Streamline
B.C.'s Watershed Restoration Technical Bulletin
Vol. 2 No. 3

Lateral and Mid-Channel Bar Stabilization

Cristina Soto, Andrew Wilson, Dave Heller, and Rick Ragan

Most watershed restoration work in British Columbia has focused on coastal watersheds which are typically high in gradient with incised, bedrock- or boulder-controlled channels. Both boulders and large woody debris from species such as cedar and Douglas fir are the elements which provide hydraulic diversity in the channel, and thus fish habitat (see *Streamline Vol.2 No 2*). These elements also function to dissipate stream energy in high flows. In contrast, interior watersheds are often lower gradient with less confined channels. Boulders may be almost absent, and the hydraulic diversity is provided almost exclusively by wood, mainly black spruce. This is the case in Narrow Lake Creek in the Willow watershed group near Prince George (Figure 1). The creek's flow is moderated by the presence of Narrow Lake above it. The floodplain is generally characterized as low gradient, and readily accessible to flood flows. Unsorted glacial till comprises the channel bed and banks.

Historically, large conifers grew along the streambanks and provided bank stability particularly at high flows, with their deep roots. With their removal, and with the building of roads and skid trails for forest harvesting activities during the 1960's, bank stability has been greatly reduced and sedimentation rates increased (a process described by Kellerhals and Miles 1996). Specifically, the sources of sediments include: upslope landslides in the headwaters, poorly constructed and undersized road crossings, and steep slopes and streambanks into which the stream is now cutting. Combined with the characteristics of the region described above, the result has been an extreme widening of the channel (up to 50 m bankfull width in some areas, Figure 2). One of the reaches in particular (Treatment Reach 3) is now composed of multiple,

Streamline welcomes the Ministry of Forests

Streamline welcomes the participation of BC's Ministry of Forests in the production of this issue. Until now, Streamline has been produced by BC Environment, and has therefore focused on the stream channel and riparian zones within the watershed. This focus reflects a 1995 memorandum of understanding between the two provincial ministries in the administration of the Watershed Restoration Program (WRP). Accordingly, Streamline's broad goal of communicating information on practical approaches to restoration has been expanded to cover the entire watershed, including the hillslope components. Therefore our readers will note articles in this issue on drainage restoration, road deactivation and relevant training, plus the new bridge replacement program. Future issues are expected to include an expansion of the Ministry of Forests' participation, as Streamline reaches their staff and partners, including consultants and contractors involved with related activities within WRP. The new Contributing Editor is Aubrey Brown, who was previously with the Ministry of Forests' Engineering Section. Since a watershed is a single hydrological unit and necessarily requires integrated management, Streamline should improve as it increasingly reflects the entirety of BC's Watershed Restoration Program.

This Quarter
Fall 1997

Feature Articles
- Lateral and Mid-Channel Bar Stabilization
- The Use of Draft Horses in Watershed Restoration
- Riparian Restoration in the Squamish and Lillooet River Watersheds

Articles
- Road Deactivation Worker Apprenticeship Program
- Forest Service Roads: Bridge Replacement Program

Technical Tips
- Techniques for Boulder Transport and Placement in Instream Watershed Restoration Projects
- The Development of Typical Drawings for Road Deactivation Planning and Prescriptions

BC Environment
British Columbia
Forest Service British Columbia
Forest Renewal BC

Feature

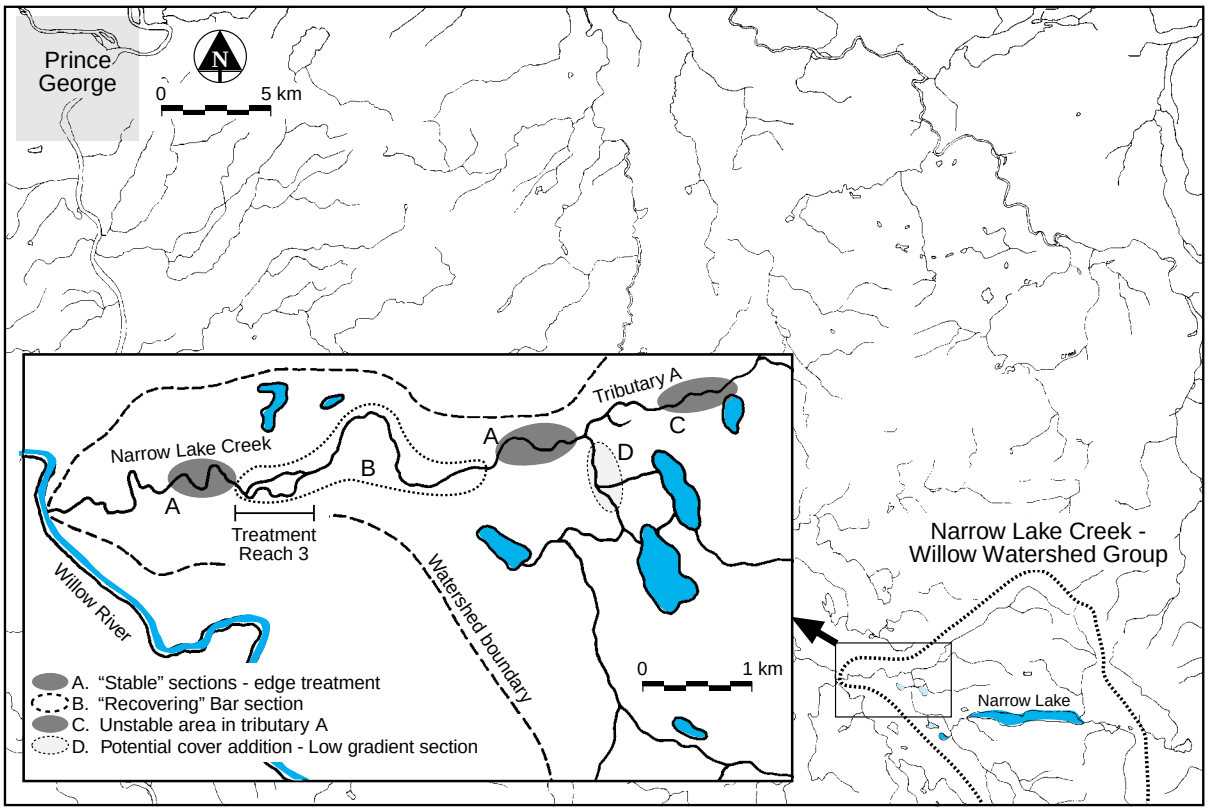

Figure 1. Narrow Lake Creek is within the Willow Watershed group near Prince George.

threaded, shallow streams; and large buildups of aggraded sediments forming bars, mostly of cobbles (Figure 2).

The species of interest in this portion of the watershed are rainbow and bull trout. Occasionally chinook juveniles are present, when adults are able to pass a partial obstruction in the Willow River. Their habitat has been negatively impacted in a number of ways by the changes in the channel, including a current predominance of shallow riffles in the reach described above, as well as in others. A shortage of instream cover for fish results both from the lack of pools and from the general lack of woody debris of any size in the wetted channel. Overhead cover is also lacking due to the current state of the riparian zone; plants and shrubs are generally of limited height and overhang, and banks are eroding in some locations. The latter point combined with the decreased depth of the stream has probably resulted in an increase in late summer water temperatures with potential negative impacts on bull trout[1].

Figure 2. Aerial photo of treatment reach 3 of Narrow Lake Creek shows greatly widened banks and expansive areas of sand and cobble bars (taken in 1996).

The channel is starting to recover naturally as indicated by: the general consolidation and narrowing of the channel, encroachment of woody vegetation on previously exposed areas, and persistence of vegetation even after a 25-year flow event in the spring of 1997. Of particular interest is the deciduous vegetation growing on lateral and mid-channel bars. The process of bar stabilization and re-vegetation occurs as follows. Often V-

Feature

Figure 3. A typical V-shaped arrangement of large woody debris (LWD) has been deposited on a bar. Natural arrangements of LWD provide a template for structures which accelerate bar stabilization.

Figure 4. Single logs generally end up with their root wads facing upstream.

shaped and other arrangements of large wood are deposited naturally on the bars (Figure 3). Single logs generally end up with their root wads facing upstream (Figure 4). These structures then serve to trap other woody debris of variable size by reducing local water velocities (Figure 5). This accumulating material acts to shunt water away from the bars permitting further accumulation of both woody debris and sediments. Fine sediments tend to settle out below the structure where water velocity slows. Small plants and shrubs including willows take root in the accumulated fines, and in time these bars are able to support larger trees such as alder, adding additional root strength (Figure 6). A similar process of re-establishment of mid-channel bars can be seen in Trapping Creek (Southern Interior), the Squamish River (Lower Mainland), and Glacier Creek (Kitzumkalum System).

In order to provide better fish habitat, the stream needs to become narrower and deeper, with meanders which provide both pool and riffle habitat, and appropriate cover. To address the former need, these 'prow structures' can be used as a template to develop a prescription for restoration of reaches of this type. An attempt to mimic these structures or augment naturally occurring ones should speed up the rate of bar stabilization and consequent consolidation of the channel into a more confined area. This process should also result in downcutting and therefore deepening of the channel, particularly as larger trees become established.

The prescriptions discussed here are the result of a site inspection in spring 1997 as part of the ongoing USFS-WRP Technical exchange, summarized in Heller and Ragan (1997 MS). The US Forest Service (USFS) has used this method with success in the Mt. Hood National Forest. Figure 7 demonstrates the principles of bar stabilization. Increasingly, the tendency in instream restoration in the U.S. is to not cable these types of structures into place. This is particularly true where relatively large, whole trees with root wads are used for restoration. Since the channel is still very dynamic as evidenced by the difference between 1996 aerial photos and 1997 observations, it is preferable to work in the areas of the channel where there is less probability of structure movement. However, in this channel, due to the almost total lack of woody debris instream, if the structures do move during high flows, they will still likely be functional by providing cover at locations further downstream. When attempting to further stabilize lateral bars, the lower risk areas are typically revegetating and are located closer to the banks (Figure 7). In mid-channel bar stabilization, structures

Figure 5. The root wad portion of the log is especially efficient at trapping other woody debris of variable size (the log shown is the same as in Figure 4).

Feature

Figure 6. Small plants and shrubs including willows take root in the accumulated fine sediments.

are also placed in areas where debris has already accumulated, thus these treatments serve as augmentation of an ongoing process. In creating the structures, a lattice work of trees is arranged as shown in Figure 7. The top third of coniferous trees should be partially buried below the streambed, with rootwads facing upstream. In some areas, whole willow clumps or rootballs may be transplanted from the floodplain to bars where fines are accumulating, in order to further speed revegetation and stabilization. Floodplain areas where these have been removed may be replanted with conifers.

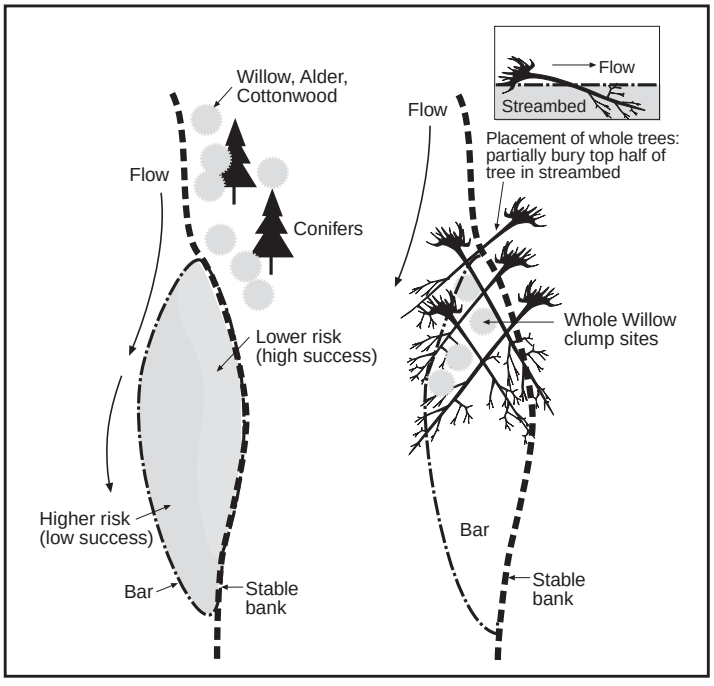

Figure 7. Typical structure design for lateral bar stabilization.

For the structures to function where they are placed at the edges of the bankfull width, requires that bankfull discharge occur following their placement. In Narrow Lake Creek, that has been the case in recent years with a probability of about one in two years.

As part of ongoing restoration of this reach, work is planned for 1998 in the riparian zone focusing on coniferous trees, including fertilization of individual trees which are competing with surrounding shrubs, brushing, and supplemental planting.

Monitoring of the reach will include pre- and post-project photo points and observations. One station has been monitored for suspended sediment levels in 1997, as may several stations in future.

Additional instream work in Narrow Lake Creek includes stabilization treatments of rapidly eroding stream banks, and placements of triangular lateral log jam structures off of stable stream banks (edge treatments in Figure 1). These project sites will be used for demonstrations during WRP short courses based at nearby Camp McInnis on the Willow River.

Notes

[1]One of the challenges in working in interior watersheds is the general lack of historical data on fish distribution and population size, thus the evidence of direct impacts is not available. Anecdotal data from elder anglers and residents both Native and non-Native might be useful in this regard in future overview assessments.

References

Heller, D., and R. Ragan. 1997 MS. British Columbia Stream Restoration Project Review Report : Narrow Lake Creek. USDA Forest Service, Portland.

Kellerhals, R., and M.J. Miles. 1996 Fluvial geomorphology and fish habitat: implications for river restoration. Pages A261-A279 *in* M. Leclerc et al., eds. Proceedings of the second IAHR Symposium on habitat hydraulics. Ecohydraulics 2000.

Cristina Soto
Watershed Restoration Program, Provincial Fisheries Office, 2204 Main Mall, U.B.C., Vancouver, B.C. V6T 1Z4; Tel: 604-222-6750 FAX: 604-660-1849

Andrew Wilson
author to whom correspondence should be directed; 325-1011 Fourth Ave., Prince George, B.C. V2L 3H9; Tel: 250-565-6135; FAX: 250-565-6629

Dave Heller
USDA Forest Service Region 6, Natural Resources, P.O. Box 3623, Portland OR 97208; Tel: 503-808-2994 FAX 503-808-2469

Rick Ragan
USDA Forest Service, Mt. Hood National Forest, Hood River Ranger District, 6780 Highway 35, Mt. Hood - Parkdale, OR 97041; Tel: 541-352-6002; FAX: 541-352-7365