

# Campbell River Canyon Spawning Gravel Placement

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With stocks currently using less than 10% of total available habitat, summer and winter steelhead stocks in the Campbell River are an extreme conservation concern (Lill 2002, p. 16). Hydroelectric development in the watershed has reduced the quantity and quality of spawning and rearing habitat, severely limiting fish production in the canyon reach. On the British Columbia coast, “declines in steelhead abundance have been caused by a sharp reduction in ocean survival combined with impaired freshwater habitat capability. Wild stocks in most systems will not recover unless their freshwater productivity can be significantly

increased to compensate for reductions in marine survival” (Lill 2002, p. 3).

Strategically placing high quality spawning gravel addresses one limiting factor for fish production in the upper Campbell River Canyon. The

overall goal of gravel placement in the short term is to increase egg to fry survival for the remnant population of summer and winter steelhead and is an important step in assisting the recovery of these stocks in the watershed.

## Project Background

The Campbell River flows east from Strathcona Provincial Park, entering Johnstone Strait near the town of Campbell River (Figure 1). Hydroelectric development began in the Campbell River watershed in 1945 and continued through 1958. Campbell River is Vancouver Island’s second largest watershed, draining 1744 km<sup>2</sup> with an average annual reservoir flow of 87 m<sup>3</sup>/s at John Hart Dam and 103 m<sup>3</sup>/s in the town of Campbell River (BC Hydro 2000).

Streamflow from John Hart Lake is routed through a penstock (pipeline) to a powerhouse on the Campbell River, bypassing a 2 km long canyon (Figure 1). With completion of the

John Hart hydroelectric facilities in 1945, the canyon received only “leakage flows” from under the dam spill gate, or periodic spills when high local inflows or system maintenance occurred. Spill flows of more than 400 m<sup>3</sup>/s, however, have been recorded through the canyon reach as a result of uncontrolled water flow through the John Hart Dam’s spillways. The unreliability and variability of flow in the canyon has profoundly affected anadromous fish habitat in the Campbell River watershed. Hydroelectric development in the canyon reach (BC Hydro 2002) produced three primary impacts:

1. significantly reduced gravel and large woody debris recruitment to mainstem;
2. penstock diversion that partly dewatered approximately 2 km of spawning and rearing habitats below Elk Falls; and
3. mainstem carrying augmented flood peaks from diversions that affect channel morphology and the Campbell River estuary.

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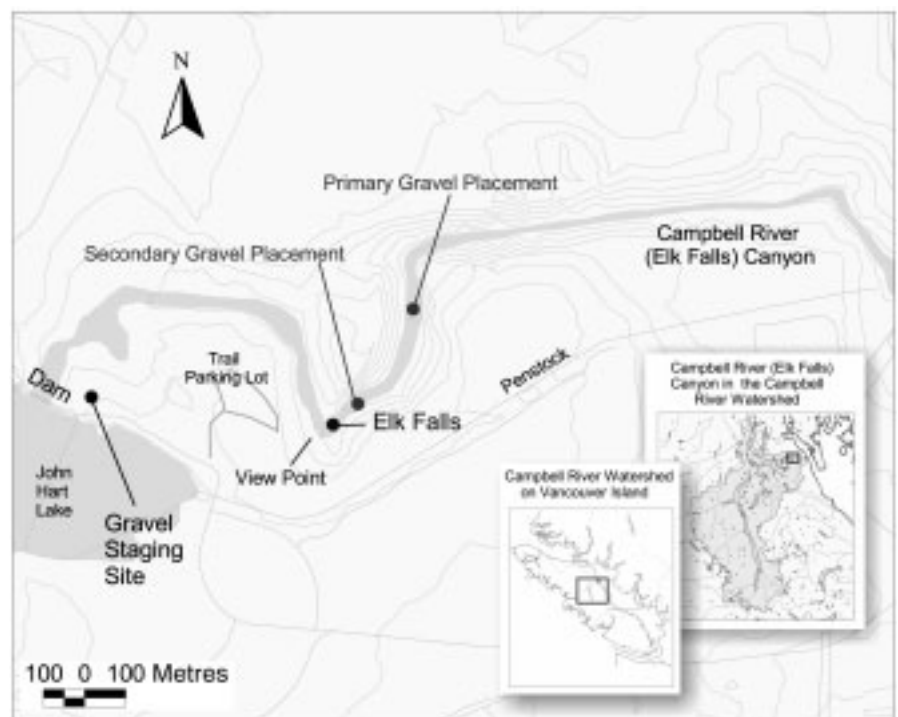


Figure 1. Campbell River (Elk Falls Canyon) gravel placement, 2002.

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Figure 2. Bucket in position prior to release.

Overall, these conditions reduced the quantity and quality of spawning and rearing habitat, severely limiting fish production in the canyon reach.

In June 1996, provincial fisheries staff initiated a monitoring program of the Canyon reach, in relation to development of the Interim Flow Management Strategy (Campbell River Hydro/Fisheries Advisory Committee 1997). By the fall of 1998, an agreement between BC Hydro, Fisheries and Oceans Canada, and the B.C. Ministry of Water, Land and Air Protection established an interim base flow of 3.5 m<sup>3</sup>/s as a controlled spill from the John Hart reservoir. This was done while negotiations in the Campbell River Water Use Plan were re-examining the issue of fisheries flows in relation to power production requirements. Currently, no limit exists on maximum flows in the canyon reach.

### Gravel Placement

In 1999, in an initial gravel placement project, LGL Limited (Sidney, B.C.) placed 75 m<sup>3</sup> of spawning gravel in the tailout of the Elk Falls plunge pool. For their project, gravel size specifications primarily focused on replenishing chinook salmon spawning substrates. In the fall of 2001, the BC Conservation

Foundation (BCCF) proposed installing an additional 75 m<sup>3</sup> of smaller-sized substrate (medium drain rock) in locations where it could be immediately used by steelhead, coho, chinook, and other species.

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Figure 3. Gravel placement.

A snorkel survey completed in July 2002 identified two primary gravel placement locations in the upper canyon reach. Primary criteria used to identify potential restoration sites included:

1. usability for all salmonids based on regulated flows at time of survey;

2. distance from gravel stockpile location; and
3. hydraulically stable locations, with a wide channel width, allowing for reduced velocities during uncontrolled spilling events.

An estimated 75 m<sup>3</sup> of gravel (6 minus) remained near the John Hart Dam from the initial spawning gravel placement project in 1999. An additional 22 m<sup>3</sup> of screened and washed medium-sized drain rock (30–70 mm) was mixed with the larger gravel on July 24, 2002.

Vancouver Island Helicopters Ltd. (VIH) installed the gravel using a Sikorsky S-61 heavy lift helicopter. Two gravel distribution buckets, owned by VIH, were specially modified to increase their capacity to 3000 kg (6500 lbs.). The helicopter used a remote release 400-foot long-line to place buckets of gravel in precise locations in the canyon (Figures 2 and 3).

A total of 94 m<sup>3</sup> of spawning substrate was placed at two locations. In all, 58 loads of gravel were delivered to the two sites using 5.7 hours of helicopter time (~5.9 minutes/load). Nineteen loads (33% of the total) were placed in the tailout of the Elk Falls plunge pool and 39 loads (67% of the total)

were placed 400 m downstream. With an average payload weight of 2950 kg (6500 lbs.), a total of 171 100 kg of gravel (about 94 m<sup>3</sup>) was transported into the canyon reach.

**The proximity of the Campbell River Canyon to the availability of heavy lift helicopters on Vancouver Island allowed this project to be completed relatively cost effectively.**

The total cost for this project was approximately \$45,000 with almost 70% of the budget allocated to helicopter costs. The proximity of the Campbell River Canyon to the VIH base near the town of Campbell River and the availability of heavy lift helicopters on Vancouver Island allowed this

project to be completed relatively cost effectively. Given a more remote site with a longer shuttle time or a longer working distance between the gravel stockpile and the primary gravel placement, the costs may have quickly become prohibitive.

### Post Gravel Placement Monitoring

Two snorkel surveys were completed in the Campbell River Canyon after the installation of the spawning gravel. An October 2002 survey examined use of the spawning substrate by sockeye and chinook while a November 2002 survey examined use by coho and chum. The October survey found that:

1. Overall use of the installed spawning substrate by spawning sockeye and chinook was considered as "high."
2. Hydraulic conditions were good for insect production and juvenile rearing but sub-optimal for spawning salmonids (flow measured at 4.3 m<sup>3</sup>/s).

The November survey found that:

1. Spawning coho used the introduced gravel and post-spawn chinook were observed guarding redds.
2. A very high abundance of rainbow parr and cutthroat adults were associated with the gravel pads, likely feeding on salmon eggs displaced from redds.
3. Most of the gravel could be immediately used by spawning salmonids.
4. The distribution of chum salmon was skewed downstream in the canyon due to a velocity barrier. The introduced spawning substrate was generally inaccessible to this species. If future placements are to benefit chum salmon, gravel distribution must also target the lower Elk Falls Canyon.

### Future Plans and Recommendations

The long-term success of this project depends highly on the yearly hydrologic regime. For the past few years, lower than normal discharge has resulted in minimal problems with gravel mobility. However, after any major spilling event, maintenance or additional placement of gravel would need to be considered. BC Hydro is currently developing a comprehensive, long-term gravel plan for the Campbell River Watershed to identify solutions for further gravel placements in the Canyon and downstream of the John Hart Generating Station.

Future spawning gravel placements should include alternate strategies for both precise gravel placements into locations where substrate can be used immediately for spawning and bulk placements of larger volumes of gravel that could be distributed naturally into suitable locations over time. A combination of techniques including gravel slinging, gravel ramps, and land-based long-lining should be investigated as a more

cost-effective alternative to using a helicopter, allowing more substrate to be placed in this reach.

A flow release schedule based on criteria developed by the Water Use Plan (currently ongoing) should be implemented to facilitate upstream migration, spawning, and rearing for all species in the Campbell River (Elk Falls) Canyon. ~

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