wood addition treatments and tree selection on other resources in these areas when planning treatments.

Recreational Use Conflicts

Projects should not be planned where they would interfere with recreational water uses including canoeing and kayaking. Local knowledge of potential of the stream reach for these uses should be investigated before a project proceeds.

Outreach

Since wood addition treatments are relatively new in Maine, many people may not be aware of the purposes of these activities. Signage and other outreach to explain the purpose of this activity can help to alleviate concerns of people who stumble on an area where trees have been intentionally felled into a brook.

Monitoring

Projects should be monitored following implementation to assess effectiveness and look for wood movement, particularly if downstream infrastructure is present. Permanent photo points are a simple way to track wood addition projects over time.

References

Oregon Department of Forestry. 2010. Guide to Placement of Wood Boulders and Gravel for Habitat Restoration. 24pp.

Frost, F.O., Trial J.G., and Gallagher M. 2004 (2). Bulldozed Trout Streams: Can they recover from the mid-1900's log drives? Maine Fish and Wildlife 25-26.

Maine Forest Service Rule Chapter 25. Standards for Placing Wood into Stream Channels to Enhance Cold Water Fisheries Habitat .12pp.

Best Management Practices in Forestry: Protecting Maine's Water Quality. Maine Forest Service. 2004. 92pp.

Naumann, B. 2011. A Supplemental Guide for Large Wood Additions to Streams to Enhance Stream Function and Fish Habitat with Particular Focus in Downeast Maine. 17pp.

Appendix A – IFW and DMR Offices and Biologists

Maine Department of Inland Fisheries and Wildlife
Fisheries Biologists

Region A - Gray
RR1, 358 Shaker Road
Gray, ME 04039
(207) 657-2345 Fisheries - Press 2

Francis Brautigam, Regional Biologist - ext. 112
James Pellerin, Asst. Regional Biologist - ext. 111
Brian Lewis, Biologist Specialist - ext. 113

Region B - Sidney
270 Lyons Road
Sidney, ME 04330-9711
(207) 547-5300 **Fisheries - Press 2**

Jason Seiders, Regional Biologist - (207) 547-5314
Wes Ashe, Asst. Regional Biologist - (207) 547-5316
Scott Davis, Biology Specialist - (207) 547-5317

Region C - Jonesboro
PO Box 220
Jonesboro, ME 04648

Gregory Burr, Regional Biologist - (207) 434-5925
Joseph Overlock, Biology Specialist - (207) 434-5925

Region D - Strong
689 Farmington Road
Strong, ME 04983

Fisheries - (207) 778-3322

Robert VanRiper, Regional Biologist - ext. 23
Dave Howatt, Asst. Regional Biologist - ext. 21
Elizabeth Thorndike, Biology Specialist - ext. 22

Region E - Greenville
PO Box 551
Greenville, ME 04441
(207) 695-3756 Fisheries - Press 2

Timothy Obrey, Regional Biologist - press 2
Jeff Bagley, Asst. Regional Biologist - press3
Steve Seeback, Biologist Specialist - press 4

Region F - Enfield
73 Cobb Road
Enfield, ME 04493 **Fisheries - (207) 732-4131**

Gordon (Nels) Kramer, Regional Biologist - press 2
Kevin Dunham, Asst. Regional Biologist - press 1
Kevin Gallant, Biologist - press 1

Region G - Ashland
PO Box 447
Ashland, ME 04732-0447
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Frank Frost, Regional Biologist - ext. 209
Jeremiah Wood, Asst. Regional Biologist - ext. 208
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Jonesboro Office
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Appendix B – Chop and Drop Plan Template

In Stream Large Woody Debris Addition Treatment Plan

Completion of this form satisfies the plan requirement of Maine Forest Service Rule Chapter 25 "Standards for Placing wood into Stream Channels to Enhance Cold Water Fisheries Habitat". All treatments proposed must be consistent with standards in Chapter 25.

Stream Name_____ Town_____ Date_____

GPS Coordinates of upstream end of treatment:

N_____ W_____

GPS Coordinates of downstream end of treatment:

N_____ W_____

Average stream bankfull width in feet: _____

Total number of pieces of wood to add:_____

By signing below I certify that I have reviewed this plan and that the proposed treatment is acceptable.

Signature_____ Date_____

Print Name_____
IFW or DMR Fisheries Biologist

Signature_____ Date_____

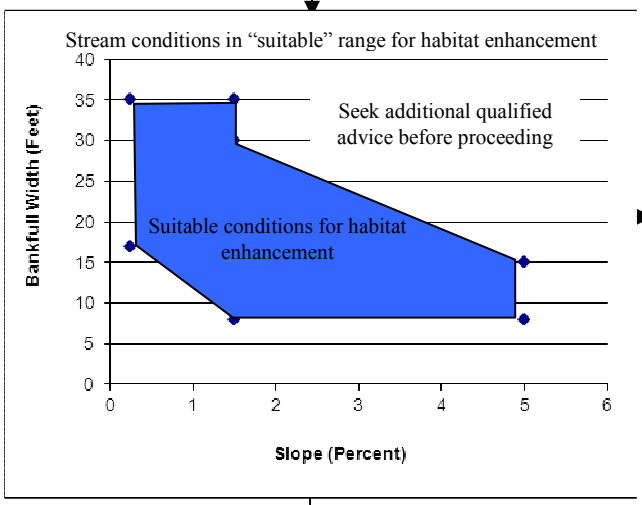
Print Name_____ License#_____
Licensed Forester

Note: Include this plan and a copy of a map of the treatment location with the Forest Operations Notification.

Appendix C – Wood Addition Decision Tree

Perennial stream supporting a viable population of acceptable fish and macro-invertebrate species

No



No

Stream totally devoid of pools

Yes

Boulder dominated stream lacking cover and / or energy inputs

No

Pools > 3' deep < 30% of stream area

No

< 50 % substrate embeddedness

No

< 20% fine sediment in spawning areas

No

Seek additional qualified assistance before proceeding

Ownership includes both streambanks

No

Adjacent owner amenable to project

Yes

No

Protection of downstream infrastructure is practicable

No

Stop

No

Proposed project consistent with all MFS Chapter 25 Standards including designation of reach and project plan

Obtain permits

Proceed with project

Manage streamside forest for natural long term recruitment of large wood. Consider limiting harvesting within 25 feet of stream.

Appendix D – MFS Chapter 25 rules

04-058
Maine Forest Service (MFS) Rule
Chapter 25
Standards for Placing Wood Into Stream Channels to Enhance Cold Water Fisheries Habitat

Effective Date: December 25, 2012

MAINE DEPARTMENT OF CONSERVATION
MAINE FOREST SERVICE

ADOPTED RULE: 2012-350

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04 DEPARTMENT OF CONSERVATION

058 BUREAU OF FORESTRY

Chapter 25: STANDARDS FOR PLACING WOOD INTO STREAM CHANNELS TO ENHANCE COLD WATER FISHERIES HABITAT

AUTHORITY. 12 M.R.S., §8867-C; Public Law 2011, chapter 599.

SUMMARY. This rule establishes standards for placing wood into stream channels under the supervision of a licensed forester for the purpose of enhancing cold water fisheries.

SECTION 1. PURPOSE

The purpose of this rule is to streamline the permitting process for implementing cold water fisheries habitat enhancement projects that involve adding wood to stream channels. Projects implemented under the supervision of Maine licensed foresters, who have been trained by the Bureau of Forestry in cooperation with the Department of Inland Fisheries and Wildlife (DIFW) in these techniques, and take place in stream reaches designated by DIFW or Department of Marine Resources (DMR) biologists as needing treatment, do not require a state permit or fee if consistent with a treatment plan developed by a DIWF or DMR fisheries biologist or their designee. The intent of the plan is to provide additional guidance to the forester implementing the treatment; the plan must be mutually agreed upon by the DIFW or DMR and the landowner or their agent. The treatment detailed in the plan must be consistent with standards in this rule.

SECTION 2. SCOPE AND APPLICABILITY

A. SCOPE. This rule establishes standards for adding wood to a river, stream or brook channel as defined in 38 MRSA §480-B(9). It does not govern federal lands.

B. APPLICABILITY. This rule applies to treatments where only wood will be placed below the bankfull elevation of the stream and that rely on the size of the wood for stability. Treatments that artificially anchor or cable wood, add boulders, or place fill material below the high water line or otherwise exceed or deviate from these standards, are not covered by this rule and require permitting.

SECTION 3. DEFINITIONS

For the purpose this rule, the following terms are defined as follows.

A. **Atlantic salmon Areas:** From the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The following impassable falls delimit the upstream extent of the freshwater range: Rumford Falls in the town of Rumford on the Androscoggin River; Snow Falls in the town of West Paris on the Little Androscoggin River; Grand Falls in Township 3 Range 4 BKP WKR, on the Dead River in the Kennebec Basin; the un-named falls (impounded by Indian Pond Dam) immediately above the Kennebec River Gorge in the town of Indian Stream Township on the Kennebec River; Big Niagara Falls on Nesowadnehunk Stream in Township 3 Range 10 WELS in the Penobscot Basin; Grand Pitch on Webster Brook in Trout Brook Township in the Penobscot Basin; and Grand Falls on the Passadumkeag River in Grand Falls Township in the Penobscot Basin.

B. **Bankfull Elevation:** The elevation of the stream banks at bankfull width.

C. **Bankfull Width:** Bankfull width is the width of the stream at the "Normal high water line" as defined in 38 MRSA §480-B.(6) to mean "that line along the shore of a great pond, river, stream, brook or other nontidal body of water which is apparent from visible markings, changes in the character of soils due to prolonged action of the water or from changes in vegetation and which distinguishes between predominantly aquatic and predominantly terrestrial land…"

D. **Biologist:** A fisheries biologist employed by the Maine Department of Inland Fisheries and Wildlife or Maine Department of Marine Resources, or other qualified person identified by those departments, who has attended a training in wood addition techniques including an introduction to timber harvesting techniques and forestry regulation.

E. **Designated Reach:** A section of stream that has been identified by DIFW or DMR as suitable for wood addition treatment and where a DIFW or DMR biologist or their designee has developed a treatment plan that has been mutually agreed upon by DMR or DIFW, and the landowner or their agent. The treatment detailed in the plan must be consistent with the standards in this rule.

F. **Dispersal Flow:** Stream flow forced around a piece of large wood and into the stream banks leading to bank erosion.

G. **Key Piece:** A piece of wood that will form the basis of a log jam structure and is of sufficient size to resist movement by bankfull flows.

H. **Licensed Forester:** Licensed forester means a forester licensed under 32 MRSA, chapter 76.

I. **Meander:** A meander is one of a series of freely developing sinuous curves or loops produced as the stream moves from side to side of its floodplain.

J. **Meander bend**: A meander bend is the convex side of a meander.

K. **Stream channel:** Stream channel means a channel between defined banks created by the action of surface water, which is characterized by the lack of terrestrial vegetation or by the presence of a bed, devoid of topsoil, containing waterborne deposits or exposed soil parent material or bedrock; and which is connected hydrologically with other water bodies. "Stream channel" does not include rills or gullies forming because of accelerated erosion in disturbed soils where the natural vegetative cover has been removed by human activity.

L. **Wood:** Wood refers to the stems and branches of trees either fully severed or partially attached to the stump. Wood may include uprooted trees if the root wad or disturbed soil is not in a position such that it will end up below the normal high water line. Wood does not include processed wood such as slabs, edgings, lumber or timbers, or logging debris including slash and material left from temporary stream crossings such as pole or brush fords, or other forest product refuse prohibited by 38 MRSA § 417 (1).

M. **Wood Diameter:** Wood diameter is the average diameter of the stem measured at the large end.

SECTION 4. TRAINING REQUIRED

Before a licensed forester can oversee the implementation of a wood addition project, they must have completed training in wood addition techniques approved by the Bureau of Forestry and the Department of Inland Fisheries and Wildlife. The Bureau of Forestry will maintain a list of foresters who have satisfactorily completed this training.

SECTION 5. DESIGINATED STREAM REACHES

A. Designating Reaches

Wood addition treatments completed under this rule may only take place in designated reaches. To be considered a designated reach, a DIFW or DMR biologist must have identified the stream reach as lacking desirable habitat features and as being suitable for wood addition treatment. Once designated, reaches remain designated for 4 years. If treatment is not undertaken in 4 years, the biologist must renew the designation before treatment can occur.

B. Plan Requirement

To be considered a designated reach a treatment plan must have been prepared by a DIFW or DMR biologist or their designee for that reach. The treatment detailed in the plan must be consistent with the standards in this rule. The plan must be mutually agreed upon and signed by the DIFW or DMR and the landowner or their agent and is intended to aid the forester implementing the treatment. The plan will include the beginning and ending coordinates of the treatment area, the number of pieces of wood to add and the average stream width. The biologist may also mark trees to be felled, but this is not required. The treatment detailed in the plan must be consistent with the standards in this rule.

C. List of designated reaches

The MFS will maintain a list of designated reaches.

SECTION 6. WOOD PLACEMENT STANDARDS

A. Key Pieces

1. Species

Decay resistant species, such as hemlock, tamarack, spruce, and cedar are preferred as the key pieces of wood.

2. Diameter

The minimum diameter required for a key piece of wood depends on the bankfull width of the stream and shall meet or exceed the requirements in Table 1.

Bankfull Width Feet	Minimum Diameter Inches
0 to 10	10
10 to 20	16
20 to 32	18
Over 32	22
Source: Oregon - Guide to Placement of Wood, Boulders and Gravel for Habitat Restoration	

Table 1. Bankfull widths and minimum diameter of logs to be considered key pieces.

3. Length

A. To be considered a key piece, a tree must be at least 1.5 times the bankfull width if the root wad is attached or 2.0 times the bankfull width if severed from the root wad. Key pieces may be shorter if they can be effectively secured against movement by bracing against or between standing trees, boulders or other naturally occurring stable objects (See Figure 3).

B. At least two key pieces must be used at each structure. Limbs and branches must be retained on key pieces to the extent possible.

B. Wood Loading Rate

Smaller pieces of wood should be placed in stream sections between the key pieces. The total number of pieces of wood per mile of treated stream reach shall not exceed 230. This number includes both existing pieces and pieces added during the wood addition treatment. 40-60% of these must be between 6" and 12" in diameter. The remainder must be greater than 12" in diameter.

C. Wood Orientation and Placement

Dispersal flow must be minimized either by placing the large wood relative to the bankfull elevation so flow passes either over or under the wood (Figures 1 (A) and (C)) or by reinforcing the bankfull sides by felling smaller trees (less than 6 inches in diameter) before the large wood is felled to protect banks from excessive erosion (Figure 2).

Figure 1. Types of flows that can be created when large wood is felled across the stream. The type of flow created by the large wood will be dependent on where the large wood is felled related to the bankfull width. If only the bottom of the large wood is within bankfull, flow will be forced under the log as shown in A. If the large wood is directly within bankfull, flow will be forced away from the large wood as shown in B. If the large wood is in or just above the summer average wetted channel bankfull flows will flow over the large wood as shown in C.

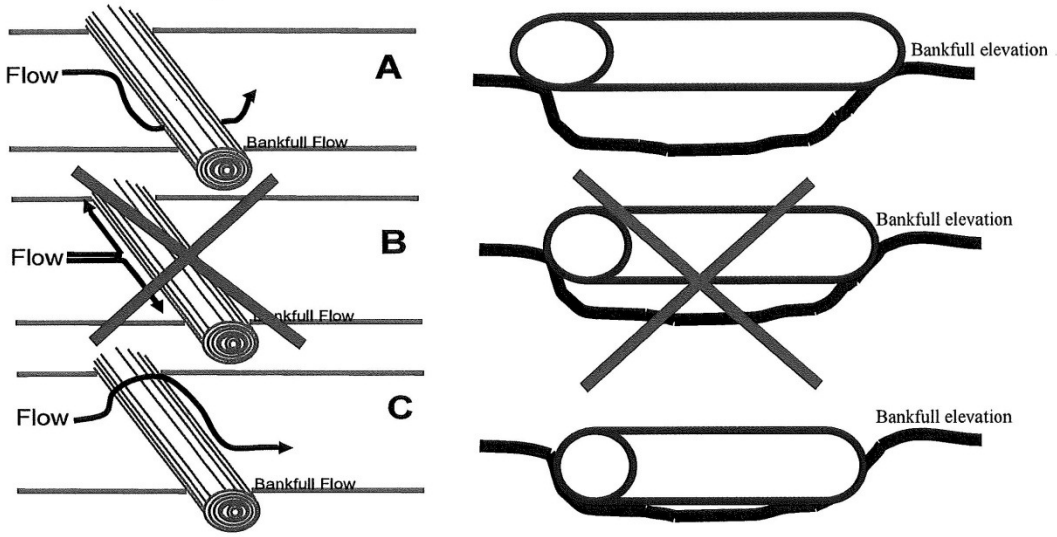
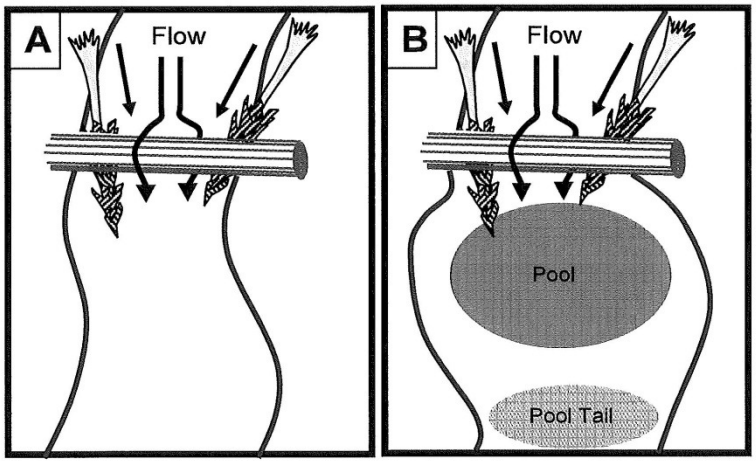


Figure 2. A) adding smaller wood on each side of the stream to concentrate flow over or under the large wood and protect banks from dispersal flow. B) over time a pool will likely form with the material moving down stream to form a pool tail/riffle habitat complex. Note this type of treatment is specifically for a stream identified by DIFW or DMR as having an over widened channel.



Wood movement is acceptable, but wood must be placed so that stable structures will eventually be formed around key pieces. Figures 3 and 4 provide examples of wood placement to form these structures. The weight of the log on the bank increases the stability and reduces downstream movement. Equipment can manipulate the logs to increase their stability by placing the wood between 2 standing trees that will lock the log in place by creating a pivot and stop point (Figure 3 panel A). In addition, one log can be placed on top of another so the weight of the top tree can pin the second tree (Figure 3 panel B). Complex structures with multiple logs with interlocking pieces of wood provide better habitat and mimic wood accumulation over time. Figure 4 provides some ideas on the configuration of the key pieces of wood in a restoration structure.

Figure 3. Panel A is single log placed between two standing trees to create a pivot and lock point. Panel B is an X pattern where the weight of the top log pins the bottom log to reduce the movement. Not shown is coarse wood (CW) or limbs that will create better habitat.

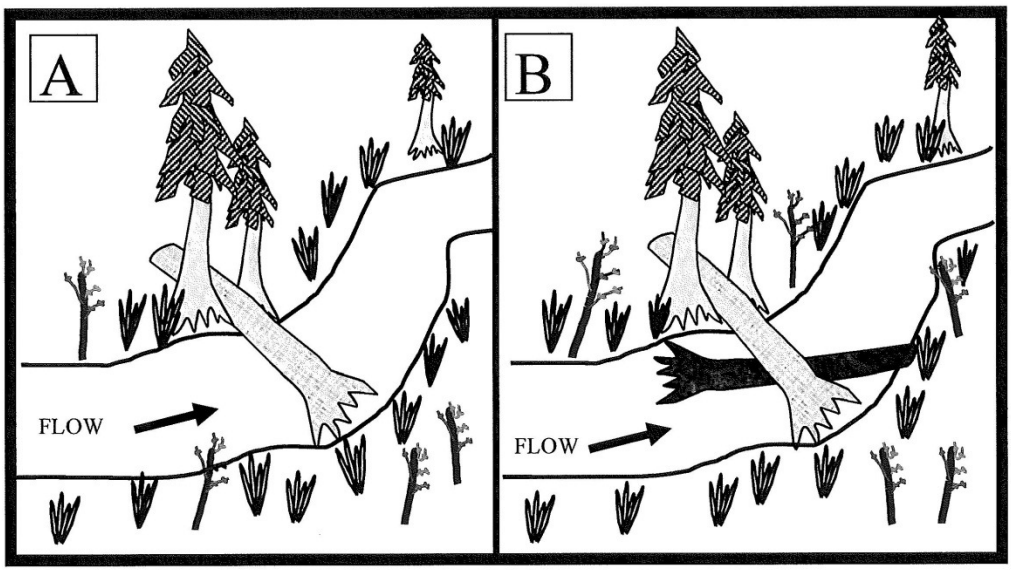
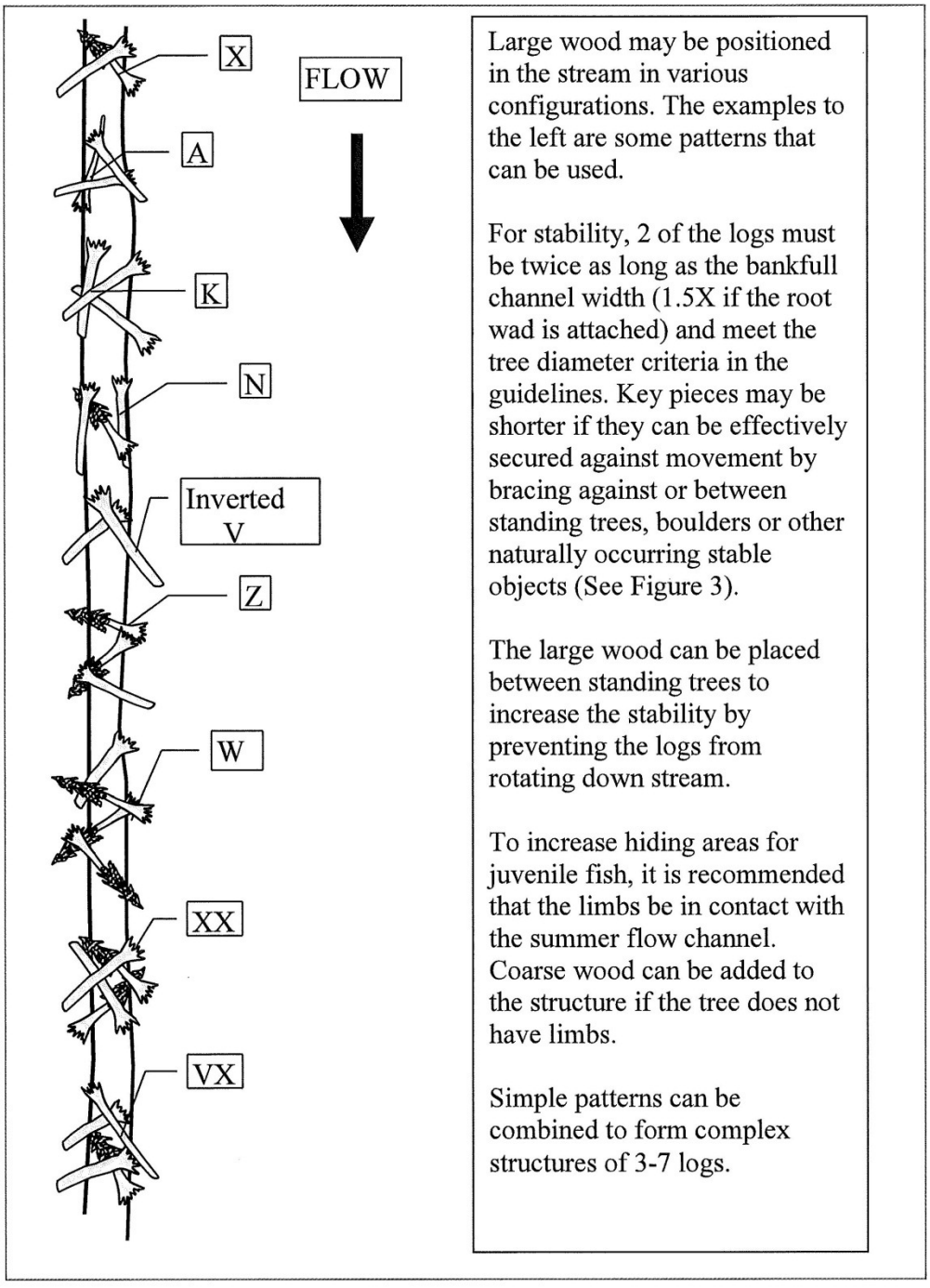


Figure 4. Showing typical plan view wood configurations and alphabet codes for use in describing them.



D. Residual Stand Condition

Trees felled for a wood addition treatment "count" toward the allowable removal under the requirements of 38 MRSA, § 438-D (shoreland zoning) or 12 MRSA, §8867-B (statewide standards for timber harvesting in shoreland areas), as applicable.

E. Soil Disturbance

Reasonable measures must be taken to avoid the occurrence of sediment entering the stream channel and the disturbance of stream banks. If, despite such precautions, disturbance occurs which could result in continuing sedimentation, these conditions must be immediately corrected with hay bales, siltation fence, water bars or other appropriate measures.

F. Downstream Infrastructure

Wood must not be placed where downstream infrastructure could be put at risk by wood movement. A minimum of 2 meander bends must be present between the end of the treatment area and any downstream road crossing.

SECTION 7. NOTIFICATION

A. Prior to implementing a wood addition project a licensed forester must a Forest Operations Notification form to the Bureau of Forestry. This submission must:

1. Have the appropriate box checked indicating that an in-stream wood addition project will be taking place.
2. Include a map showing the location of the treatment area. The map shall have sufficient detail for a person unfamiliar with the site to locate the treatment area.
3. Include a copy of the treatment plan previously prepared and signed by IFW, DMR or their designee and the landowner or their agent, for the designated stream reach. DMR must sign the form if the reach is in an Atlantic salmon area.

B. The Bureau of Forestry will provide copies of the Forest Operations Notification form, map and treatment plan to DIFW and DMR if the project is in an Atlantic salmon Area.

SECTION 8. RESPONSIBILITY

The licensed forester overseeing the wood addition treatment is responsible for complying with the standards in this rule.

SECTION 9. VIOLATIONS

Any person, including but not limited to a landowner, a landowner's agent or a contractor, who orders, contracts for, or conducts any activity in violation of this rule commits a civil violation, and is subject to the penalties located in12 MRSA, chapter 809.

SECTION 10. EFFECTIVE DATE

The effective date of this rule is December 25, 2012.

STATUTORY AUTHORITY:
AUTHORITY. 12 M.R.S., §8867-C; Public Law 2011, chapter 599.

EFFECTIVE DATE:
December 25, 2012 - filing 2012-350

Appendix E – Maine IFW Forest Management Recommendations for Brook Trout

MAINE DEPARTMENT OF
INLAND FISHERIES AND WILDLIFE

Forest Management Recommendations for Brook Trout

Background

Brook trout (*Salvelinus fontinalis*), commonly referred to as squaretail, brookie, and speckled trout, are native to Maine and are the most preferred sport fish sought by Maine anglers. Size may vary, depending on water temperature, productivity, and food sources, but 3 year-old brook trout in Maine lakes may range from 7.5 to 17.5 inches long. Stream populations are typically slower growing, and lengths of 6 to 10 inches are more common place, although some populations mature and reproduce at lengths smaller than 6 inches.

Maine is the last stronghold for wild brook trout in the eastern United States. There are more than twice as many watersheds supporting wild populations in Maine than all of the other 16 states within the historical eastern brook trout range combined. Maine is also the only remaining state with extensive intact lake and pond dwelling populations of wild brook trout.

Brook trout require clean, cool, well oxygenated water and are very sensitive to changes in habitat and water quality. Rivers and streams typically provide spawning and nursery habitat. Adults are commonly resident in streams, but migrate throughout and between drainages to meet seasonal life history requirements.

Stream habitat suitability is maintained by the presence of intact, mature wooded riparian corridors that conserve forest soils, provide shade to reduce stream warming, protect stream water quality, provide cover for fish, and provide a source of woody debris and leaf litter from mature trees that maintain in-stream habitat for fish and the aquatic insects they feed upon. Floodplain and fringe wetlands associated with streams can be a significant source of springs and groundwater discharge that maintain stream flows and cool temperatures during warm low flow summer periods. Protection of these important riparian and wetland functions ensures that the overall health of the stream habitat and watershed is maintained.

Maine brook trout fisheries are unique and highly valuable, but they are vulnerable to habitat alteration that may be caused by poorly planned and implemented land management activities. Well planned forestry operations can protect habitat and help ensure that forests remain as forest; a compatible land use for brook trout and many other fish and wildlife.

Forest Management Recommendations
Brook trout are not afforded any special state or federal regulatory protection for forestry operations, and as such management recommendations are advisory.

The MDIFW recommends following Best Management Practices (BMPs) during all road and trail building activities, as well as timber harvesting. BMPs are detailed in the booklet titled *Best Management Practices for Forestry*, which offers guidance on managing and protecting water quality, installing road-stream crossings, and providing fish passage. This booklet is available at: http://www.maine.gov/doc/mfs/pubs/bmp_manual.htm or contact the Maine Forest Service at 1-800-367-0223.

Potential harmful impacts to fish and wildlife may be further minimized by designating low impact "riparian management zones" adjacent to streams and stream-associated fringe and floodplain wetlands in forest management and harvest plans. Smaller streams may be greatly influenced by land management practices; these systems benefit the most from well-managed and intact riparian corridors.

The MDIFW also recommends limiting the harvest of trees and alteration of other vegetation within 100 feet of streams and their associated fringe and floodplain wetlands to maintain an intact and stable mature stand of trees, characterized by heavy crown closure (at least 60 – 70%) and resistance to wind-throw. In some situations wider buffers should be considered where severe site conditions (e.g., steep slope, vulnerable soils, poor drainage, etc) increase risk to soil and stand stability. Any harvest within the riparian management zone should be selective with a goal of maintaining relatively uniform crown closure.