Construction of Artificial Fish Habitat in the Englishman River, 2004

prepared for:

Ministry of Transportation
Environmental Enhancement Fund
Victoria, BC

Pacific Salmon Foundation
Englishman River Watershed Recovery Plan
Vancouver, BC

Ministry of Water, Land and Air Protection and the
Greater Georgia Basin Steelhead Recovery Plan
Nanaimo, BC

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GREATER GEORGIA BASIN
STEELHEAD Recovery Plan
www.SteelheadRecoveryPlan.ca

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ACKNOWLEDGEMENTS

Whole trees used in site construction were donated by TimberWest from private forest land adjacent to restoration areas. Bo Ferguson[1] helped to identify and facilitate tree harvesting. Whole trees were also made available by Weyerhaeuser from private land near Qualicum, with timber value applied against San Juan Opportunistic Fund commitments. Wayne Brown[2] and John Eden[3] facilitated timber harvesting on Weyerhaeuser forest lands. Tim Clermont[4], Jeff Ainge[5] and Jonathan Lobb[6] approved access to sites through Top Bridge Regional Park. Rock for ballasting structures was secured by Mel Sheng[7] from a Highway 4 construction project for the cost of transport only. An additional 10 loads of ballast rock was donated by Sean Wong from the Ministry of Transportation and delivered on site at no cost. Vince Miller and Moss Creekmore[8] provided exceptional machine operation in challenging circumstances. Craig Wightman[9] acted as the project advisor.

Funding was provided by the Pacific Salmon Foundation (through the Englishman River Watershed Recovery Plan), the Ministry of Transportation, the Ministry of Water, Land and Air Protection and the Habitat Conservation Trust Fund.

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1.0 INTRODUCTION

The Englishman River is one of the most important salmon bearing streams on the central east coast of Vancouver Island. The watershed supports all five species of anadromous salmon as well as resident rainbow and cutthroat trout. In 2000, the BC government designated the Englishman as a sensitive stream under the Fish Protection Act. Also in 2000, the watershed became part of the United Nations designated Mount Arrowsmith Biosphere Reserve (Jamieson 2000). The Outdoor Recreation Counsel of British Columbia has identified the Englishman as one of the most threatened watersheds in BC (ORC 2002).

The Englishman River was the first watershed to be selected by the Pacific Salmon Endowment Fund Society for attention in the Georgia Basin salmon recovery process for coho and steelhead trout. The vision of the Pacific Salmon Endowment Fund (PSEF) is to achieve healthy, sustainable and naturally diverse Pacific salmon stocks through the development of recovery plans for specific watersheds. The Pacific Salmon Foundation manages the annual proceeds of the PSEF, and now administers seven watershed recovery plans in BC. The Englishman River Watershed Recovery Plan (ERWRP; Bocking and Gaboury 2001) was developed to identify and prioritize activities required to achieve recovery goals for the watershed and its fish stocks. Several other reports including an *Overview Assessment of Fish and Fish Habitat in the Englishman River Watershed* (Lough and Morley 2002) and the *Englishman River Channel Condition Assessment* (nhc 2002) have been developed to complement the original plan and facilitate recovery activities.

Significant off channel development has taken place in the Englishman River watershed, with the creation of the TimberWest and Weyerhaeuser side channels. These channels extend for 1,300 and 950 m respectively (8% of watershed anadromous length) and account for 15-25% of coho smolt production in the watershed (Decker et al. 2002).

Historically, restoration works in the mainstem Englishman River have been minimal. Recent work completed through ERWRP include several "debris catcher" structures designed to protect the Weyerhaeuser side channel and intake while creating lateral scour pools (built in 2002), 14 instream LWD and boulder riffle sites (McCulloch 2003) and a series of rock groins completed in 2003 and bolstered in 2004 to control bank erosion and create fish habitat in the lower Englishman River.

On June 27, 2003, an on-site, multi-agency meeting[10] reviewed proposed restoration works to ensure that planned activities would act synergistically with existing restoration projects. Meeting minutes including resolutions were recorded and circulated as a file note from BC Conservation Foundation (BCCF) to the participants (Appendix A). Several broadly accepted principles to be applied to future restoration works were established, including:

- potential smolt production benefits (particularly steelhead) resulting from mainstem LWD development were deemed to outweigh risks associated with working in a volatile channel; and,
- integrated bank protection measures should be developed into restoration works where LWD structures may deflect flows into adjacent banks.

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[10] C. Wightman and R. Guthrie, Ministry of Water, Land and Air Protection; M. Sheng and R. Doucet, Fisheries and Oceans Canada; M. Gaboury, LGL Limited; F. Smith and C. Cornish, ERWRP Coordinators (MVIHES and Parksville Streamkeepers) and J. Young, Englishman River Enhancement Group.

In 2004, BCCF was contracted by PSEF to construct 10 LWD and boulder riffle sites. Due to budgetary shortfalls the original PSEF contract was reduced. Significant financial contributions from other funding partners including the Ministry of Transportation and the Greater Georgia Basin Steelhead Recovery Plan (GGBSRP) through the Habitat Conservation Trust Fund allowed BCCF to complete 16 sites (12 LWD, four boulder riffle) plus fish access improvements on a small tributary.

Sites were constructed with design principals and concepts outlined by Gaboury (2003) in *Fish Habitat Restoration Designs for Englishman River*. Restoration objectives for mainstem works identified by Gaboury include:

- improve overwintering and rearing habitat for native salmon stocks, steelhead and resident trout;
- increase fry densities in LWD complexed sites to 0.9 coho fry/m^2, and 0.3 trout fry/m^2; and,
- increase trout parr densities in LWD and boulder complexed sites to 0.2 to 0.3 parr/m^2.

Further to the stated objectives, work completed by BCCF in both 2003 and 2004 attempted to:

- increase bank stability adjacent to restoration sites through the strategic placement of ballast and integrated boulder groins;
- develop fast water habitats specific to steelhead parr rearing;
- stockpile LWD, boulder ballast and natural riffle rock in strategic locations to be used in future restoration projects.

2.0 STUDY AREA

From its headwaters at Mount Arrowsmith (1,817 m elevation), the Englishman River flows east draining 324 km^2 of the central east coast of Vancouver Island (Figure 1). It enters Georgia Strait near the City of Parksville and supplies water to two of the city's water districts. Mainstem anadromous length is 15.8 km to the barrier in Englishman River Falls Provincial Park. The largest sub-basin, the South Englishman River, enters the mainstem 8.3 km upstream from the mouth. It drains 83 km^2 and has an anadromous length of 4.5 km. Other significant tributaries include Centre Creek (a sub-basin of the South Englishman), Morison Creek and Shelley Creek with anadromous lengths of 5.2, 2.1 and 1.0 km, respectively (Lough and Morley 2002). Weyerhaeuser owns 69% of the watershed and manages its Northwest Bay Division within the watershed. Of the total watershed area, 27% is below 300 m, 47% is between 300 – 800 m elevation and 26% is above 800 m (Weyerhaeuser 2004).

Mainstem reaches E3 and E4 (Allsbrook Canyon to Morison Creek confluence) are suitable for restoration because:

- gradient and channel morphology are conducive to instream restoration activities;
- historical use by target species (steelhead trout and coho salmon) was relatively high;
- vehicular access adjacent to sites allows transport of restoration material to identified sites;
- these reaches were previously identified by nhc (2002) and Lough and Morley (2002) as primary candidates for rehabilitation works.

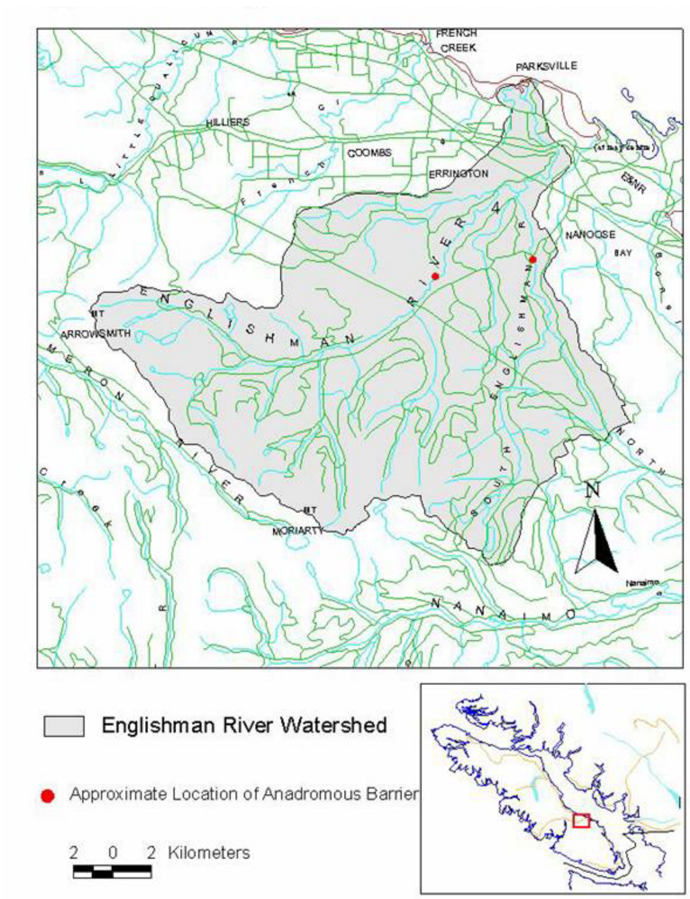


Figure 1. Location of the Englishman River watershed on southern Vancouver Island.

Reach E3 (Allsbrook canyon to South Englishman confluence) has been identified as the most active reach on the Englishman River based on the downstream progression of meanders, cutoffs and avulsions, and many banks in this reach are eroding along part or most of their length (nhc 2002). Riparian forests adjacent to many eroding banks are often too immature to contribute to bank stability and, after falling in, trees are quickly moved into non-functional locations or transported out of the target restoration reach. Despite the current volatility of this reach, air photo interpretation has determined that channel narrowing and gravel bar re-vegetation are occurring (nhc 2002).

2.1 Hydrology

Englishman River discharge has been gauged by the Water Survey of Canada at the Highway 19a Bridge crossing (Station 08HB002) continuously since 1979. This rainfall driven watershed follows trends similar to other east coast Vancouver Island streams with large flows typically occurring November through February and low flows occurring August through September. Mean annual discharge (MAD) for the watershed is approximately 13 m^3/s. Typical summer base flow before development of storage at Arrowsmith Lake in 1999 was 1.2 m^3/s, or 8.5% MAD (nhc 2002) although very low flows (< 5% MAD) were routinely recorded. With the Arrowsmith reservoir in operation, the minimum mandated flow is now 1.6 m^3/s or 11.3% MAD. In a recent analysis of flood frequency the 2-year and 50-year maximum daily flows were estimated at 204 and 471 m^3/s, respectively (nhc 2002).

Gaboury (2003) measured channel widths at five sites within reaches E3 and E4. Bankfull channel widths averaged 37.7 m while wetted widths averaged 22.9 m. Bank heights and bankfull depth averaged 2.3 m and 1.8 m respectively. Gradient in the upper restoration reach (E4) averaged 0.9% while gradient in the lower reach (E3) averaged 0.7%.

Complete hydrological assessments including detailed analysis of flood and drought return period and channel morphometrics can be found in the *Englishman River Channel Condition Assessment* (nhc 2002) and *Fish Habitat Restoration Designs for the Englishman River* (Gaboury 2003).

2.2 Fisheries Resources

The Englishman River supports anadromous populations of steelhead and cutthroat trout, chum, coho, chinook, pink and occasionally sockeye salmon. Resident rainbow and cutthroat, Dolly Varden char, stickleback and cottid populations are also found in the watershed (Lough and Morley 2002).

Hatchery programs have historically included a combination of fry out-planting, bulk incubation/volitional release and fed fry release for pink salmon (Quinsam River brood), chinook salmon (Big Qualicum River brood) and native coho salmon stocks. Stocks of steelhead trout (native brood) were historically enhanced through smolt out-plants from the provincial hatchery in Duncan (1979–1997) and the Little Qualicum Project (1991–1999) respectively. Englishman cutthroat continue to be augmented with smolts (Little Qualicum stock) from the Little Qualicum Project.

Recent steelhead escapement estimates include 145 in 2002 (Smith 2003[1]), 96 in 2003 (Smith 2003[2]) and 81 in 2004 (Silvestri 2004). The wild stock trend was most recently classified as "stable at a low level" (Lill 2002).

Coho populations have historically ranged from 750 to 1,500 adults, with a long term mean (1953–2000) of 960 adults (Bocking and Gaboury 2001). Recent escapements have been substantially higher with population estimates of 5,280, 8,000 and 3,100 adults for 2000–2002, respectively. Recent increases in coho abundance likely relate to changes in enumeration methodology and decreases in marine exploitation rather than a significant increase in smolt production or ocean survival (Baillie and Young 2003).

3.0 METHODS

3.1 Materials

A diverse range of instream enhancement projects has been completed on Vancouver Island and across BC since the mid 90s under programs such as the Watershed Restoration Program and Forest Renewal BC. Reviews and monitoring of such projects have consistently recommended that wood used in artificial habitat structures be:

- large in bole diameter (>0.5 m) for structural durability;
- green wood to maximize structure life; and
- conifer species (cedar is preferred) as they generally rot slower than hardwoods.

Cover, complexity, and fish use of instream structures increases dramatically when rootwads or branched trees are incorporated into structures. Structures located in moderate to high flow velocities consistently see the highest use by steelhead fry and parr.

A portion of the LWD needed for instream construction in 2004 was stockpiled on site as surplus to construction needs during the summer of 2003. This wood consisted primarily of full length Douglas fir and western red cedar trees both with and without rootwads.

In June 2004, the author and B. Ferguson[11] identified 23 candidate trees located on TimberWest forest land about 350 m south of the mainstem, north of the Centre Creek sub-basin. Diameters at breast height ranged from 0.4-0.67 m (mean 0.51 m). Selected trees included 14 Douglas firs and nine western red cedars.

BCCF staff and Wayne Brown[12] selected an additional 24 trees on Weyerhaeuser private land identified as Coombs North-1, located adjacent to Highway 4, south of Qualicum Beach. These trees, primarily Douglas fir and western red cedar averaged 0.5 m in diameter. One additional load of non-merchantable boles (Appendix B, Photo 1) was secured from a completed Weyerhaeuser setting in Northwest Bay and transported into staging areas adjacent to worksites using a self-loading logging truck.

Excavators (John Deere, models 270 LC, 892) were contracted to harvest the standing trees in the Englishman and Coombs North areas. The excavators first destabilized root systems and then pushed over trees in a controlled manner, preserving structural integrity. Trees from the Coombs North stand were bucked once by necessity, loaded into a hydraulic "bin truck" and transported to a staging area under the hydro-lines in Englishman River Regional Park. Trees harvested from the Englishman stand were moved directly into the river corridor with the excavator and stockpiled on a gravel bar prior to construction.

Rock used for ballasting LWD sites was supplied from a construction project on Highway 4 (upper Little Qualicum watershed). After a successful drill and epoxy test to confirm suitability, rock was ordered and stockpiled at four riverside locations near restoration sites.

Round rock for riffle enhancement was already on site, donated by Weyerhaeuser in 2003 from the Rhododendron (155) Mainline gravel pit. Round boulders were also gathered from the old Haylock Pit located in Englishman River Regional Park.

[11] Engineer, Nanaimo Lakes Division, TimberWest Forest Ltd., Nanaimo, BC.
[12] Engineer, Northwest Bay Division, Weyerhaeuser Company Ltd., Nanoose, BC.

3.2 Construction

Construction materials were staged near restoration sites using excavators (John Deere, model 270; Hitachi, model EX 120), a rubber-tired front end loader (Caterpillar, model 966) and/or a 6WD articulated hauler (Volvo, model A30C). All heavy equipment operating near the river channel used "fish-safe" hydraulic fluid[13]. Fuel and oil containment booms were used at all sites. If heavy equipment was positioned directly in the stream channel at or near the wetted edge, several staged oil booms were employed. Additionally, every piece of heavy equipment carried a spill kit on board at all times and an additional spill kit was carried by the construction manager on site.

LWD structures were built starting at the uppermost site and progressing downstream using access routes developed in 2003. Structures were generally positioned to take advantage of higher water velocities within the habitat unit to maximize use by steelhead juveniles. All structures were built to function most effectively at summer base flows.

Whole trees (boles with attached rootwads) were typically used in site construction to increase site complexity and maximize the hydraulic influence of the individual LWD elements. Boles were occasionally used in secondary roles or were used to further triangulate and secure structures to riparian trees. A 2003 lateral LWD structure (6+200) that functioned well at base flows and remained stable during the winter of 2003/2004 was used as a template for most of the 2004 structures (Figure 2).

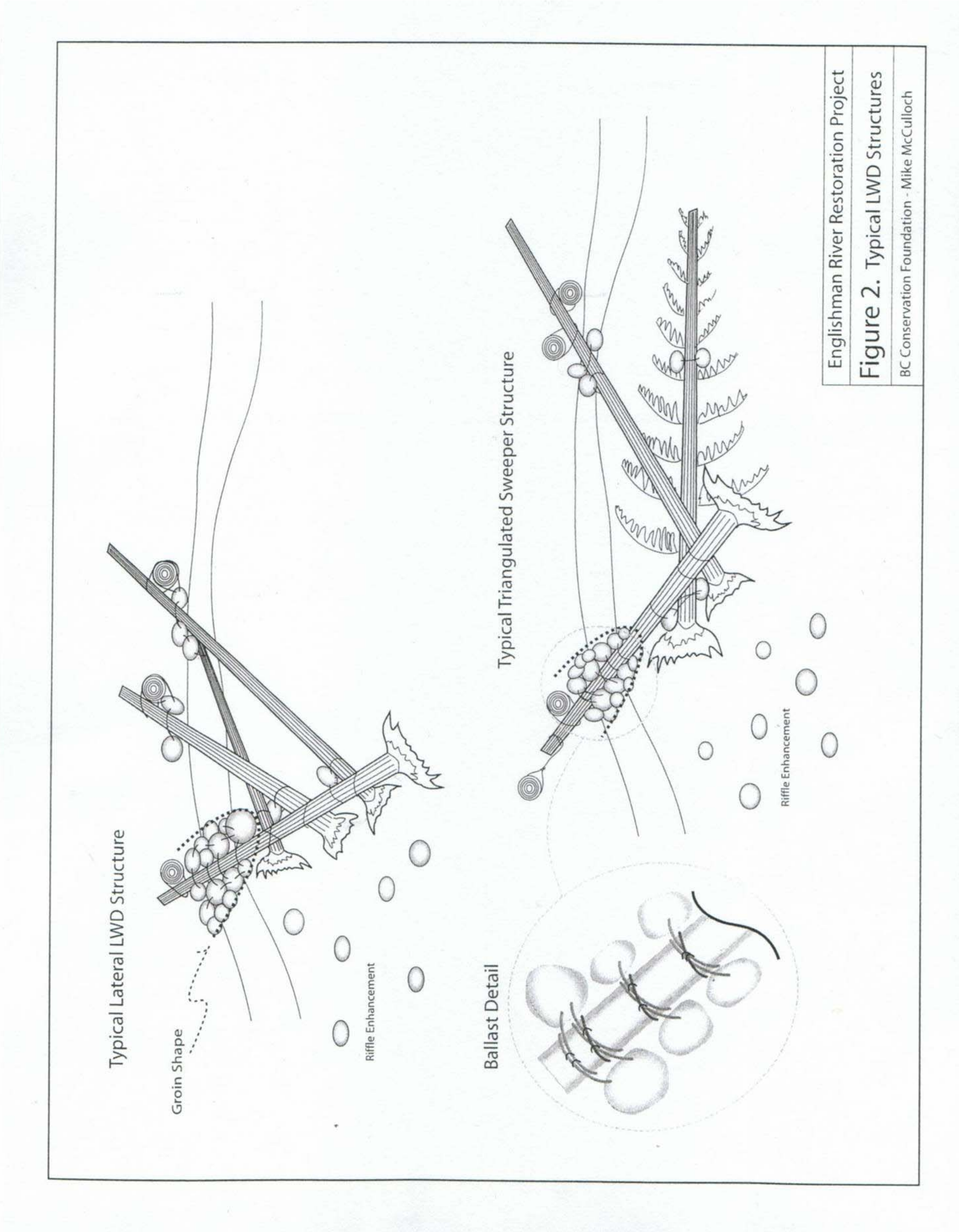
Half inch steel cable (ungreased, wire core) was used to attach ballast rock to LWD. New cable was used to ensure the best possible epoxy bond in the rock drill holes. Less expensive used half inch cable was employed to attach LWD to trees in the riparian zone. Once positioned, ballast rock was drilled using an electric hammer drill (Bosch, model 11241 EVS) and a 9/16 inch drill bit. Holes approximately 25 cm deep were scrubbed and flushed to remove loose material and a sufficient quantity of Epcon C6 epoxy was injected into the hole to fill it once the cable was inserted. Cable was cut with an electric grinder (Dewalt, 7 inch) and attached to LWD or anchor trees using galvanized cable clamps tightened with an electric impact wrench (Dewalt, ½ inch drive). Cables between ballast and LWD were as short and tight as possible to reduce movement and wear within the structure. To secure and further tighten cables, steel staples (4 x 3/8 inch minimum) were hammered into the logs. To hide cables, LWD boles were bored using an electric wood drill (Dewalt, ½ inch chuck) and a 3/4 inch ship auger bit with a welded extension (total length 35 inches). Cables were loosely attached around the base of anchor trees and sheathed with 3/4 inch black pvc tubing to help protect anchor trees. A portable generator (Honda, model EW 2500) was used to power all equipment.

Construction and cable crews followed forest fire prevention and suppression regulations as outlined in the Forest Practices Code of BC Act. Sufficient shovels, pulaskis, and hand-tank pumps were kept on hand at all times during site construction and cabling. A portable pump unit with a screened intake and 200 feet of discharge hose was set up daily at each site[14]. Fire watches occurred following each day's construction.

[13] Chevron Clarity ® Hydraulic Oils

[14] Because work was in a stream channel, written exemption from the Code's 450 m hose length requirement was obtained from K. Seegmiller, Forest Officer/Official, South Island Forest District, MOF, Port Alberni.

All construction personnel used safety equipment including hard hats, gloves, high visibility vests, two-way radios and eye and ear protection when applicable. Emergency procedures were



Englishman River Restoration Project
Figure 2. Typical LWD Structures
BC Conservation Foundation - Mike McCulloch

clarified and first aid equipment kept on hand included Level 1 first aid kits, blankets, neck collars, eye wash bottles and a cellular phone. The site supervisor and at least one other crew person held Level 1 First Aid certification and Transportation Endorsement.

In most sites, ballast rock and imported materials were used to create a rock groin at the upstream edge of the site. Groins should act as integrated bank protection by deflecting moderate and high flows away from the bank and are intended to reduce potential for scour "behind" the structure.

Boulders were installed at riffle locations to roughen the stream bed and enhance steelhead parr habitat. Riffle sites had cobble and boulder dominated substrates that required no stream bed armoring. The heights of boulders were adjusted relative to the stream bed to achieve hydraulic conditions preferred by steelhead parr (McCulloch 2000), including:

- pockets of at least 0.5 m in depth;
- areas of non turbulent (laminar) flow; and
- broken water cover from aeration and surface turbulence.

In July 2004, project planners identified fish access through a culvert beneath the road in Englishman River Region Park as problematic. This small tributary drained a significant swamp area on the north side of the road that appeared ideal for coho rearing. Culvert gradient was ~3%, and its outlet was perched 0.45 m above the plunge pool. A dump truck load of rock was placed near the downstream end of the culvert and key pieces were placed into the stream channel by excavator. Subsequent work involved placing large boulders in stream by hand to raise the crest of the plunge pool and form a series of steps thereafter, each no more than 0.15 m in height. Additionally, a small metal baffle was placed in the culvert to partly backwater the pipe and functionally reduce the internal gradient.

One new access was established to reach two riffle sites adjacent to Top Bridge Regional Park. This temporary grade followed a historic logging road down onto the floodplain several hundred meters above the Inland Island Highway bridge crossing. To minimize riparian impacts, a smaller excavator (Hitachi, model EX 120) was mobilized to transport riffle rocks into this reach and place them instream.

Access routes were naturalized (covered with small logs, branches and native forest debris) in all cases to reduce potential for erosion or sediment transport. Reclamation seed[15] was applied to all temporary accesses once they were put to bed. Further riparian planting including conifer seedlings will continue as a separately funded initiative of both the Mid Vancouver Island Habitat Enhancement Society and the GGBSRP.

[15] CWH biogeoclimatic zone mix, Common No.1 Forage; Pickseed Canada Inc., Abbotsford, BC.

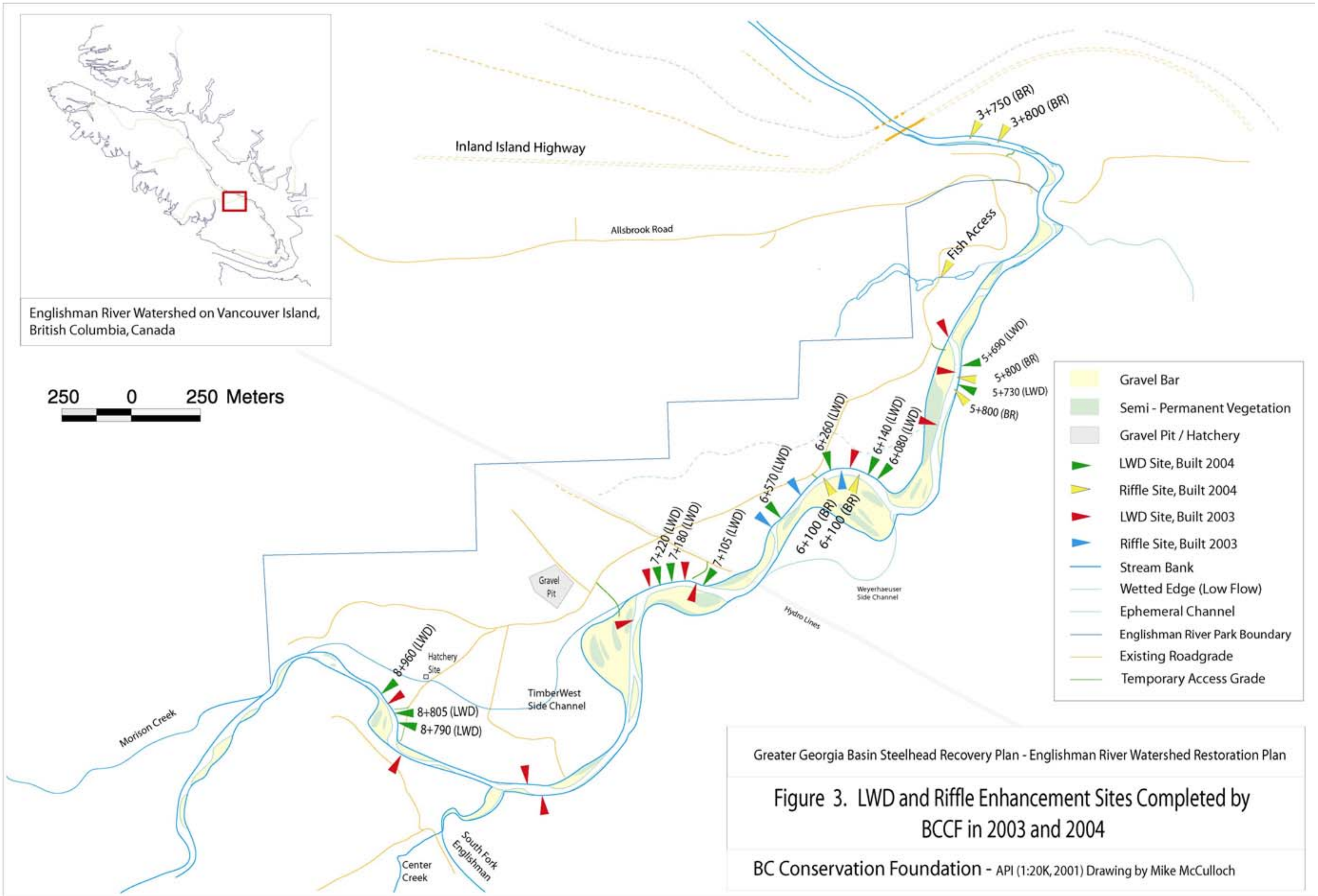
4.0 RESULTS

4.1 Site Construction

Tree falling took place on June 28 and 29, 2004. A total of 23 trees were harvested from TimberWest and 24 trees were harvested from Weyerhaeuser private forest lands. Under MWLAP permit (Appendix A), instream LWD construction was completed over seven days between July 26 and August 4, and riffle enhancement followed on September 8 and 9. A total of 12 LWD sites, 4 large scale riffle enhancement sites and one fish access site were completed for a cost of $54,588.00 (Table 1, Figure 3).

Table 1. Mainstem fish habitat rehabilitation sites completed in 2003 and **2004** by BCCF on the Englishman River.

Site Chainage	**Site # (built in 2004)**	Description
3+750	**1**	**Boulder Riffle (built in 2004)**
3+800	**2**	**Boulder Riffle (built in 2004)**
Access		**Built in 2004**
Culvert Improvement	**3**	**On tributary entering at ~5+300 (built in 2004)**
5+600		LX 6, Large site, two linked structures (built 2003)
Access		Built in 2003
5+690	**4**	**Typical lateral LWD structure (built in 2004)**
5+700		LO-1 Cedar, single cedar on natural ballast (built 2003)
5+730	**5**	**Typical lateral LWD structure (built in 2004)**
5+800	**6**	**Boulder Riffle (built in 2004)**
5+900		LX 4 built off of gravel bar, near natural bartop jam (built 2003)
6+080	**7**	**Typical lateral LWD structure (built in 2004)**
6+100	**8**	**Boulder Riffle**
6+140	**9**	**Typical lateral LWD structure (built in 2004)**
6+200		Typical lateral LWD structure (built 2003)
6+210		Long Run - lower boulder, associated with structure
6+260	**10**	**Typical lateral LWD structure (built in 2004)**
Access		Built in 2003
6+430		Long Run - main boulder, largest boulder site
6+570	**11**	**Small triangulated LWD Structure (built in 2004)**
6+550		Long Run - upper boulder, moderate site in deeper water run
7+105	**12**	**Triangulate existing cedar onto bank (built in 2004)**
7+120		LX Sweeper, last of series (built 2003)
Access		Built in 2003
7+140		LX Sweeper (built 2003)
7+180	**13**	**Typical lateral LWD structure (built in 2004)**
7+220	**14**	**Typical lateral LWD structure (built in 2004)**
7+260		LX Sweeper, at top of run (built 2003)
Access		Built in 2003
7+420		LX Sweeper, off gravel bar, near large existing sweeper (built 2003)
Access		Built in 2003
8+140		LX Sweeper (built 2003)
8+240		LX Sweeper (built 2003)
8+600		LX Sweeper, with additional cover logs (built 2003)
Access		Built in 2003
8+790	**15**	**Typical lateral LWD structure (built in 2004)**
8+805	**16**	**Lateral LWD structure (built in 2004)**
8+820		LX Sweeper, low profile structure on eroding bank (built 2003)
8+960	**17**	**Modified lateral LWD structure (built in 2004)**



Greater Georgia Basin Steelhead Recovery Plan - Englishman River Watershed Restoration Plan

Figure 3. LWD and Riffle Enhancement Sites Completed by BCCF in 2003 and 2004

BC Conservation Foundation - API (1:20K, 2001) Drawing by Mike McCulloch

Local media were invited to cover the construction phase of the project and relate current steelhead conservation concerns. An article (Appendix C) and follow up were completed for the Parksville Qualicum Beach News Weekender.

A three-person crew completed cable and epoxy work over 12 days between July 22 and August 17, 2004. Approximately 1,500 m of cable, 300 steel staples, 10 rock drill bits, 12 epoxy cartridges, 200 cable clamps, and 100 m of cable sheathing hose were used in site construction.

Additional incidental work completed while the excavator was on site included two minor riffle enhancements and two minor additions to sites developed in 2003 (8+820 and 7+120). Placement of rocks near the gate on Allsbrook Road and near the south Englishman River confluence was completed for T. Clermont of the Nature Trust to restrict motorized vehicle access into Englishman River Regional Park.

All disturbed streambanks and accesses were re-contoured and “put to bed” using native material (old stumps, logs, etc.). Disturbed banks were lined with boulder and cobble material to reduce erosion.

4.2 Initial Monitoring

Only preliminary monitoring of structures has occurred to date. Since construction, one moderate flood event (approximately 252 cms) and one extreme flood event (approximately 342 cms) have taken place (Appendix D). After the first significant event in December 2004, a raft survey briefly examined all structures and found all ballasted sites functioning as intended. A simple log triangle structure located at 6+570 that relied upon small riparian alders to stop lateral movement shifted significantly as the primary alder anchor was uprooted in the flood event. Following the larger event in January 2005, the lower eight LWD structures were briefly examined and appeared to be providing good bank protection and functioning as intended.

Increases of pool depth (related to scour) for all sites could not be accurately measured due to elevated flow conditions. Because of the time of year and low water temperatures, no assessment of juvenile fish was possible. More thorough assessments of both fish use and structure condition/function are planned during routine effectiveness monitoring completed as a separate initiative of the GGBSRP in summer 2005.

5.0 RECOMENDATIONS

Further LWD development is recommended in the Englishman River watershed in locations with similar channel characteristics using design templates that have been proven in past restoration projects. Future instream development will be expedited using stockpiled trees and boulder ballast not used in 2004.

Locations in the mid-river area that appear to be conducive to future LWD placements include:

- mainstem between 4+700 and 5+000 (two lateral LWD structures);
- mainstem between 5+800 and 5+950 (two lateral LWD structures); and,
- South Englishman River between 0+020 and 0+350 (four lateral LWD structures).

In future restoration, consideration should be given to integrate conifer, cottonwood, red osier dogwood and willow staking/planting in and near restoration sites in combination with riparian stand management. These activities should enhance bank protection and local site stability and ultimately help the riparian corridor naturally contribute large woody debris to the river channel.

All recommended restoration sites and activities are subject to change pursuant to the PSEF-funded restoration co-ordination project being completed by LGL Limited.

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APPENDIX A

Project Documentation

BRITISH COLUMBIA

July 17, 2003

File: 76945-20/N1-1575

Water, Land and Air Protection
Environmental Stewardship
2080-A Labieux Rd
Nanaimo BC V9T 6J9

ATTENTION: Craig Wightman

Dear Mr. Wightman:

Re: Work In and About a Stream
Water Act, Section 9 - Regulation 204/88

I have your Notification dated July 2, 2003, and received July 2, 2003, for works described as fish habitat restoration or maintenance affecting Dickson Lake.

I have no objection to your undertaking the project described in your application **PROVIDED THE WORK IS DONE IN COMPLIANCE WITH THE *WATER ACT*, SECTION 9 AND REGULATION 204/88, PART 7** and is completed within the year 2003 timing window. Please refer to the document titled *"A Users Guide to Working in and Around Water - Revised January, 2001"* (Users Guide) which sets out work requirements. This guide is available on the Land and Water British Columbia Inc. web site at:

http://lwbc.bc.ca/water/surface.html

A qualified environmental monitor must be on site at all times during construction to ensure that all potential impacts to fish habitat are mitigated. This person will be responsible for ensuring that sediment control procedures are followed as per the Fisheries and Oceans' Land Development Guidelines (Chilibeck 1992) and that fish salvage operations are

. . . /2

Ministry of Water, Land and Air Protection
Vancouver Island Region
Mailing Address:
2080A Labieux Road
Nanaimo BC V9T 6J9
Telephone: 250 751-3100
Facsimile: 250 751-3103

conducted, as necessary. All construction personnel should be familiar with these guidelines prior to commencing work on the site. Four guiding principles are worthy of note here:

- the natural riparian vegetation and stream banks should be protected and/or rehabilitated during and after construction;
- prevent the introduction of pollutants and deleterious substances by controlling construction activities and site conditions;
- prevent the generation of sediment by utilizing proper instream construction controls and supervision; and
- conduct fish salvage as required to remove fish from the area of impact (using minnow traps, beach seines, or lastly, electrofishing).

Please note that we may contact you in the future to monitor the works that you are doing under this Notification.

This grants authorization under Section 9 of the *Water Act* only, and does not constitute permission or consent under any other Act or Authority. In addition to DFO, you must also consult with local government (municipality or regional district), to determine if there are any requirements under that level of government for your proposed works.

Yours truly,

Peter Law
Designated Habitat Officer, Water Act Regulation
Vancouver Island Region

Enclosure

cc: Brad Rushton, Fisheries & Oceans, Port Alberni
Mike McCullough, BC Conservation Foundation

AGREEMENT FOR THE INSTALLATION AND MAINTENANCE OF WORKS IN ENGLISHMAN REGIONAL PARK

THIS AGREEMENT is made this day of , 2004.

BETWEEN:

REGIONAL DISTRICT OF NANAIMO
6300 Hammond Bay Road
Nanaimo, B.C.
V9T 6N2

(hereinafter called "**RDN**")

OF THE FIRST PART

AND:

THE BRITISH COLUMBIA CONSERVATION FOUNDATION
#206 - 17564 - 56A Avenue
Surrey, B.C.
V3S 1G3

(hereinafter called "**BCCF**")

OF THE SECOND PART

W H E R E A S :

A. The RDN is the owner of certain lands designated as regional park on a Regional Park Plan, which land is known as Englishman River Regional Park and which has a legal description of Block 602, Nanoose District, PID 009-438-645VIP69346 (the "**Park**");

B. BCCF wishes to enhance fish habitat and has requested permission from the RDN to construct and maintain log and boulder structures within part of the Englishman River which lies within the Park and RDN has agreed on the terms and conditions herein;

NOW THEREFORE THIS AGREEMENT WITNESSES that in consideration of the premises and covenants and agreements contained in this Agreement and for other good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, RDN and BCCF covenant and agree with each other as follows:

29-Mar-04/195 405/Agreement/AB

BRITISH COLUMBIA

File: 14350-07

July 26, 2004

James Craig
Fisheries Technician
British Columbia Conservation Foundation
#3-1200 Princess Royal Avenue
Nanaimo, BC
V9S 3Z7

Dear Mr Craig:

This is in reply to your telephone conversation of July 26, 2004, in which we discussed your fax request of July 23, 2004 for an exemption to Part 2, Section 20(1) of the Forest Fire Prevention & Suppression Regulation (FFPSR). Namely, you requested an exemption that will allow you work on theEnglishman River fish habitat construction project using power saws occasionally and cable cutters using grinding discs.

In addition you request a variance from section 10(1)(c) for having only 67 m of fire hose.

These exemptions are granted with the following conditions:

1. All large engines, including pickup trucks that are not used solely as crew transport must have equipment as outlined by the FFPSR.
2. There must be a two hour fire watch at the end of the shift.
3. All bucking must be done on the stream bank. The log that will be bucked must be wetted down before cutting it.
4. Cable cutting can only be done on a gravel bar in stream.
5. The water delivery system must be started and test run daily.
6. The water delivery system must be set up on site and ready for use if required.
7. All other provisions of the FFPSR must be adhered to.

If you have any questions, contact the undersigned at (250) 731-3051.

VANCOUVER 2010

Page 1 of 2

Ministry of Forests South Island Forest District

Location:
4885 Cherry Creek Road
Port Alberni, B.C. V9Y 8E9

Mailing Address:
4885 Cherry Creek Road
Port Alberni, B.C. V9Y 8E9

Tel: (250) 731-3000
Fax: (250) 731-3010

Transport Canada
Pacific Region
Navigable Waters Protection Division
Suite 200 – 401 Burrard Street
Vancouver, BC V6C 3S4
Tel: (604) 775-8896 Fax: (604) 775-8828

NAVIGABLE WATERS PROTECTION ACT

WORK ASSESSMENT

APPLICANT INFORMATION	
APPLICANT'S FILE #:	NWP # 8200-03-8586.2
OWNER: British Columbia Conservation Foundation	OWNER'S REP. :
ADDRESS: #3 - 1200 Princess Royal Avenue Nanaimo BC V9S 3Z7 Attn: James Craig	ADDRESS: Attn:

WORK/SITE DESCRIPTION	
TYPE OF WORK:	Shore Protection – Large Woody Debris installation for fish habitat creation
WORK IS:	P (Legend: P=Proposed E=Existing EP=Existing/Proposed)
WATERWAY:	Englishman River
APPROX. COORDINATES:	Latitude 49° 17' 27" N Longitude 124° 16' 22" W
SITE DESCRIPTION:	10 sites along the banks of the Englishman River starting approx. 1.5 km upstream from the Highway 19 bridge crossing ending approx. 5 km further upstream, near Parksville, Vancouver Island, British Columbia.

It has been determined, pursuant to ss. 5(2) of the Navigable Waters Protection Act, that the proposed work as showin in these plans will not substantially interfere with navigation if it is built or placed, and maintained in accordance with these plans, site description and schedule provided by the proponent. Since conditions may change it would be advisable, in the case of a proposed work, to obtain a reassessment if the work has not commenced within two years from the date hereon.

J. Schellenberg
(SIGNATURE)

Navigable Waters Protection Officer
(TITLE)

JIM SCHELLENBERG
(PRINT NAME)

2004-7-26.
(DATE)

Englishman River
Reach E3/E4 Restoration Discussion Group
June 27, 2003

Meeting Summary

In attendance:

Cornish	Carol	MVIHES	Streamkeeper
Craig	James	BCCF	Technician
Doucet	Russ	DFO	Engineer
Gaboury	Marc	LGL Ltd	Biologist
Guthrie	Rick	MWLAP	Geomorphologist
McCulloch	Mike	BCCF	Technician
Sheng	Mel	DFO	Biologist
Smith	Faye	MVIHES	Streamkeeper
Wightman	Craig	MWLAP	Biologist
Young	Jeff	EREG	Technician

After a brief discussion and review of recent high water photographs and aerial photography at Robin's (Parksville) the group arrived at the EREG hatchery site in TW Block 602 at approximately 10:30am. Discussion on the river was extensive. The flowing summary is intended to capture the key issues.

First stop was the TW side-channel intake, where RD outlined DFO plans (2004?) to improve the intake structure. Structure will be located further upstream ~30m and be larger to meet requirements of planned side-channel extension (extension will have a second outlet and therefore require more flow – up to 10% of whatever is in mainstem). BCCF/LGL has prescribed a LWD habitat structure near the upstream end of the intake pool for construction in 2003. Group agreed that habitat structure should not interfere with new intake location.

Group continued downstream accessing the river in two areas. Several issues were discussed:

ISSUE: Gravel bar stabilization

- The amount of sediment moving through the mainstem annually is not documented.
- Whether or not watershed is in "recovery mode" not definitively known.
- According to nhc (2002), the main morphologic issues are lack of functioning LWD and sand and gravel deposition in pools and throughout riffles. They surmised that "sediment transport would maintain the existing substrate condition for many years." Though not confirmed, their feeling was that most course sediment below the falls is coming from alluvial mainstem reaches in the upper watershed such as E8-E10 (as opposed to slopes and tribs). They state that even if course sediment sources on slopes and tributaries are rehabilitated, decades would pass before stream substrate (i.e., steelhead overwintering) improves due to the volume of sediment stored along river and available for transport. They mention bar stabilization for E8-E10, but have no suggestions for anadromous reach sediment management.
- Weyerhaeuser's recent draft Englishman River Watershed Assessment (Ostapowich & Pollard 2002) states that the majority of headwater reaches lack LWD that would normally retain sediment and that this will likely be a long-term problem as the riparian forest is too young for new LWD recruitment. They confirm that as a result of logging, accelerated transport of sediment from upstream reaches has increased deposition below the anadromous barrier. There appears to be no statement concerning whether the anadromous reaches are "in recovery" or not.
- The group noted signs of recovery at several locations throughout the reach i.e., significant deciduous re-growth (8-20 foot alder and willow) on many bars, with 3-5 foot conifers interspersed.
- MS supports efforts to increase sediment trapping and gravel bar stabilization, either through plantings or LWD "wind rowing", or both.
- RG cautions that such treatments should be done sparingly with an eye to ensure that flood flows continue to be accommodated within the channel and that gravel bar treatments do not put undue pressure on adjacent stream banks.
- RG retrospectively noted that there needs to be some consideration about overall approach to stabilization. Continued chasing of unstable gravel bars or beginning with upstream portions and sources and working downstream over several years. See related issues below.

- MG noted that some LWD jams on bartops are already exerting pressure on nearby banks and suggested that adjustments to jam size and/or orientation may alleviate bank erosion.
- The diversity of situations supports prescriptions on a site by site basis.

ISSUE: Clay bank (150m downstream of SF Confluence)

- May or may not be an important issue (in the big picture).
- Need to document rate of erosion. Guthrie suggests staking and monitoring over time unless there is sufficient evidence on historical photographs to estimate sediment contribution.
- Failures due to water from upslope may be as significant as, or more significant than river cutting. Should be investigated. Are upslope water sources reasonable to turn off? RG notes that the site could be drained if critical, but solution may be expensive (unknown).
- Need to investigate water seepage source from Block 564, particularly in light of imminent development in area (related to previous point).
- Determine if this site is a significant problem before addressing. Caution: this is not the same as suggesting postpone any action on this site. Should not be overlooked until extent of contribution is known or more accurately estimated. Metric might be cubic metres of fines contributed annually, possibly in relation to other sources if that is identifiable.

The second area toured was the mainstem adjacent to the outlet of TW side-channel.

ISSUE: Need for parr habitat now.

- With the current steelhead stock conservation concern, Wightman expressed urgent need for functioning LWD to increase parr rearing habitat (identified as limiting by Lough and Morley). As steelhead are mainstem rearing, LWD offering cover in and adjacent to fast water habitats is ideal. There may be risk associated with installing LWD in this relatively unstable reach, but stock status warrants that some degree of risk should be acceptable. Site selection should be done to maximize success rate and longevity.
- During the recent review process and in light of the status of Englishman steelhead, the ERWRP Steering Committee supported mainstem LWD projects to create fish habitat despite the associated risks of doing so in a relatively unstable channel.
- The group agreed that some sites would be more likely to erode behind installed LWD than others. In those cases, Doucet recommended rip rap groins being incorporated upstream of LWD to avoid the "end run" scenario as seen at the Parrys site. BCCF will consider adjustments to current prescriptions.

ISSUE: Need for a long term plan to restore these critical reaches (E3/E4)

- A thorough, long term plan focused on restoring these reaches is required.
- Involve Weyerhaeuser and their plans for the upper watershed.
- Determine the watershed's current status and expected rate of recovery.
- Both fisheries agencies and PSEF/ERWRP need to work together to ensure this plan is funded.
- There was considerable discussion around reducing bank erosion at large elbows of the river. Discussion included some works suggested by MG. Again, considerable upfront time should be spent looking at the long term plan for this watershed and addressing the recovery in a complete way (RG's opinion, not necessarily that of all participants). It would be nice to see a realistic plan develop that looked at full restoration over a timeline, if not over a dollar amount. It might give the group realistic targets and small successes would be easier to measure.

ISSUE: Public safety and Navigable Waters Act.

- With the recent tuber incident at Parrys RV, structure design and location in relation to public safety issues is more important that ever, particularly in streams adjacent to urban centres. Key issues discussed on June 25, 2003 with the regional Navigable Waters Protection Officer were:
    1. Proponents of existing instream restoration projects should monitor same to ensure structures are and remain as safe as possible.
    2. Proponents of current and future instream restoration projects must submit applications to the Navigable Waters Protection Officer using appropriate forms and attaching required documentation.
    3. Proponents should evaluate risk associated with proposed projects on a site by site basis and avoid situations where risk is deemed to be high.
    4. Proponents should where possible minimize the degree to which artificial structures block a stream channel's cross section.
    5. Signage warning the public about instream structures is prudent. Highly visible signs with simple wording, placed on both sides of the channel upstream of structures, are recommended. Where

reaches contain a high density of structures, access points and/or points every half kilometre should be posted.

6. Exposed cable extending into the channel should be avoided.

The third area toured was the "Long Run" downstream past the outlet of the M&B side-channel (Sheng and Doucet had commitments and were unable to attend).

Trees cabled to the left (west) bank along the Long Run were examined. These trees had fallen into the channel due to erosion/wind and were cabled to standing live trees to retain them as LWD by EREG. In all cases, the root plate of these trees had deflected high water flows and caused significant local erosion of the bank. Their unbranched boles were providing some habitat, though the group believed there was likely a net loss in light of the erosion. Root plates should either be lifted up on top of the bank or protected from scouring flows by keying boulder groins into the bank immediately upstream. Another option is to entirely move this wood to more appropriate locations. Should the wood stay, cable around anchor trees should be sheathed with protective hose to reduce girdling.

To highlight channel movement, BCCF noted an example of where the river's thalweg had shifted during the past season in the riffle that enters the Slough Hole (outlet of M&B side-channel).

Consideration was given to further complex the bottom of the M&B side-channel with LWD.

A large LWD jam sitting atop a mid-channel bar adjacent to the tailout of the Slough Hole appears to be pushing flood flows hard against the right (east) bank and causing new and relatively significant erosion. Gaboury highlighted this as an example where there is potential to re-orient portions of jam to widen the channel to better accommodate flood flows.

Tour ended at 3:30pm.

Subsequent to the tour, a brief comment was sought from Weyerhaeuser on the watershed's current state of recovery. The following was received from G. Horel of Ostapowich Engineering Ltd., the company that did the watershed assessment for Weyerhaeuser.

> "With respect to the overall watershed condition, the watershed is trending toward recovery. Riparian forest along the disturbed alluvial reaches is becoming well advanced and seasonal erosion from these channel banks and bars is diminishing. There are still numerous sediment sources from the upper watershed (Middle Fork, Moriarty Creek and the upper Englishman) that deliver sediment to the Englishman River mainstem. A significant number of these sources are natural, and works in the lower Englishman should take into account that normal peak seasonal bedload transport in the mainstem will always be quite high. Because there are extensive bars and glaciofluvial deposits in the alluvial reaches, very high sediment loads can be mobilized during extreme storm events. One of the consequences of this is that channel switching in the lower alluvial reaches can occur during extreme storms, and this has happened historically. Old channels are visible in these reaches. Some of these take overflow during peak flow events.
>
> In summary, the lower Englishman mainstem will always be subject to high bedload transport -- it is a natural behaviour in this watershed. As well, the main thread of the river can switch locations on the wide alluvial reaches during extreme storms."

APPENDIX B

Photo Documentation

Photo 1. Typical non merchantable wood used in LWD site construction

Photo 2. Looking at lowermost access near 3+800 after deactivation.

Photo 3. Small excavator placing rocks at riffle site 3+800.

Photo 4.looking upstream at site 3+800 pre-construction.

Photo 5. Looking upstream at site 3+800 post-construction.

Photo 6. Looking across stream at excavator staging wood at restoration site 6+140.

Photo 7. Looking upstream at 5+690 and 5+730 pre-construction.

Photo 8. Looking upstream at sites 5+690 and 5+730 post-construction.

Photo 9. Looking downstream at site 5+730 with riffle 5+800 in foreground.

Photo 10. Looking across-stream at site 6+080 post-construction.

Photo 11. Looking upstream at site 6+140 pre-construction.

Photo 12. Looking upstream at site 6+140 post-construction.

Photo 13. Looking across stream at site 6+260 post-construction.

Photo 14. Looking downstream at site 7+120 further modified in 2004 to capture debris.

Photo 15. Looking downstream at site 7+105 pre-construction.

Photo 16. Looking downstream at site 7+105 post--constriction.

Photo 17. Looking upstream at site 7+180 pre-construction.

Photo 18. Looking downstream at site 7+180 post-construction.

Photo 19. Looking upstream at site 7+220 pre-construction.

Photo 20. Looking upstream at site 7+220 post-construction.

Photo 21. Looking downstream at site 8+790 post-construction.

Photo 22. Looking upstream at site 8+805 post-construction.

Photo 23. Looking upstream at site 8+980 pre-construction.

Photo 24. Looking upstream at site 8+980 post-construction.

APPENDIX C

Media Coverage

news

THE NEWS, Tuesday, August 17, 2004 • A21

Woody debris give fish cover, habitat in rivers

By JESSICA KERR
News Reporter

Work being done on some local rivers is wrapping up for the season.

Both the Englishman and Little Qualicum rivers have undergone some construction in the last few weeks. Work has been done in and around both rivers as a part of a fish habitat rehabilitation project.

The project — part of the Greater Georgia Basin Steelhead Recovery Plan, which is administered by the B.C. Conservation Foundation — involves constructing Large Woody Debris (LWD) structures at various locations along the river banks.

The LWD structures simulate wood accumulations that would naturally occur, and provide cover for the fish in the rivers, mainly Steelhead trout and Coho salmon.

"It's really quite cutting edge," said Mike McCullough, project manager with the GGBSRP. "We really go out of our way to do as much for as little as possible."

James Craig, a fisheries technician with BCCF who oversaw the work at Little Qualicum River, said another year of work is expected to be done there.

"We're slowly getting to the end of the list with this river."

Work is also being done on three other rivers on the east coast of Vancouver Island, Goldstream, Chemainus and Quatse rivers have also been targeted for repairs.

The work is funded by several partner groups, including the Pacific Salmon Foundation, the Ministry of Transportation, Ministry of Water, Land and Air Protection, the Habitat Conservation Trust Fund. Wood for the LWD structures for both projects was donated by Weyerhaeuser, TimberWest and Ozero.

For more information on the plan visit www.steelheadrecoveryplan.ca.

JESSICA KERR PHOTO

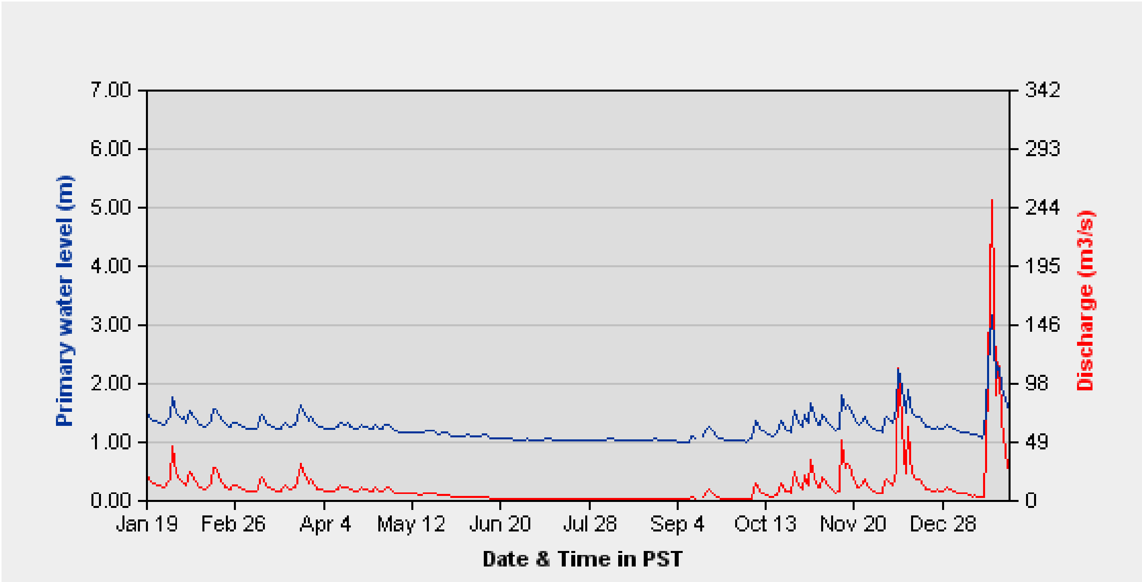
CREWS WERE WORKING at using cables to secure the large logs and rocks that make up one of the four new Large Woody Debris structures along the Little Qualicum River Friday morning.

The News and Weekender

APPENDIX D

Englishman River Hydrograph (2004)

From gauge 'Englishman River near Parksville (08HB002)'
http://scitech.pyr.ec.gc.ca/


7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Primary water level (m)
342
293
244
195
146
98
49
0
Discharge (m3/s)
Jan 19
Feb 26
Apr 4
May 12
Jun 20
Jul 28
Sep 4
Oct 13
Nov 20
Dec 28
Date & Time in PST