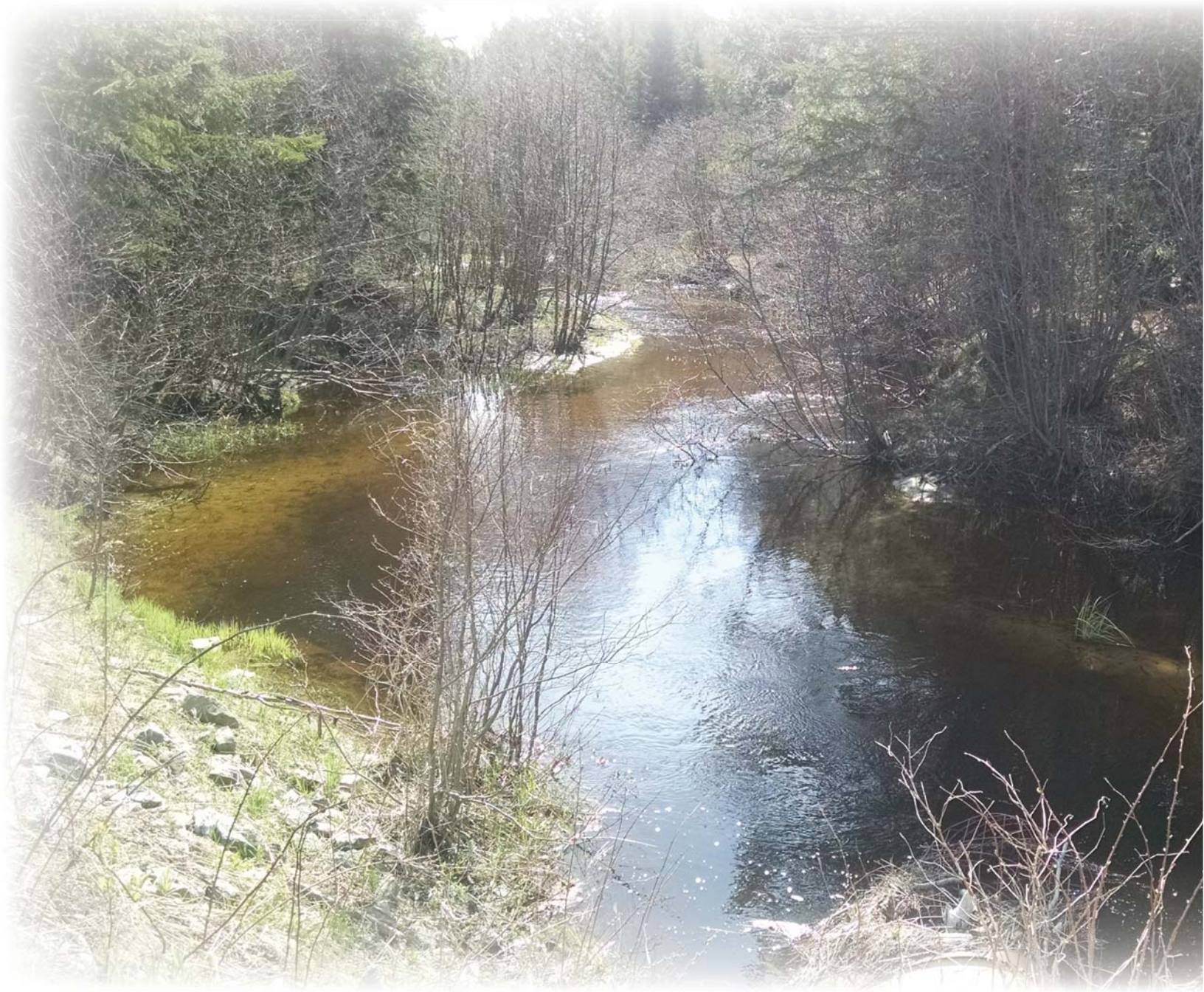
Rehabilitation Approach to Depot Creek

From Headwater to Boulter Road



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June 15, 2016

Rehabilitation Approach to Depot Creek: Headwaters to Boulter Road

Overview of stream morphology

This 1.8 km section from the headwaters to Boulter Road begins with a relatively steep gradient watercourse consisting of fast-moving run/riffle that runs straight for approximately 700 m (photos 1 & 2).

Photos 1 and 2. Fast-moving, alder-lined section, boulder-cobble rapids (first 700 m)

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The gradient flattens considerably at the first large meander, where high, steep, exposed sandy banks become prominent (Photo 3).

Photo 3. Typical sand banks and meander for 550 m after gradient flattens

The creek continues to slow and the meanders continue, forming a sand-bottomed, slow, run-pool morphology that continues to Boulter Road for the last 550 m (Photo 4).

Photo 4. Typical morphology for final 550 m to Boulter Road

Overview of Opportunities for Habitat Rehabilitation and Enhancement

Most impairment to channel flow in this section is the result of bank erosion. Steep sand banks mean that there will always be sand deposition into the watercourse and movement of bedload downstream. Strategic reduction (not elimination) of this erosion should improve habitat conditions for brook trout by:

- Maintaining quicker flow which keeps water temperature cool;
- Reducing obstructions to fish passage so that fish can access more of their critical habitats;
- Increasing stream diversity which can increase habitat quality and food sources.

Streambank erosion has led to at least 3 visible problems:

1. Channel obstruction preventing fish passage and diverting stream; leading to additional bank erosion (photo 4);
2. Braided channels reducing flow causing additional sand deposition, alder growth, warmer water temperatures and fish obstruction (photo 5);
3. Alder overgrowth reducing flow, causing additional sand deposition, and reducing stream productivity (photo 6)

Photo 4. Channel Obstruction

Photo 5. Braided Channel

Photo 6. Alder Overgrowth

While many small pools exist within this reach that could support larger trout, very little cover habitat exists within these, making habitat quality within these pools marginal (Photo 7).

Photo 7. Typical small, deep pool with minimal cover to support larger trout.

Recommended Approaches to Channel Rehabilitation and Habitat Enhancement

For this section of stream, the biggest problem that has led to habitat impairment is large-scale erosion of steep sand banks. Channel rehabilitation should focus on stabilizing these steep banks where appropriate and where possible; while also fixing some of the problems within the channel caused by this erosion.

Bear in mind that it is natural for a stream such as this to have some eroding banks and sand/nutrient input; therefore it is not necessary or desirable to stop every potential erosion problem. Stabilizing some of the major erosion issues and rehabilitating some of the instream issues caused by this erosion should however, improve the habitat conditions within the stream for trout.

The section that follows describes habitat rehabilitation and enhancement techniques that, in my opinion, are appropriate for this portion of Depot Creek. Expected results over time would be increased flow, improved direction of flow (i.e. water energy is in center of channel, and not

directed at a stream bank), fewer erosion issues, fewer obstructions to fish passage, and improved habitat structure for adult trout.

Before You Start

Key things to bear in mind before you begin, so that you minimize the chances of causing harm to fish or habitat:

- Work in low flow, during the driest periods of the summer. Don't work in the rain or after a rainfall.
- Don't work when sensitive life stages of fish could be present. Work between June 15th and September 1 to avoid fish in spawning condition, eggs, and larval brook trout.
- Use what is available on-site as much as you can. It saves time and effort.
- Don't remove existing fish habitat. If in doubt after reading the instructions below, leave things intact.
- Read the 'Cautions' for each Rehabilitation Action that is described – this will help you avoid causing harm to fish or fish habitat while working in the water.

The intent of this report is to provide advice and guidance on appropriate techniques to rehabilitate or improve trout habitat in this section of Depot Creek. It is still your responsibility to consult with the appropriate agencies (Ministry of Natural Resources and Forestry and/or Fisheries and Oceans Canada) and obtain any required permissions or approvals.

Rehabilitation Action 1. Remove Channel Obstructions

Approximate Locations and Photos

17T 647608 5109103

17 T 647269 5109110

17T 647483 5109088

Overview of Approach

- Starting downstream, cut and remove debris that is not submerged, and stockpile in an accessible area away from the streambank.
- Be careful what you remove. Only remove submerged pieces that are entirely blocking the channel. Pieces that are allowing lots of water flow underneath it are providing habitat.
- On the shore, separate the larger logs from the brush. Cut the logs into lengths that you can transport to other areas and use to stabilize banks. Stockpile logs well away from shore for later use.
- Bundle the brush using small gauge wire and a set of pliers, or wrap in burlap. Stockpile well away from shore for later use.

Cautions

- Be careful what you remove.
- Keep your stockpiles well away from shore.

Rehabilitation Action 2: Stabilize Major Erosion Areas

Approximate Locations and Photos

17T 647610 5109216

17T 647261 5109090

17T 647399 5109088

Overview of Approach

- Brush bundles by themselves can be keyed into the exposed bank to prevent further erosion, as well as capture sand and soil which will eventually allow vegetation to colonize and permanently stabilize the bank:

- Given the advanced erosion identified at this site, more extensive erosion control is likely required in most locations. A Fact Sheet excerpt from the MNR's Stream Rehabilitation

Manual (Community Fisheries Involvement Program –circa 1986) follows that provides specific instructions:

6.6 FACT SHEET

LOG-RIP-RAP

This fact sheet has been adapted from the Fisheries Habitat Rehabilitation Manual, Ontario Ministry of Natural Resources and C. Marshall, Cold Creek Flyfishers and Federation of Flyfishers.

Purpose

- To stabilize eroding stream banks.
- To narrow stream width.
- To create additional fish habitat.

Conditions Where Applicable

- In streams of low to moderate gradient.
- In streams which are less than 15 m.(50 ft.) wide.
- In streams where flooding is light or moderate.
- In streams where ice damage is not a potential hazard.
- Avoid streams which exhibit a shifting substrate or hard rock rubble substrate.
- Banks to be stabilized should not be more than 1.0 m (3.1 ft.) high.

Advantages

- Stabilizes moderately eroding banks.
- Uses natural materials. The cost of materials is low and the structure blends into the natural setting.
- The logs have uneven surfaces that provide hiding cover locations for fish.

Disadvantages

- Building the structure is labour intensive.
- The structure has general application to streams less than 15 m (50 ft.) wide.
- Does not work well in streams that have wide fluctuations in water level.

- Life expectancy of structures is relatively short compared to rock rip-rap.
- Annual maintenance (spring & fall) may be required.
- Wood might not be readily available at site.

Design Criteria

- This technique can be used to stabilize an eroding streambank or to narrow the stream width. In the case of the former, a log wall is built up to the height of the eroding bank (fig 6.6.7). In the case of the latter use as a stream narrowing technique, the profile of the structure is kept low so that freshets can easily overtop the structure (fig. 6.5.6). In this latter case the structure acts very much like a deflector.
- Build along an eroding bank where water depth is 0.3-1.0 metres (1-3.1 ft.). The eroding bank can be along a straight stretch or an outer bend.
- The structure width should extend out to the edge of the current but not more than 150 cm (60 in.) from the toe of the eroding bank (Fig. 6.6.1).
- Use cedar or hemlock logs 15-35 cm (6-14 in.) in diameter if available at site, or any other log material available nearby - preferably wood that would be slow to rot.
- Determine the amount of material suitable for the project. The structure needs enough logs to stretch the entire length of the erosion site and enough to stack up to the original height of the bank. This wall is usually one layer thick.
- Slope backfilled area gradually up into stream bank. This will allow waters to overtop cribbing during flood periods. The profile of the structure must be kept low.
- Use heavy duty 3.3 m (7 ft.) T-bars or metal posts (minimum length) as main supports. Note: if metal posts are used a hole must be drilled 10 cm (4 in.) from top to secure wire.
- Shorter wooden or metal stakes, approximately 40 cm (16 in.) are used on the old bank to help secure the structure.

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- Use heavy duty galvanized fencing wire (9-16 gauge) for lashing materials.
- For backfilling structure, brush, stumps, rotten wood, or gravel should be available. Wooden bundles composed of branches and small logs are created by wiring together these materials. Use bailer twine for lashing bundles. The bundles should be approximately 1.0 - 1.5 m. (3.3 - 5.0 ft.) long and 30 cm (12 in.) in diameter.
- Until experience is gained, work should only be attempted on sections no greater than 20 m. (66 ft.) in length.
- Timing of this technique may not be critical since actual instream work is minimal. However, this type of work is ideally suited during mid-summer when stream flows are low.

Implementation Steps

1. Determine location.
2. Stake the line of the current with temporary wooden stakes to mark the outside edge of the new bank. The line of the current can be determined visually by standing upstream of the planned devices. It is important that this be located with some accuracy as it is essential that the current, if possible, run swiftly along the edge of the outside logs.
3. Stockpile necessary materials at the site.
4. Begin work at the upstream portion of the structure.
5. Using a sledge or pile driver, drive a line of metal fence posts into the stream bed at 1.0 - 1.5 m. (3.3 - 5.0 ft.) intervals so that they lean into the current at about a 10 degree angle and lean out slightly. This prevents the buoyancy of the logs lifting the stakes out of the water during the spring runoff. The metal stakes should be located along the line marked by the temporary stakes which can be removed after all the metal posts are in place (fig. 6.6.1).

6. Using heavy gauge fence wire (the larger gauge the better) lash a line of logs to the metal posts forming a wall. It is important that these be located right on the stream bed, not on silt or mud which should be removed, exposing the underlying gravel before the logs are moved into place. Wire should be placed around the logs and posts in a figure "8" fashion (fig. 6.6.2).

7. Repeat the above procedure building up successive rows of logs to within 10 cm (4 in.) of the top of the metal posts.

8. Where the spring runoff is fierce, the structure can be strengthened by driving a second row of stakes on the bank side of the horizontal logs. Note: Do not use poplar, beavers love to eat it. These should be wired to the outside line of metal posts by pushing the wire through the gaps provided by irregularities in the horizontal logs.

9. Backfill the space between the log wall and the old bank to within about 15 cm (6 in.) of the top of the metal posts. This is a good way of getting rid of bankside debris - brush, stumps, rotten wood, turf, rocks, etc. (fig. 6.6.3). Compact the mixture by having the heavyweights in your group jump up and down on it, and put your heaviest items of fill on top to keep everything down.

10. Drive a series of stakes (wood or metal) in an offset pattern to the main stakes at a distance of 50-100 cm (1.8 - 3.1 ft.) back from the edge of the old bank at an angle back from the stream. Dig a shallow trench to eventually bury the wire. Wire these to the outside line of metal stakes with double strands of heavy gauge fence wire according to the pattern shown in fig. 6.6.4. A crossover pattern of wire wrapping is suggested (fig. 6.6.5). Tighten the whole structure by inserting a stick between the strands of wire and twisting.

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Figure 6.6.1 Illustrating the line of posts which mark the line of the current and the outside edge of the new bank. The posts or T-bars are driven into the substrate at approximately 1.0-1.5 m (3.1-4.6 ft.) intervals.

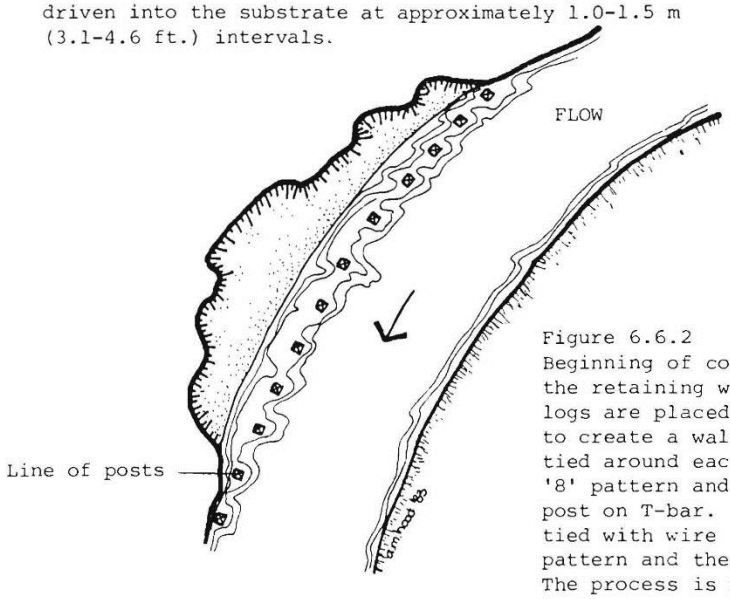
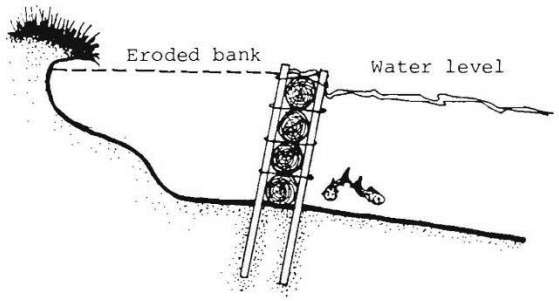


Figure 6.6.2
Beginning of construction of the retaining wall. Note the logs are placed behind the post to create a wall. The wire is tied around each log in a figure '8' pattern and then around the post on T-bar. The next log is tied with wire in a figure '8' pattern and then around the post. The process is repeated for all logs.



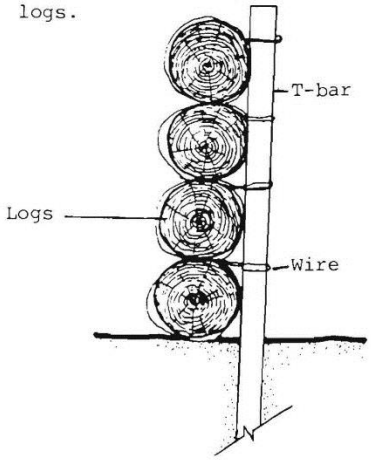
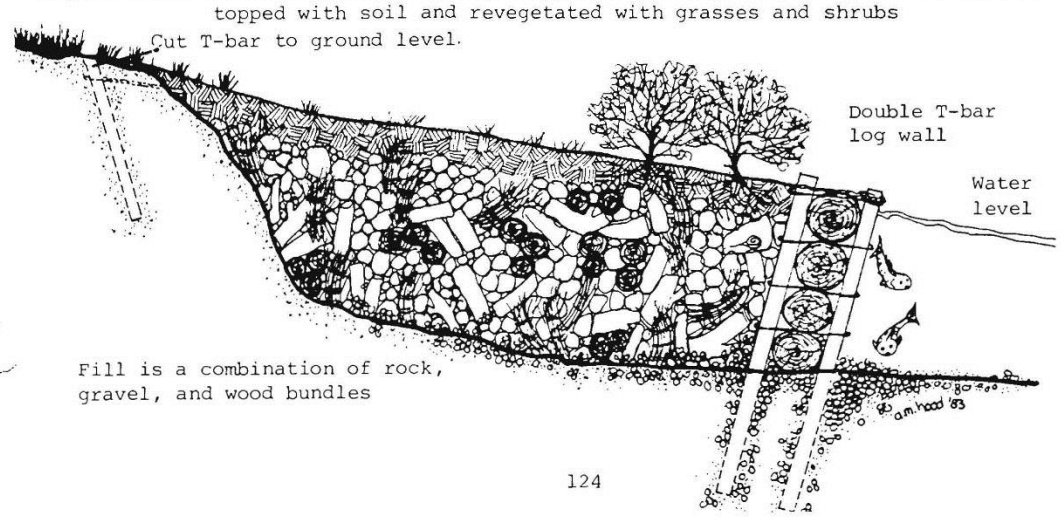


Figure 6.6.3 Cross section of a complete project of log rip-rap. The new bank is topped with soil and revegetated with grasses and shrubs



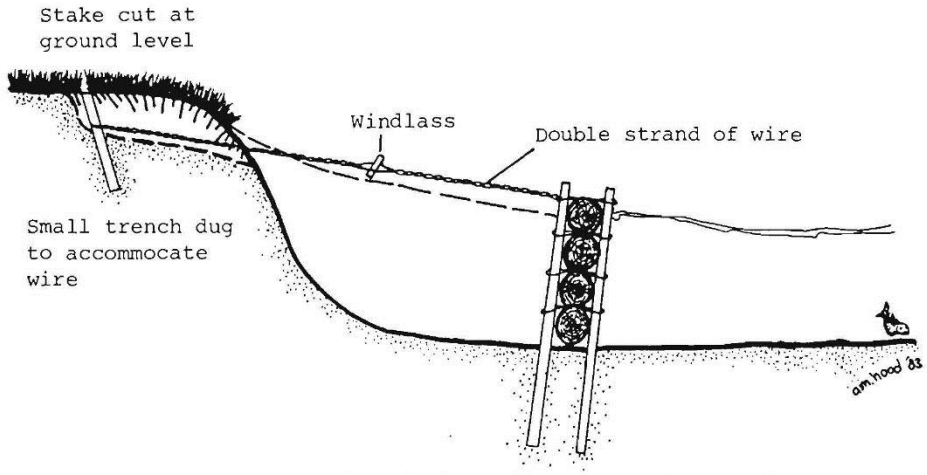
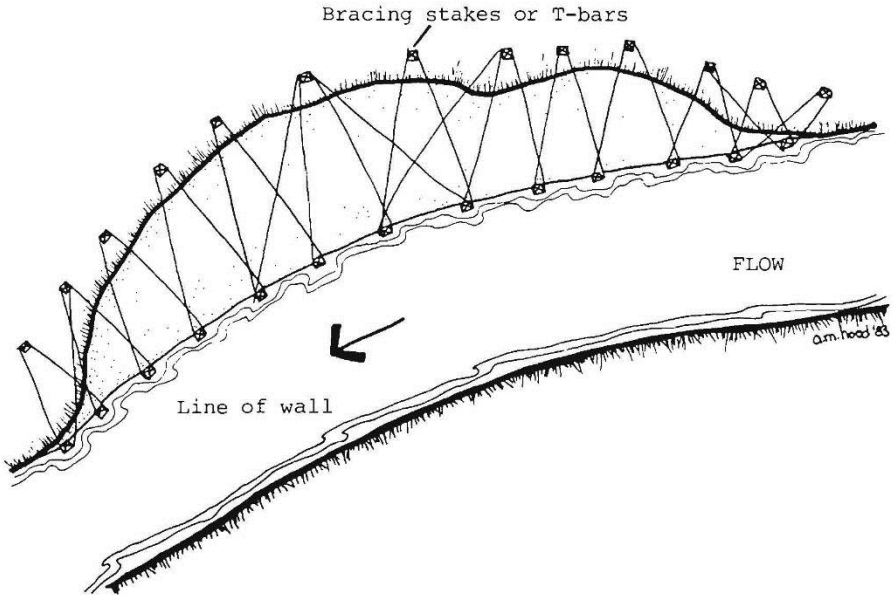


Figure 6.6.4 A cross section of the wall construction and 'keying' operation. Note a small trench is dug in the bank to bury the wire. The wire should be braced to the outside post and then over top of the uppermost log.

Figure 6.6.5 The bracing pattern. The wire when tightened should not be too snug. The criss-cross pattern is used for added stabilization of the structure.



Cautions

- Check base of slope for groundwater inflow. Do not impede groundwater from entering back into the creek.
- This technique is intended to prevent further erosion. Structures should be keyed into banks and not protrude into the main channel. The log rip rap must be aligned with the channel direction such that it does not end up deflecting stream flow into the other bank and causing a similar problem.

Rehabilitation Action 3: Deflect Flow back to Main Channel

Approximate Locations and Photos

17T 647654 5109212

17T 647581 5109185

17T 647510 5109091

17T 647483 5109088

17T 547269 5109110

17T 647599 5109221

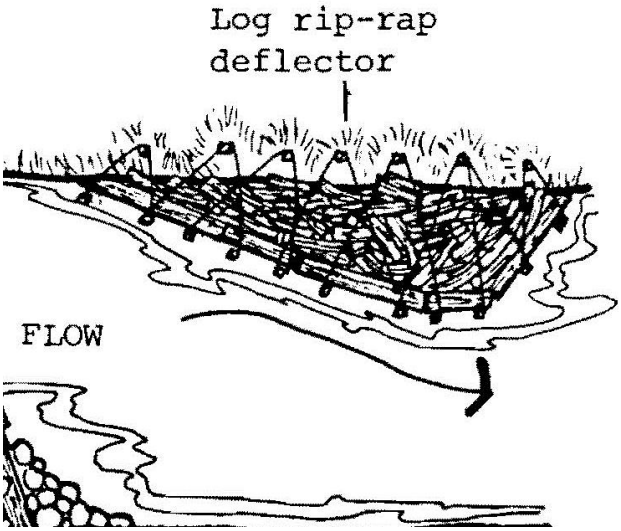
Overview of Approach

The objective in this case is to concentrate flow and develop a narrower, deeper channel, thereby eliminating many of the channel braids that have formed. One technique that is most appropriate for this case is the use of log deflectors. The intent of the log deflectors in this case, is to divert stream flow away from the braids in the channel and back into the main stream flow. The desired outcome is:

- A faster, more concentrated main channel;
- Reduction or elimination of braids in the channel;
- Increased bank stability.

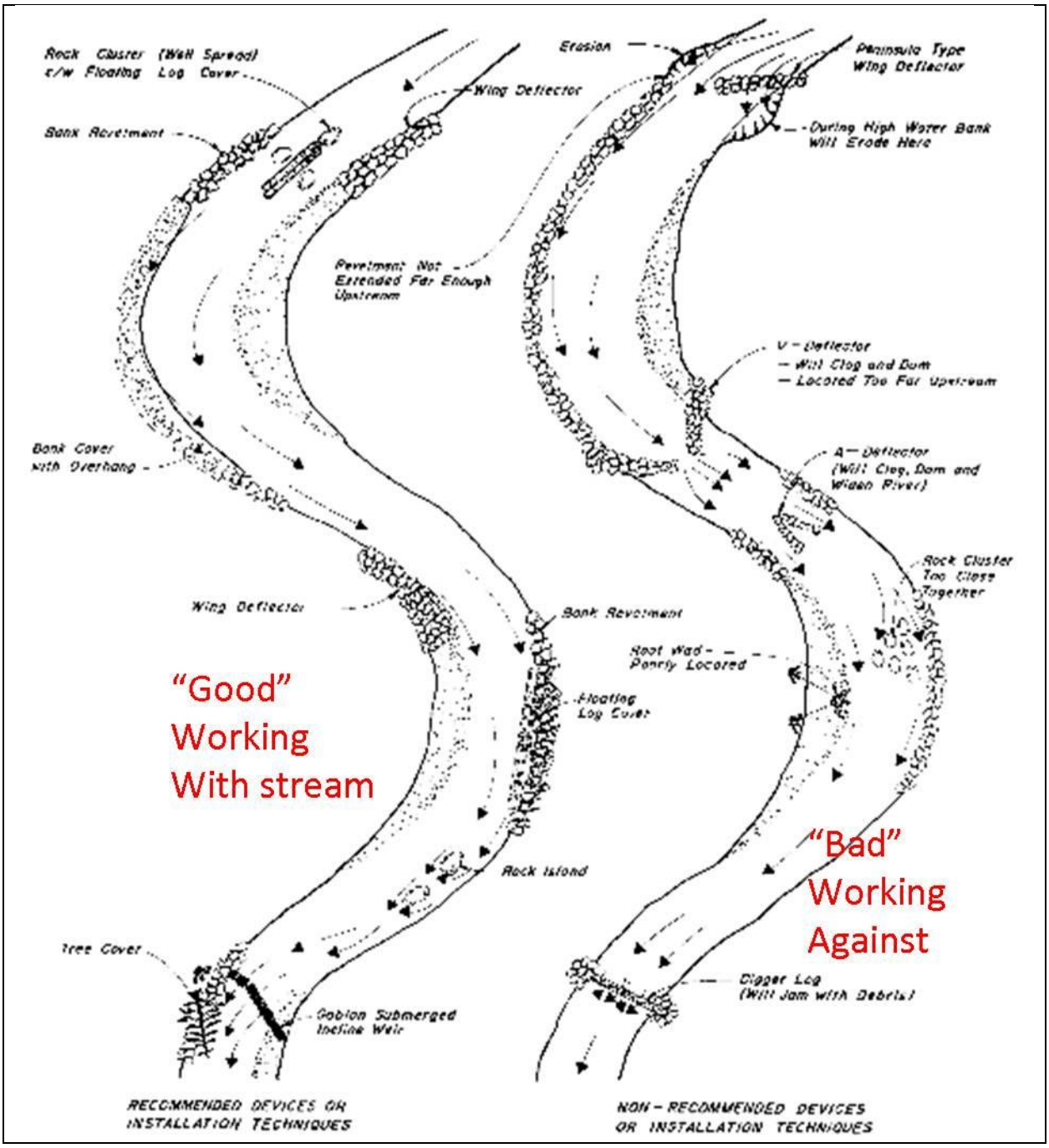
The key to installation of these deflectors is to observe the braids in the channel and the areas where sand has been deposited. Let this sand deposition guide you by installing directly on or in front of the sand deltas such that most of the flow gets diverted back into the main channel. The structure should have a low profile such that during periods of increased flow such as a freshet, water will spill over it and deposit sand.

Materials can consist of t-bars, logs, brush bundles and lashing wire as shown below.



Cautions

These deflectors need to be installed carefully so that they do not deflect the main current back into the opposite bank and cause another erosion problem. The intent is to divert the braided flow back into the channel; nothing else in this case. The key thing to remember is to work with the stream and its flow, not against it.


Rock Cluster (Well Spread) c/w Floating Log Cover
Bank Revetment
Wing Deflector
Revetment Not Extended Far Enough Upstream
Bank Cover with Overhang
Wing Deflector
Bank Revetment
Floating Log Cover
Rock Island
Tree Cover
Gabion Submerged Incline Weir
"Good" Working With stream
RECOMMENDED DEVICES OR INSTALLATION TECHNIQUES
Erosion
Peninsula Type Wing Deflector
Outing High Water Bank Will Erode Here
V - Deflector
- Will Clog and Dam
- Located Too Far Upstream
A - Deflector
(Will Clog, Dam and Widen River)
Rock Cluster Too Close Together
Root Wad - Poorly Located
"Bad" Working Against
Digger Log
(Will Jam with Debris)
NON - RECOMMENDED DEVICES OR INSTALLATION TECHNIQUES

Rehabilitation Action 4. Cut Back Areas of Overgrown Alders

Approximate Locations and Photos

17T 648095 5108984

17T 647296 5109096

17T 648033 5109004

Overview of Approach

In some places, alders have completely straddled the stream and could be negatively affecting trout habitat in three ways:

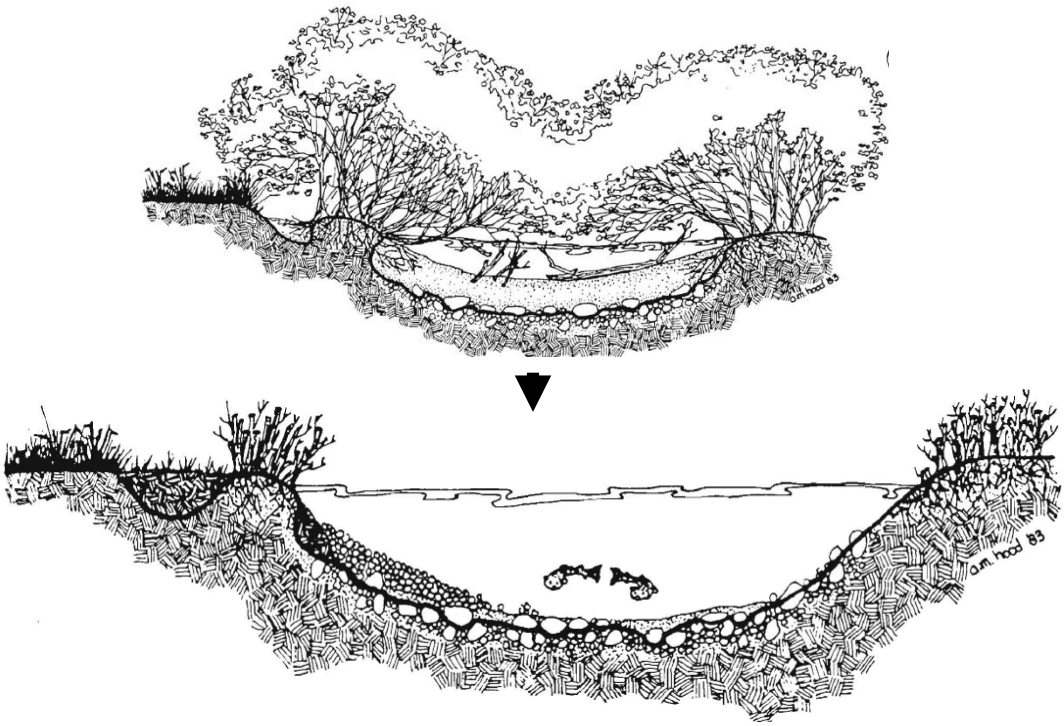
1. Reduction of sunlight to the point that food organisms such as microscopic plants and animals and stream-living insects are not growing and developing;
2. Dead stems which fall into the water and roots which grow out from the stream bank combine to slow water currents and allow sands to be deposited on the stream bottom;
3. During freeze-up, the dead stems and roots get frozen into the ice mass; and then in the spring, this ice can pull the entire shrub out of the bank and cause increased erosion.

Cutting back the alders will encourage new growth of dense shoots and a fibrous network of roots to develop. The new root system will provide added anchoring strength to the stream bank. Grasses should also regenerate on the stream bank, and the combination of grasses and bushy new shrub growth will provide improved stream bank cover for fish.

Work should be carried out mid-summer. Do not work during high water periods.Take stream temperatures just prior to doing the work – this will guide you as to how much of the shrub growth to remove.

If the stream temperature is around 20 C, you will need to be conservative, and only cut back branches that are in the stream. If the temperature is lower, you can afford to cut a little more

aggressively to let some sunlight penetrate to the stream. Do not cut as aggressively as shown below; maintain some shading.



Cut from the downstream area and work your way upstream. Stockpile the cuttings well away from the stream bank for use as brush bundles. A diagram follows, but cutting back the alders

Cautions

Do not completely cut back these alders. Keeping cool stream temperatures is critical for trout in this creek. Make sure there is still lots of shade provided by these shrubs. Try to balance the need for shade and the need for some sunlight.

Enhancement Techniques for Adding Structure to Small Pools

Approximate Locations and Photos

17T 646743 5109170

17T 646892 5109121

17T 646848 5109127

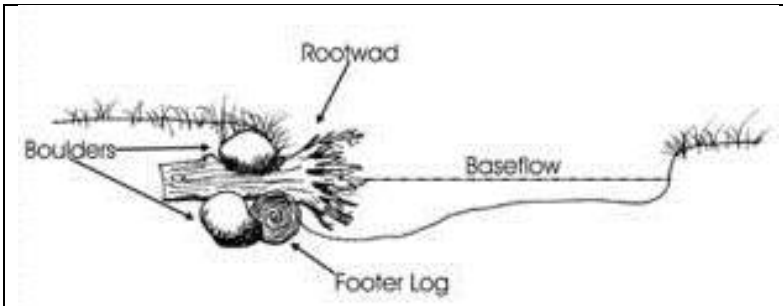
Overview of Approach

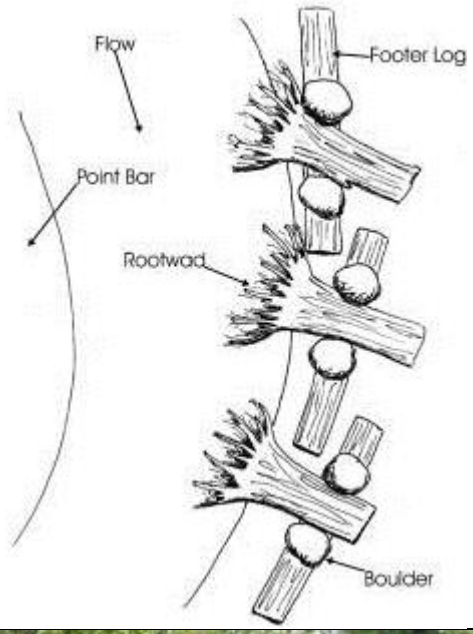
These pools have high sand banks and a sand bottom. Placing any structure on the stream bottom will not likely be effective, as the moving sand bedload, which is a natural feature of this watercourse, will eventually cover it up.

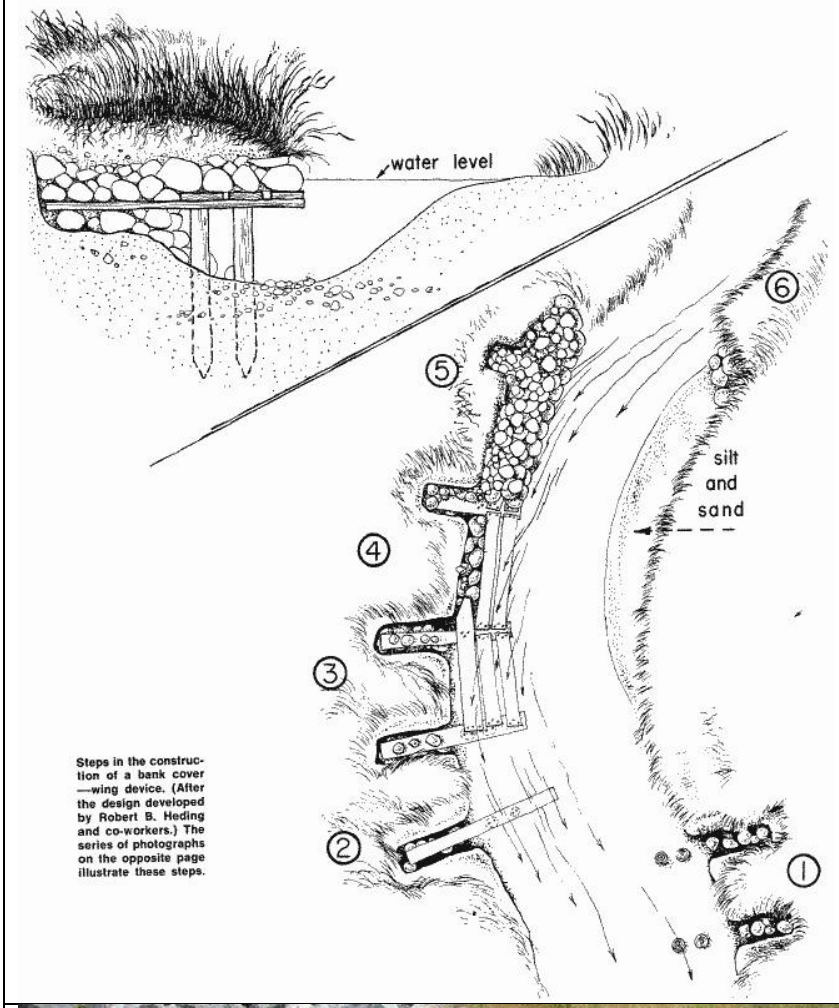
It is recommended that instream cover structures be built into the bank; as the banks are relatively easy to key into and will prevent the structure from becoming embedded in sand.

There are many options for building structures that will attract adult trout. The key is to provide overhead cover to fish in the deepest pools available.

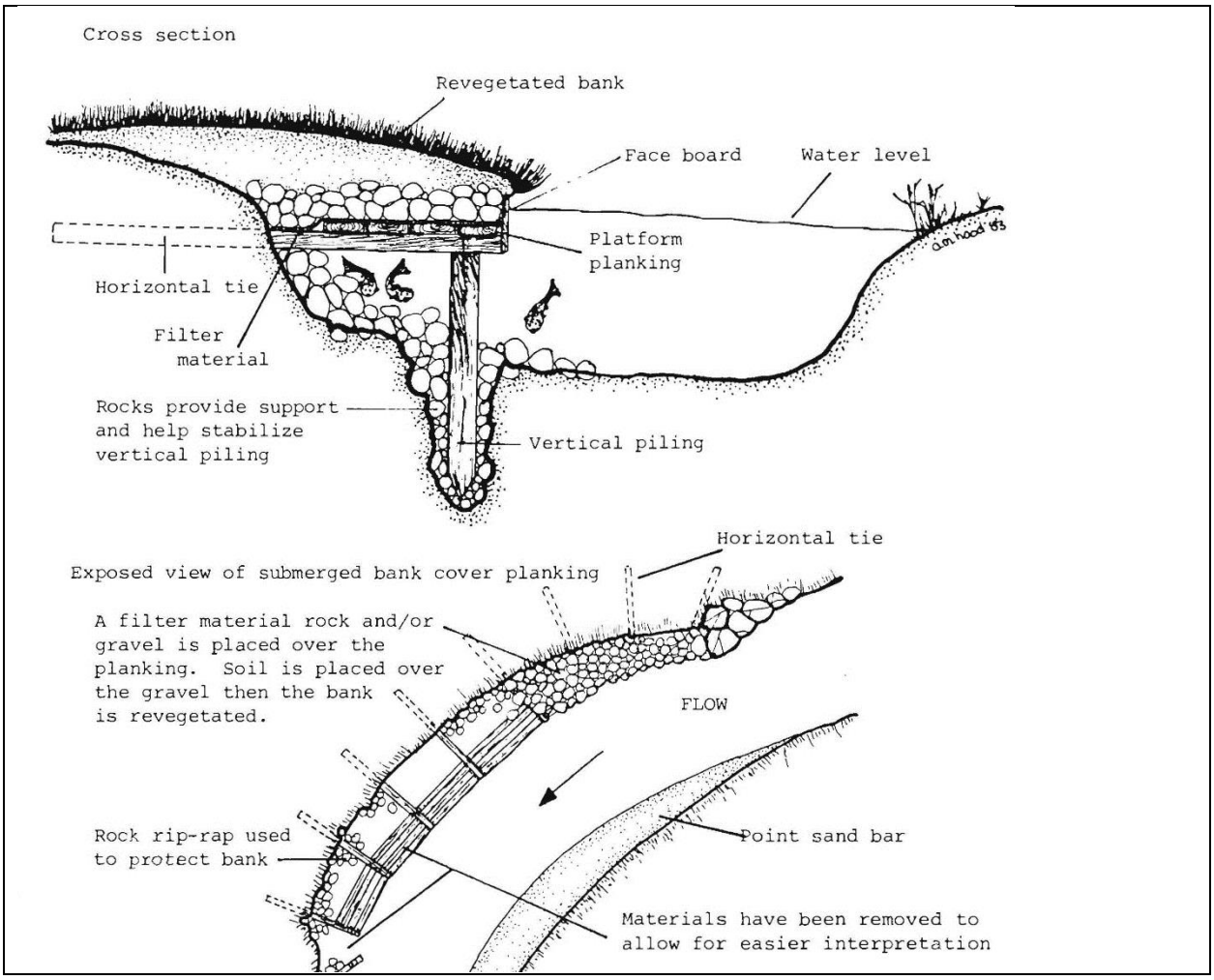
Some typical designs follow.







Steps in the construction of a bank cover—wing device. (After the design developed by Robert B. Heding and co-workers.) The series of photographs on the opposite page illustrate these steps.



<u>Cautions</u>

Make sure that structure is adequately secured and keyed into bank.

Recommendations for Monitoring

- Take photos during and after work is completed for each area that you work on. Make sure you take a GPS point as well.
- In areas to be cleared of alder and in the deep pools, take water temperatures before and after work is completed, during sunny days (above 20 C) where no rain has occurred in the prior 3 days.
- Where stream deflectors are to be installed, measure and record the depth of water every 30 cm (1 ft) across the entire channel of the stream upstream and downstream of where the structure will be installed. Take these measurements before work begins, immediately after work is completed, and at least two months after work completion.