

Revised Study Plan
Boundary Hydroelectric Project (FERC No. 2144)

Study No. 10
Large Woody Debris Management Study

Seattle City Light

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Study No. 10 – Large Woody Debris Management Study

1.0 INTRODUCTION

Woody debris can be an important component of aquatic habitat in both riverine and reservoir habitats (Bjornn and Reiser 1991, Northcote and Atagi 1997). Woody debris provides habitat complexity and cover for fish, provides substrates for periphyton and macroinvertebrates, and can contribute to the localized storage of sediments. As woody debris decomposes, it may also provide nutrients to the water column and sediments (Harmon et al. 1986). Large wood entering Boundary Reservoir may lodge along the reservoir margins or may float downstream. Wood entering the Boundary Project (Project) forebay area may collect along a log boom structure or may catch and be removed at trashracks. The Project does not have a formal large woody debris management plan, but wood periodically gathered from the log boom and trash rack is cut into pieces and made available at no charge to the recreational public for their use (e.g., firewood).

Large woody debris (LWD) in reservoirs can be divided into three categories, each with distinct biological functions, based upon wood location: 1) submerged LWD, 2) floating LWD, and 3) shoreline LWD; each of these three categories of LWD is described in more detail below.

Submerged LWD. The biological effects associated with submerged wood in reservoirs have been studied more thoroughly in systems containing warmwater fisheries than coldwater fisheries. Two reviews prepared by Ploskey (1985) and Laufle and Cassidy (1988) almost exclusively involve studies of warmwater lacustrine systems. During the late 1980s, several papers were published from field studies conducted in Wyman Lake, Maine, to determine the ecological importance of submerged pulpwood logs on fish (Moring et al. 1986; Negus 1987; Moring et al. 1989). All three of these papers showed that suckers and shiners were attracted to areas containing large concentrations of submerged logs, while yellow perch were more abundant in non-log areas.

A common practice observed throughout central and southeastern United States is the retention of standing timber during the filling of a new reservoir to provide fish and wildlife habitat (Laufle and Cassidy 1988). Studies have shown that such reservoir structures function well as fish attractants and produce higher standing crops of warmwater sport fish such as largemouth bass and crappie (Layher 1984; Willis and Jones 1984, as cited in Ploskey 1985).

In coldwater systems, selective clearing in the littoral zone and at the mouth of tributaries may reduce the accumulation of woody debris that could otherwise impede the movement, spawning, or feeding of salmonids (Faubert 1982, as cited in Ploskey 1985). Research on a small, uncleared reservoir located on the Falls River, British Columbia, determined the surfaces of standing flooded timber contained diverse and abundant periphyton and invertebrate communities (Anonymous 1983). Stomach analysis of cutthroat trout and Dolly Varden collected from the reservoir showed that more than half of the prey taken by these two species were found on the submerged tree surfaces, suggesting the standing submerged timber was highly important to the production of these two salmonid species. Northcote and Atagi (1997) reviewed proposed plans to harvest submerged timber in Nechako Reservoir, British Columbia,

and concluded that the removal of standing, floating, and submerged trees in the littoral zone would negatively impact those species of periphyton and invertebrates that colonize the surface of submerged timber. The authors suggested that a reduction in these taxa could impair the existing fish community's (including kokanee and rainbow trout) feeding, growth, and production potential.

Floating LWD. Information on the function of floating LWD in coldwater lakes and reservoirs is scarce. In warmwater lakes, floating rafts of wood provide rearing habitat and escape cover for juvenile fish, increase habitat complexity, and provide additional surface area for invertebrate production. On Cazenovia Lake, New York, Helfman (1979) observed that substantially greater numbers of juvenile warmwater species utilized the area directly beneath artificial floats compared to an adjacent empty frame control float. Predator species were also observed near the floats, but there was no evidence that the floating cover, rather than the presence of prey species, attracted the predators. Helfman (1979) suggested that the area of floats used in his experiments might have been too small to attract substantial numbers of predator fish species. Floating debris rafts likely provide larger juvenile and subadult salmonids cover from terrestrial predators. However, floating debris rafts may also provide nesting platforms and potential resting areas for avian piscivorous predators.

Shoreline LWD. If woody debris is delivered to Boundary Reservoir from tributaries or Box Canyon Reservoir, a portion could eventually become stranded on the floodplain or gravel bars and, when inundated during high pool conditions, increase the complexity of littoral habitats for aquatic invertebrates and fish. Wood remaining on the floodplain reduces water velocity, allowing suspended sediments to be deposited adjacent to the anchored wood. These sediments provide ideal conditions for the establishment of new riparian vegetation (Maser and Sedell 1994). Wood lodging along the tributary deltas may provide cover during upstream and downstream fish movements between tributaries and the reservoir environment.

2.0 STUDY PLAN ELEMENTS

2.1. Nexus Between Project Operations and Effects on Resources

Boundary Project operations may affect the volume and type of large wood within the Pend Oreille River through active removal of wood at trash racks and other Boundary Project facilities.

2.2. Agency Resource Management Goals

A broad set of agency management goals are provided in the Mainstem Aquatic Habitat Modeling Study (see Study No. 7, section 2.2). In regards to fisheries for the Colville National Forest, one of the Standards and Guidelines is "Maintain the general character of aquatic and riparian habitat features. Maintain a natural source of large woody debris to provide structural fish habitat" (USFS 1988). Similarly, in the USFS's Inland Fish Strategy (USFS 1995), one of the riparian goals is to "provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems."

2.3. Study Goals and Objectives

The goal of this study is to gather information pertinent to developing a large woody debris management plan under the new Project license. The objective of this study is to quantify the volume, type and location of large wood within Boundary Reservoir and evaluate management alternatives to increase the availability of large wood in the reservoir.

2.4. Need for Study

Summary of Existing Information

A log boom structure is employed in the Project forebay to intercept and contain large debris floating downstream and prevent floating debris from potentially interfering with Project operations. A trash rack measuring 290 feet long and 100 feet deep with a clear opening between bars of 5-1/2 inches is located at the entrance to the forebay and is designed to prevent woody debris and other objects from entering the intake tubes and potentially damaging turbines and other structural components to the facility. The Boundary Project does not have a formal large woody debris management plan, but wood is generally gathered from the trash rack and log boom on an annual basis each spring. Pieces large enough are sent to a mill. Smaller pieces are cut and made available at no charge to the recreational public for their use (e.g., firewood). Smaller pieces are burned in the winter after a burn permit is obtained. The current distribution, size, and abundance of submerged, floating or shoreline wood within Boundary Reservoir has not been quantified.

Need for Additional Information

This study is needed to fill information gaps regarding current LWD management practices at Boundary Reservoir and to quantify existing LWD abundance and distribution. The size and volume of LWD annually removed at Boundary Dam should be quantified to identify the scope of existing wood removal operations and to identify alternative wood management opportunities.

2.5. Detailed Description of Study

Study Area

The study area includes all of Boundary Reservoir from Box Canyon Dam to Boundary Dam.

Proposed Methodology

A number of assumptions, listed below, are associated with the use of the methodology. If the following assumptions are false, the study may fail to meet one or more of its objectives or may require substantial changes to the methodology:

- The volume and type of LWD within Boundary Reservoir may affect multiple resource values such as the productivity of aquatic habitats, recreational boating, Project operations and maintenance, bird nesting, availability of recreational firewood, cultural resources, and fishing access.

- Land-use management within the tributary drainage basins pertaining to the growth and potential recruitment of LWD is not affected by Boundary Project operations.
- The minimum size of wood to be classified as LWD will be determined by the Technical Consultant in coordination with Seattle City Light (SCL) and relicensing participants; however, for planning purposes, the minimum size of wood to be classified as LWD is 30 cm in diameter and 3 m long (1.0 foot by 9.8 feet) (AREMP and PIBO 2004; USFS 2001; R2 Resource Consultants 2003).

The work effort for this study has been divided into five tasks, as described below.

Task 1) Existing LWD Management Activities at Boundary Project

Describe existing Boundary Project LWD management activities, including the timing, volume, and type of debris removed from trash racks and other Boundary Project facilities.

Task 2) Existing LWD Management Activities at Box Canyon Project

Contact and interview Pend Oreille County PUD representatives to identify LWD management activities associated with operation of Box Canyon Dam.

Task 3) LWD Mapping

In coordination with the Habitat Mapping effort in the Aquatic Habitat Modeling Study (Attachment 2, Study No. 7 of this RSP), use aerial photos to map the existing distribution of LWD in Boundary Reservoir. Conduct a survey of reservoir shorelines by boat to verify the aerial photo mapping results. During the boat survey, determine the functional quality (e.g., size distribution and decay class) and volume of LWD sampled. Estimate the total LWD volume and size distribution along Boundary Reservoir shorelines.

Task 4) Quantify LWD Removal

Quantify the volume, size and type of wood removed from trash racks and other Boundary Project facilities.

Task 5) LWD Management Alternatives

Evaluate LWD management alternatives and potential effects on multiple resources in Boundary Reservoir. Potential management alternatives may include, but not be limited to, the following:

- Collect LWD at the Boundary Dam trash rack and log boom and release it into the Boundary Dam tailrace.
- Dispose of LWD collected at the Boundary Dam trash rack and log boom by cutting it up into recreational firewood, or other beneficial uses.
- Dispose of LWD collected at the Boundary Dam trash rack and log boom, and place and anchor the collected wood, or an equivalent volume of LWD obtained elsewhere, at suitable locations in Boundary Reservoir for enhancement of native salmonid aquatic habitat while avoiding the potential for fish entrapment.

2.6. Work Products

Work products for the Large Woody Debris Management Study include a tabular summary of LWD survey results, final study report describing Boundary Reservoir LWD survey methods and results of 2007 monitoring, and an evaluation of the LWD management alternatives.

2.7. Consistency with Generally Accepted Scientific Practice

Studies regarding the distribution and abundance of large woody debris are commonly conducted at many hydroelectric projects as part of FERC licensing (e.g., Watershed GeoDynamics 2005 and R2 Resource Consultants, Inc. 2003). The LWD survey proposed in the current study plan utilizes protocols similar to those performed at other hydroelectric projects.

2.8. Consultation with Agencies, Tribes, and Other Stakeholders

Input regarding the Large Woody Debris Management Study was provided by relicensing participants during Fish and Aquatic Workgroup meetings. An outline for the Large Woody Debris Management Study plan was presented and discussed with relicensing participants during a workgroup meeting held in Metaline Falls, Washington, on June 27, 2006. The proposed Large Woody Debris Management Study plan was developed from the outline and relicensing participant comments. Comments provided by relicensing participants on the review outline for this study are summarized in the Proposed Study Plan (PSP) Attachment 4-1 (SCL 2006b) and can also be found in meeting summaries (available on SCL's relicensing website, <http://www.seattle.gov/light/news/issues/bndryRelic/>).

In its PAD/Scoping comment (USFWS 2006), the USFWS endorsed the Large Woody Debris Management Study outline presented at the workgroup meeting. The USFS did not specifically reference the Large Woody Debris Study outline in its PAD/Scoping comment letter (USFS 2006), but in a follow-up conference call on September 8, 2006, USFS staff indicated that there was general agreement on the outlines. The Large Woody Debris Management Study plan, as modified to address relicensing participant comments, was included in the PSP that was filed with FERC on October 16, 2006.

Since filing the PSP, SCL has continued to work with relicensing participants on its proposed study plans. Relicensing participants provided no comments on the Large Woody Debris Management Study at the November 15 study plan meeting and comments filed with the FERC by the USFS (2007) stated that "The Forest Service agrees with SCL's proposed Large Woody Debris Management Study. The agency [USFS] appreciates SCL's collaborative effort to provide a consensus based study proposal." No other PSP comments were filed with FERC regarding this study. (Comments are summarized in Attachment 3 and consultation documentation is included in Attachment 4 of this RSP). As a result, SCL has made no further technical modifications to the Large Woody Debris Management Study plan as part of this RSP. Additional details will be developed in early 2007 when the Technical Consultant finalizes the study implementation details in coordination with SCL and relicensing participants (Attachment 1, section 2.2 of this RSP).

2.9. Schedule

The schedule for completing the Large Woody Debris Management Study is provided in Table 2.9-1.

Table 2.9-1. Schedule for completing the Large Woody Debris Management Study.

Activity	2007				2008			
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q
Technical Consultant study refinement								
LWD Mapping			▲▲					
Evaluate LWD Management Alternatives								
Prepare draft study report				●				
Distribute draft study report for relicensing participant review					●			
Meet with relicensing participants to review study efforts and results					●			
Include final study report in Initial Study Report (ISR) filed with FERC					●			
Hold ISR meeting and file meeting summary with FERC					●			

2.10. Progress Reports, Information Sharing, and Technical Review

The draft and final study reports will be available to relicensing participants. Prior to release of the Initial Study Report (which will include the results of this study), SCL will meet with relicensing participants to discuss the study results, as described in Attachment 1, section 2.3 of this RSP. In addition, relicensing participants will have opportunities to discuss and comment on the study’s progress at quarterly workgroup meetings and ad hoc subcommittee meetings, as necessary.

2.11. Anticipated Level of Effort and Cost

Based on a review of study costs associated with similar efforts conducted at other hydropower projects, the estimated cost to implement this effort at the Boundary Project ranges from \$25,000 to \$40,000; estimated study costs are subject to review and revision as additional details are developed. To obtain efficiencies in the overall relicensing work effort, portions of this study will be conducted in conjunction with the Habitat Mapping component of the Aquatic Habitat Model study (Study No. 7).

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