DAKOTA CREEK BIOINVENTORY
FOR SUBDIVISION OF LOTS G & J, HILLSIDE INDUSTRIAL PARK, PORT MELLON

(B.C. Environment File No. 72000-25/01-005-13385)

submitted to:
Fish and Wildlife Habitat Protection
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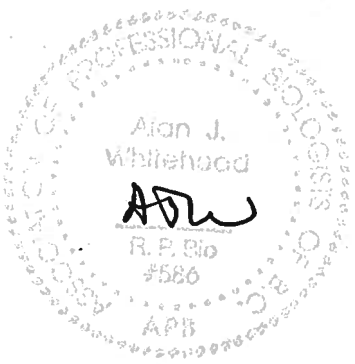

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1. Introduction

This report provides a stream and riparian bio-inventory as required by B.C. Environment for the the Sunshine Coast Regional District's subdivision of Lots G and J in Hillside Industrial Park, Port Mellon. The report is comprised of a brief description of the proposed subdivision and the requirements of BC Environment, a summary of existing environmental information, the results of the stream and riparian bio-inventory, and an assessment of potential habitat enhancement opportunities.

A series of colour photographs, maps, schematic drawings, and appended background information are also included.

2. Project Understanding

The Sunshine Coast Regional District (SCRD) has been developing Hillside Industrial Park (H.I.P.) since the late 1980s. The 478 acre (199 ha) property, which is accessed by Highway 101, is located approximately 15 km north of Langdale and 1 km south of Port Mellon (Figure 1). The central portion of H.I.P. that is dealt with in this report lies within the watershed of Dakota Creek. With the exception of Hillside Industrial Park (which lies at the very downstream end of the catchment), the Dakota Creek watershed is entirely forested, and the main land use is logging. However, some recreational use (cross-country skiing and possibly hunting) also occurs in the upper watershed (Dakota Bowl). The area is also designated as a Community Watershed for the SCRD, which holds a water licence on the creek (although there is no water use at present).

Since the beginning of implementation of the H.I.P. comprehensive development plan, the subdivision has proceeded in phases, with several other lots having already been subdivided in the past (e.g. BC Environment file 72000-25/94.SE.014). Lots G and J (Figure 2), which are the subject of the present phase, are currently under review for permitting and approval by the appropriate government agencies. In addition to the SCRD, the main regulatory review agencies for this project include the ministries of Transportation and Highways (MOTH), Environment, Lands and Parks (MELP), and Forests (MoF). As part of the review process, MELP has instructed the proponent (SCRD) to retain a consultant to complete a bio-inventory and habitat enhancement assessment of the stream system. The terms of reference for the present assessment are provided in Appendix A.

Lots G and J are located beside Dakota Creek and its tributary Little Dakota Creek, and Lot G also fronts on the marine foreshore of Howe Sound (Figure 2). As part of the SCRD's comprehensive plan for H.I.P., restrictive covenants have been established, in consultation with MELP, along much of the environmentally sensitive areas at Hillside, as shown in Figure 2. The 15 to 30 m setback zones from these waters are currently protected by the aforementioned covenants on the property title, and have been fenced.

Whitehead Environmental Consultants Ltd. were retained by the SCRD to conduct the bio-inventory and habitat assessment required by BC Environment for these lots.

3. Existing Sources of Environmental Information

Considerable environmental information is already available on this property. The following sources are available:

- **Environmental Impact Assessment - Hillside Industrial Park.** 1990. Report prepared by Norecol Environmental Consultants Ltd. for The Economic Development Commission, Sunshine Coast Regional District. February 1990.

- **Habitat Compensation Plan: Marine Terminal Fill Area, Hillside Industrial Park.** 1994. prepared by Alan J. Whitehead, M.Sc., R.P.Bio., on behalf of Hillside Industrial Park, Sunshine Coast Regional District; submitted to Fisheries and Oceans Canada, Nanaimo, B.C.

- **Hillside Industrial Park Stormwater Management Plan** (Draft). 1995. Prepared for the Sunshine Coast Regional District by Dayton & Knight Ltd. Consulting Engineers, West Vancouver.

- **Dakota Creek Watershed Restoration Project**. Annual Report 1997-1998 (Year 4). Prepared by A.J. Whitehead & Associates, on behalf of the Sunshine Coast Regional District, for the Watershed Restoration Program, B.C. Environment.

  The following reports, which provide considerable information on riparian conditions, fish habitat and fish population data, are included as appendices in the above report:

  Dakota Creek Riparian Assessment, Howe Sound, B.C. Final Report. 1998. Prepared by A.J.Whitehead & Associates on behalf of the SCRD for the Watershed Restoration Program, B.C. Environment.

  Preliminary Evaluation of Juvenile Salmonid Populations and Aquatic Habitat in the Anadromous Section of Dakota Creek, Howe Sound, B.C. 1996. prepared by D.J. Bates and J. Ellis for Fisheries and Oceans Canada and the S.C.R.D. [*included below as Appendix B, without its own appendices* .]

  Fish Monitoring Data for Little Dakota Creek habitat enhancement, for September 17 1996, June 11 1997, January 8 1998, and February 12 1998, prepared by J.Wilson, for the S.C.R.D. and Fisheries and Oceans Canada. [*included below as Appendix C.*]

- Colour aerial photography is also available from 1994, at a scale of 1:10,000 (Series 30BCC94151, Frames 124 and 125).

- Fish Information Summary System (FISS) report on Dakota Creek [*included below as Appendix D*].

4. Field Investigation

A field survey was completed on September 2 and October 8th 1999. The survey concentrated on documenting existing riparian vegetation, wildlife, aquatic habitat and land uses. The primary intent of the field study was to update and complement the extensive information already available.

4.1 Methods

For the purpose of this inventory, the primary study area in lots G and J was defined as: the covenanted riparian corridors along the right (south) bank of Dakota Creek below Highway 101, the marine foreshore of lot G. and a historical stormwater channel through the south-central portion of Lot J. The study area was divided in to eight sampling areas, as described below:

Sample Area	Description
A	Marine shore area at southeast corner of Lot G
B	Marine shore area at northeast corner of Lot G
C	Constructed saltmarsh in Lot G
D	Dakota Creek mouth to Forest Service Road (north end of Lot G)
E	Dakota Creek from Forest Service Road to Highway 101 (north end of Lot J)
F	Highway 101 to Little Dakota Creek Ponds (central Lot J)
G	Little Dakota Creek Riparian corridor below Forest Service Road (lot G)
H	Little Dakota Creek Habitat Enhancement Ponds (Lots G and J)

The locations of these areas are shown in Figure 3. The field survey included an examination of the following parameters:

- riparian vegetation communities,
- land use adjacent to the watercourse(s),
- watercourse characteristics,
- wildlife habitat values,
- wildlife species presence,
- fish habitat values,
- fish species presence, and
- potential habitat enhancement needs and opportunities.

4.2 Results

The findings are provided below for each site separately or, where more appropriate, for the study area as a whole.

4.2.1 Area A - Marine shore area at southeast corner of Lot G (Photos 1 and 2)

The riparian vegetation in this area is dominated by a thicket of red alder saplings, with Scotch broom and other shrubs, as well as sparse herbaceous species. (This vegetation has grown naturally on the site over the past 10 - 15 years.) The substrate is primarily organic matter (decomposed wood waste, up to ~1.5 m thick) over alluvial sand and gravel with occasional cobbles and boulders.

Adjacent land use is an undeveloped industrial lot, much of which is unvegetated. However, significant natural revegetation by red alder is present in patches. The site of the proposed Lot G used to be a wood waste deposit, which has since been reclaimed (the substrate within the reclaimed portion of the lot itself is fill composed of sand and gravel). The adjacent marine foreshore consists of a sloping gravel/cobble beach. Storage of log booms takes place in the adjacent marine environment.

Fish and wildlife habitat values are high. The foreshore provides habitat for a diversity of marine and anadromous fish species, including rearing habitat for juvenile salmonids such as coho and chum salmon, sea-run cutthroat trout, and steelhead.

Wildlife observed in the area includes deer, bear, and several species of passerine birds, waterfowl, raptors and shorebirds. The density of Great Blue Heron using the adjacent log booms can be very high in late summer and early fall, reaching up to one individual approximately every 200 - 300 m. Garter snakes and numerous terrestrial and marine invertebrates have also been observed. No nests of herons, raptors or other birds have been observed.

4.2.2 Area B - Marine shore area at northeast corner of Lot G (Photos 3 and 4)

The riparian vegetation in this area is dominated by a band of young to mature coniferous forest, including redcedar, western hemlock, Douglas-fir and Sitka spruce (up to 0.6 m diameter at breast height [dbh]). The understorey includes salal, rose, Pacific crabapple, and other shrubs. This vegetation is representative of relatively undisturbed conditions. The substrate is primarily a relatively thin humus layer (<0.3 m thick) over alluvial sand and gravel. Adjacent land use is the same as described above under Area A, an undeveloped industrial lot on land and log booming in the marine environment.

The adjacent marine foreshore consists of a sloping gravel/cobble beach with significant vegetation cover, including dunegrass (*Elymus mollis*), sea milkwort (*Glaux maritima*), silverweed (*Potentilla anserina spp. pacifica*), as well as macroalgae such as rockweed (*Fucus sp.* and greenstrap (*Enteromorpha* sp.).

As in Area A, fish and wildlife habitat values are high, and similar species occur. No bird nests were observed.

4.2.3 Area C - Constructed saltmarsh (Photos 5, 6 and 7)

The saltmarsh at this site was constructed in 1997 as habitat compensation associated with the development of the barge terminal further south within Hillside Industrial Park. Figure 4 is a pair of sketches of the constructed saltmarsh site, showing its main features and connections to the shore. The 415 m^2 saltmarsh was designed to provide 125% replacement of the original saltmarsh lost at the barge terminal site.

Vegetation within the saltmarsh consists of sedge (*Carex lyngbyei*), arrowgrass (*Triglochin maritimum*) and other grasses, as well as silverweed and milkwort. The permanently flooded pool at the western end of the site is devoid of vegetation. The surrounding riparian vegetation differs on the north and south sides, according to previous land uses. The undisturbed area to the north is young to mature mixed riparian forest, with the same species as described below for Area D. To the south, however, within the reclaimed woodwaste site of Lot G, the vegetation is natural regeneration of dense red alder saplings, up to approximately 4 m high and less than 6 cm dbh. Understorey in the regenerating alder thicket is negligible, largely due to shade.

The adjacent land use to the south, beyond the covenanted area, is the undeveloped industrial lot G, already described above under Area A (Section 4.2.1).

Fish and wildlife habitat values are very high. During very high tides, the entire saltmarsh is temporarily submerged, and the marsh can be directly accessed by fish for limited periods. However, and probably more importantly, even though fish access is limited, the organic matter produced by the saltmarsh vegetation, and exported by receding tidewater into the adjacent marine environment, contributes significantly to the marine food web.

Wildlife species observed over the years at this site include deer, black bear, Canada geese, Mallard, and numerous species of passerine birds. Wilson's and MacGillivray's warblers, as well as Chestnut-backed Chickadee, Fox Sparrow, Nuthatch, and Red Crossbill were observed during the field study. No nests of heron, raptors or other bird species were observed.

4.2.4 Area D - Dakota Creek mouth to Forest Service Road (Photos 8, 9 and 10)

This sampling area is influenced by the tides of Howe Sound (Thornbrough Channel) (Figure 3.) Riparian vegetation consists mainly of a deciduous pole-sapling forest, dominated by red alder, with lesser amounts of bigleaf maple and cottonwood. However, a few conifers such as redcedar and Western hemlock (<0.5 m dbh) are also present next to Dakota Creek at the upstream end of this sample area. Canopy closure was approximately 80%. Understorey vegetation was moderately dense, consisting of maple and redcedar seedlings and saplings, salmonberry, currant and sparse Himalaya blackberry. The main herbaceous species included mosses and swordfern.

Vegetation in the southern section, within the previously disturbed area of Lot G (Fig. 3), is a regenerating alder thicket identical to that described above for Area C (Section 4.2.3). The hummocky microtopography and presence of discarded human-made materials (old vehicles, bottles, and other waste) toward the western end of this sampling area indicates that the site was disturbed in the past. This disturbance was probably associated with the historical use of Hillside as a gravel quarry several decades ago (Norecol 1990). Adjacent land uses are as described above for Areas A, B and C.

This sampling area is located on the south side of the Dakota Creek mouth; the mouth of McNair creek is on the opposite side of the channel to the north (Fig. 3). The channel width in Area D ranges between approximately 110 m at the easternmost (seaward) end and 15 m upstream at the Forest Service Road bridge. The stream substrate is predominantly cobble and boulder in the narrower western segment, with gravel and sand increasing downstream, reflecting the influence of tidal inundation.

The other watercourse in Area D is Little Dakota Creek (Figure 3). A full description of Little Dakota creek is provided below in Section 4.2.7.

Wildlife habitat values in this area are high. Terrestrial wildlife species are as described above for the other sampling areas. (A noteworthy observation by the author at this site in 1997 was the presence of a Sharp-Shinned Hawk successfully preying on a Red-Bellied Sapsucker.) The gravel bars at the mouth are used by several species of shorebirds, gulls and waterfowl. A flock of 28 Common Mergansers was observed at the mouth during the present field study. No nests of heron, raptors or other bird species were observed.

Fish habitat values are also high in this estuarine setting. Dakota Creek is known to support coho, chum, steelhead and coastal cutthroat trout. However, for hydrological and topographical reasons, the overall fish productivity is considered low (Grant McBain, DFO Community Adviser, Sechelt, personal communication.). Detailed information on fish habitat and species in lower Dakota Creek is documented in Bates and Ellis (1996), and summarized below in Section 4.2.9.

Habitat enhancement opportunities in this area have been realized though the Dakota Creek Watershed Restoration Project, implemented under Forest Renewal BC (FRBC). Full details are provided in Whitehead (1996, 1997, 1998).

4.2.5 Area E - Dakota Creek from Forest Service Road to Highway 101 (Photos 11,12,13)

Riparian vegetation in this area consists of a mixed (coniferous-deciduous) mature forest, dominated by bigleaf maple and red alder, with subdominant western hemlock and Sitka spruce. Canopy closure is approximately 70%. Understorey vegetation includes maple saplings, salmonberry and occasional red elderberry, as well as huckleberry, thimbleberry, twinberry and salal. Herbaceous species include swordfern, coltsfoot, twisted stalk, ladyfern and mosses.

Land uses adjacent to Area E include Highway 101 along the west boundary and the covenanted forest between Dakota Creek, and the undeveloped portion of Lot G to the south.

Dakota Creek next to Area E is unstable, and the channel has changed considerably in this zone over the past three to five years, mainly through erosion of the left (north) bank. The substrate is dominated by boulder and cobble. On the date of inspection, two channels were present. The southern channel, which used to contain the entire flow until 1997, was dry. Based on prior observations, down-cutting in the new channel has isolated the original channel so that it only carries water during extreme high flows. The northern channel, which has been created through erosion of the banks and riparian forest, carried all of the flow on the date of inspection. The characteristics of the main channel are summarized below:

Channel characteristics of lower Dakota Creek between the Forest Service Road and Highway 101, 2 September 1999.

	South channel	North channel
Bankfull width (m)	13	17
Wetted width (m)	0 (dry)	17
Riffle (%)	dry	75
Pool (%)	dry	25
Pool residual depth (m)	0.4	0.5

Wildlife habitat values in this area are high, similar to the entire study area. A Great Blue Heron was observed during the field study, in addition to tracks of deer and bear. No bird nests were observed.

Fish habitat values, fish species presence, and potential habitat enhancement opportunities are discussed below in Sections 4.2.7 and 5.0.

4.2.6 Area F - Lot J, from Highway 101 to Little Dakota Creek Ponds (Photos 14, 15, 16, 17, 18)

Riparian vegetation in Area F is a mature deciduous forest, dominated by bigleaf maple and red alder, with lesser amounts of western hemlock and Sitka spruce. Crown closure on September 2 1999 was approximately 70%. Standing snags, mainly red alder up to 0.4 m dbh, were observed. The understorey shrubs included salal, twinberry, crabapple, salmonberry and huckleberry. The main herbaceous species was swordfern.

Land uses adjacent to Area F include Highway 101 on the west side, undeveloped forested land of Lot J to the south and east, and the Little Dakota upper pond system to the north.

There appear to be no functional watercourses in this sampling area at present. However, in the past, during periods of extreme high flow in Dakota Creek, a distributary of Dakota Creek directed flows into the stormwater ditch on the west side of Highway 101 and then, through two wooden culverts under Highway 101, into the south-central portion of Lot J. Once in Lot J, the main stormwater flow followed an abandoned roadway and several other low-lying areas, and eventually discharged into the roadside ditch on the west side of the Forest Service Road (see Figure 3 and Figure 7).

The central portion of Lot J was inspected on October 8th 1999 to ascertain the present condition of the historic channel. The gravel, cobble and occasional boulders in the roadway "channel" were covered with a dense layer of moss, which suggested that surface flow is very infrequent or absent. However, it was considered that groundwater recharge from this area of Lot J likely contributes, to some extent, to the spring that feeds the habitat enhancement ponds in the northwest corner of this lot (see also Section 4.2.8).

It should be noted as well that flood protection works are planned by the SCRD and the Ministry of Transportation and Highways, for the west side of Highway 101 across from Lot J. These works include a berm that will preclude future passage of Dakota Creek floodwaters under the highway and into Lot J.

Wildlife habitat values in this area are high, similar to the previously discussed areas. Tracks of deer and bear were observed. No bird nests were observed.

4.2.7 Area G - Little Dakota Creek Riparian corridor below Forest Service Road (Photos 19, 20)

The riparian vegetation on the north side of Little Dakota Creek consists of young to mature deciduous forest. Dominant tree species are bigleaf maple and red alder, with western hemlock, redcedar and Sitka spruce subdominant. The shrub layer includes alder, hemlock and spruce seedlings and saplings, red elderberry, seedlings of redcedar and salal.

On the south side of Little Dakota the vegetation consists of three distinct bands of habitat. Immediately adjacent to the creek, for a width of no more than 3 m, approximately, the riparian vegetation includes dense salmonberry, interspersed with willow (2 species) and cascara. Herbaceous vegetation is generally sparse; common species, in order of abundance, include patches of grasses, pearly everlasting, sword fern, buttercup, large-leafed avens, and brooklime. Beyond the 3 m zone, there is a zone of densely regenerating alder thicket, similar to that described previously for Area A (Section 4.2.1), which varies in width from approximately 5 to 20 m. At least one Sitka spruce seedling was observed in the understorey of this zone. Farther away from the creek, within the southernmost portion of the covenanted area, vegetation is very sparse and limited to naturally seeded red alder saplings and transplanted redcedar seedlings. Most of the cedar transplants, which have been in the ground for over a year, appeared unhealthy.

The poor revegetation in this outer zone is due to poor soil conditions resulting from insufficient removal of the woodwaste during prior reclamation of the site. A recommended enhancement approach to complete the reclamation at this site is provided in Section 5.0.

Aquatic habitat in the Little Dakota Creek system is described below in Section 4.2.8.

Wildlife habitat values are similar to those described above for the other areas. No bird nests were observed.

4.2.8 Area H - Little Dakota Creek Habitat Enhancements
(Photos 19, 20, 21, 22, 23, 24)

Little Dakota Creek is a mainly groundwater-fed ephemeral tributary of the Dakota main stem. During periods of very high flow in Dakota Creek proper, Little Dakota is also a distributary or overflow channel of the main stem, as shown in Figures 2 and 3. The main source of groundwater is a spring at the upper end, which was flowing on September 2 1999. This spring is likely fed by the aquifer contained in the alluvial sands and gravels of the Dakota Creek delta, and to a much lesser degree by local groundwater recharge through infiltration of precipitation within Lot J.

Little Dakota Creek has been the site of significant habitat enhancement works that were completed under the Dakota Creek Watershed Restoration Project (WRP). Schematic sketches of the enhancements are provided in Figures 5 and 6. The following description of the stream is taken from the Dakota Creek WRP Annual Report for 1997-1998:

> "Little Dakota Creek, a distributary of the Dakota Creek main stem, had been found to contain abundant coho fry as well as cut-throat trout. This small stream was selected as the site for habitat enhancement and, accordingly, fish habitat rehabilitation in Little Dakota Creek was completed in the fall of 1996 under the direction of DFO. The purpose of the in-stream project was to increase the availability of over-wintering habitat for coho salmon fry and resident and sea-run cut-throat trout. The design included the creation of up to six rock weirs and pools, above and below the Forest Service Road within Hillside Industrial Park; a sketch of the works is included in [Figures 5 and 6]. The utilisation by fish was first monitored during 1997-1998."
>
> "Fish utilisation of the rehabilitated habitat in Little Dakota Creek was assessed by DFO in January and February 1998. The following species were present, in order of abundance: coho salmon, cut-throat trout, rainbow trout and (one) Dolly Varden char. The record of the latter species is important in that it may have been a bull trout (G.McBain, pers. com.). The full sampling results, which include the results of pre-construction fish salvage, are included in Appendix [C]." (Whitehead 1998).

An additional pool was constructed during the summer of 1998. The following excerpt, taken from the Annual Report for 1998-1999, provides a description of this work.

> "The work completed during [1998-1999] consisted of an expansion of the previously constructed rearing and over-wintering pond, from approximately 120 m^2 to a total of 276 m^2, plus addition of large woody debris for habitat complexity. A sketch of the as-built habitat is shown in Figure [5]. A mini-excavator was used, as during the first phase of this work in 1997, to ensure that disturbance to adjacent riparian vegetation was minimized."
>
> "Fish utilization of the rehabilitated habitat in Little Dakota Creek was first assessed by DFO in January and February 1998, during Year 5 (Whitehead 1998). Additional sampling was undertaken during September - October 1998 and January - March 1999 to ascertain the degree of fish use of the newly constructed habitat. The fish monitoring report prepared by Jim Wilson, Fisheries Technician, is provided in Appendix 1 [*Appendix C of this report*].
>
> A total of 132 fish were caught in Little Dakota creek during the [1998-1999] monitoring program. The following species were present, in order of abundance: cutthroat trout, trout

(undetermined [1]), coho salmon, steelhead (rainbow) trout and Dolly Varden char. A tissue sample was collected from the char in 1999 for DNA analysis to confirm whether the specimen was a bull trout or a Dolly Varden. The tissue sample was provided to Dave Bates of the Sechelt Capilano College Fisheries Program, for submission to a larger MELP genetics research project headed by Susan Pollack (D. Bates, personal communication).

The fish [abundance] in the created habitat in Little Dakota Creek was found to be approximately one fish per two m^2 (0.48 fish/m^2). This result is reported to be similar to values found in streams and over-wintering ponds elsewhere on the Sunshine Coast (Wilson, 1999, Appendix C).

The sampling program also included mark-and-recapture campaign in the Dakota Creek mainstem and in Little Dakota creek. The intent of the campaign was to ascertain whether the off-channel habitat in Little Dakota Creek was being used by fish from the lower Dakota Creek main stem. A total of 32 fish in the main stem were marked by maxillary clipping; of these, none were recaptured in Little Dakota creek and 16 were recaptured in the mainstem. These results were unable to confirm that fish from the adjacent mainstem river were using the new pond as refuge habitat.

Salmon spawning in the restored habitat of Little Dakota Creek was also confirmed in the fall of 1998. Both coho and chum adults were observed spawning on the crests of the lower weirs, and redds were observed in the gravel of the upper weirs." (Whitehead 1999)

Descriptions of the habitat as observed during the present field study are provided below. On September 2 1999, water was present only in the pools and channel above the Forest Service Road and in the lower pool immediately below the road culvert. The source of the flow was groundwater and a small spring approximately 4 m above the upper pool (approximately 5 m north of the fence delimiting the covenanted area. Below the lower pool, the stream was dry all the way to the mouth.

The riparian vegetation surrounding the ponds within Lot J consisted of a mixed mature forest of western hemlock, red alder, bigleaf maple, Sitka spruce and cottonwood. Crown closure was approximately 50%. The shrub layer included saplings of hemlock and bigleaf maple, seedlings of redcedar, sparse salmonberry and red elderberry, and salal and currant. Herbaceous species included, in descending order of abundance, mosses, sword fern, grasses, woodfern, ladyfern, foam flower, and coltsfoot.

The aquatic habitat characteristics in the upper ponds were essentially unchanged from the earlier descriptions (Whitehead 1998; Wilson 1998). However, at the lower end of the original pond (Figure 5), a tree (red alder) had fallen within the past year, providing additional cover. Fish ranging in length from 5 to 15 cm were observed. A frog (probably a Pacific tree frog or red-legged frog) was observed briefly in the expanded pool.

Flow was present in the short reach of riffle connecting the ponds in Lot J with the lower pool in Lot G. The total length of this reach was approximately 17 m, plus an additional 15 m culverted in the 1.2 m diameter concrete pipe under the road. The average bankfull width above the culvert was 2 m. The wetted width on the date of inspection was 0.5 to 1 m; average depth was typically less than 5 cm; and maximum water depth was 10 cm. Water temperature at approximately 1:00 p.m. was 11° C, while air temperature was approximately 20° C in the shade. Fish up to 5 cm were observed in this reach.

1 Specimens of trout under 80 mm total length cannot be readily identified to the species level.

The stormwater ditch along the west side of the Forest Service Road enters the stream just upstream of the culvert. The lower end of the ditch contains a sediment trap, which was built as part of the H.I.P. stormwater management plan, before the Forest Service Road was paved. The sediment trap was full on the date of inspection; however, addition of sediment is likely negligible since the road is now paved.

The lower pool, which is fed by flow through the culvert under the Forest Service Road, was well shaded by dense salmonberry as well as the remains of alder saplings. The sapling trunks and branches had been pruned from the road right-of-way and purposefully placed over the pool by DFO staff to provide additional cover and protect the fish from predation by herons. At least eight fish, all salmonids up to approximately 6 cm long, were observed in this pool on September 2 1999.

Downstream of the lower pool, the channel was dry. Surface flow in this reach typically occurs only during late October through April, when surface runoff increases. However, the lower 125 m of the channel (i.e. from approx. 25 m below the lower pool) is also cyclically flooded by tidal waters. The channel width in this reach increases from approximately 3 to 4 m at the upper end to 7 m near the mouth. A series of rock weirs that were built on this reach in 1997 as part of the Dakota WRP are still in place. Due to the lack of permanent flow, however, their habitat enhancement function is intermittent and seasonal.

4.2.9 Fisheries Values in Dakota Creek

In general, fisheries values in Dakota Creek are considered low due to limited spawning and rearing habitat, which are caused by a combination of:

- limited areas of suitable gentle gradient near the mouth;
- steep gradient throughout much of the watershed; and
- extreme variations in flow, including torrential peak flows between late fall and late spring.

This condition is representative of many coastal streams within Howe Sound and the Coast Range generally (D. Bates and G. McBain, personal communications).

The detailed fish and habitat inventory for lower Dakota Creek is provided in Appendix C. In addition, the Fish Information Summary System (FISS) file on Dakota Creek is provided in Appendix D.

5.0 Habitat Enhancement Opportunities

Habitat enhancements and protection opportunities in the vicinity of Lots G and J have been largely implemented as part of the development planning process at Hillside Industrial Park. As described in the foregoing sections, the site includes the following existing protection and enhancements:

- Restrictive covenant along the marine foreshore and Dakota and Little Dakota creeks; (the entire covenanted area in both lots is now fenced, with appropriate signs);
- Reclamation of the woodwaste deposit in Lot G (see below);
- Constructed saltmarsh and tidal pool within the covenanted area in Lot G;
- Constructed ponds and rock weirs in Little Dakota Creek in lots G and J;
- Stormwater management system for the Forest Service Road.

5.1 Remediation of Residual Woodwaste site in Lot G

The one exception is the need for remedial restoration in part of the reclaimed woodwaste deposit in Lot G (Photo 19). This need was also identified by MELP (Appendix A). The following remediation approach is recommended, based on our almost 10 years of observations at Hillside, including the wood waste site.

It is evident that natural revegetation by red alder is successful in reclaimed woodwaste dumps, provided that soil conditions are adequate. This is occurring even in areas that contain considerable residual woodwaste, such as next to the problem area in Lot G. Natural succession by shade tolerant conifers such as Sitka spruce is already beginning within the dense alder thicket of the healthier site. One of the main differences between the densely revegetated site and the problem site is the presence of sufficient mineral soil. Therefore, it is necessary to increase the mineral soil content of the problem area. Depending on whether it is desired to retain the scant alders and redcedars that are present, two potential approaches are available:

1. Remove the remaining woodwaste to a maximum thickness of 0.3 m, and scarify to mix with the underlying soil. (This is what was done in the adjacent areas where revegetation has been successful.) To be implemented efficiently with a machine, this approach will almost certainly require the disturbance of the existing alders and redcedar transplants. It will therefore be necessary to again transplant seedlings into the site after the soil is amended. This approach will likely also require removal or a portion of the existing fence for machinery access.

2. Top dress the area around the individual cedar transplants with mineral soil, to a depth of 20 cm and for a radius of approximately 0.6 – 1 m around each stem. Following top-dressing, the area around each transplant should be scarified to mix the mineral soil with the woodwaste to a depth of approximately 0.3 m. To avoid damaging the seedling roots, the deeper mixing should be no closer than approximately 20 or 30 cm from the stem. This approach will require intensive manual labour, using a wheelbarrow, shovel, digging fork, and rake or hand-cultivator. However, the existing fence would not have to be removed.

   The decomposition of organic matter is determined in part by the ratio of carbon to nitrogen. Woodwaste contains an abundance of carbon and virtually no nitrogen. To accelerate the decomposition (mineralization) of the wood particles while the alder stand becomes established, it is also recommended that a slow-release nitrogen fertilizer be broadcast at the site if this approach is used. Addition of nitrogen may be necessary once a year for two to three years. Continued fertilization will be unnecessary once the alder establish, since this species favours the establishment of a nitrogen-fixing root zone.

5.2 Preventive planning for tennant industries

In addition to the remediation options described above, long-term protection of the covenanted areas should be ensured, with specific methods tailored to the type of industry to be established on the lots. Specifically, management systems for stormwater, wastewater and solid waste, as well as effective barriers against accidental encroachment into the covenanted areas, should be carefully planned in advance of any construction, and built into any future industrial developments on Lots G and J.

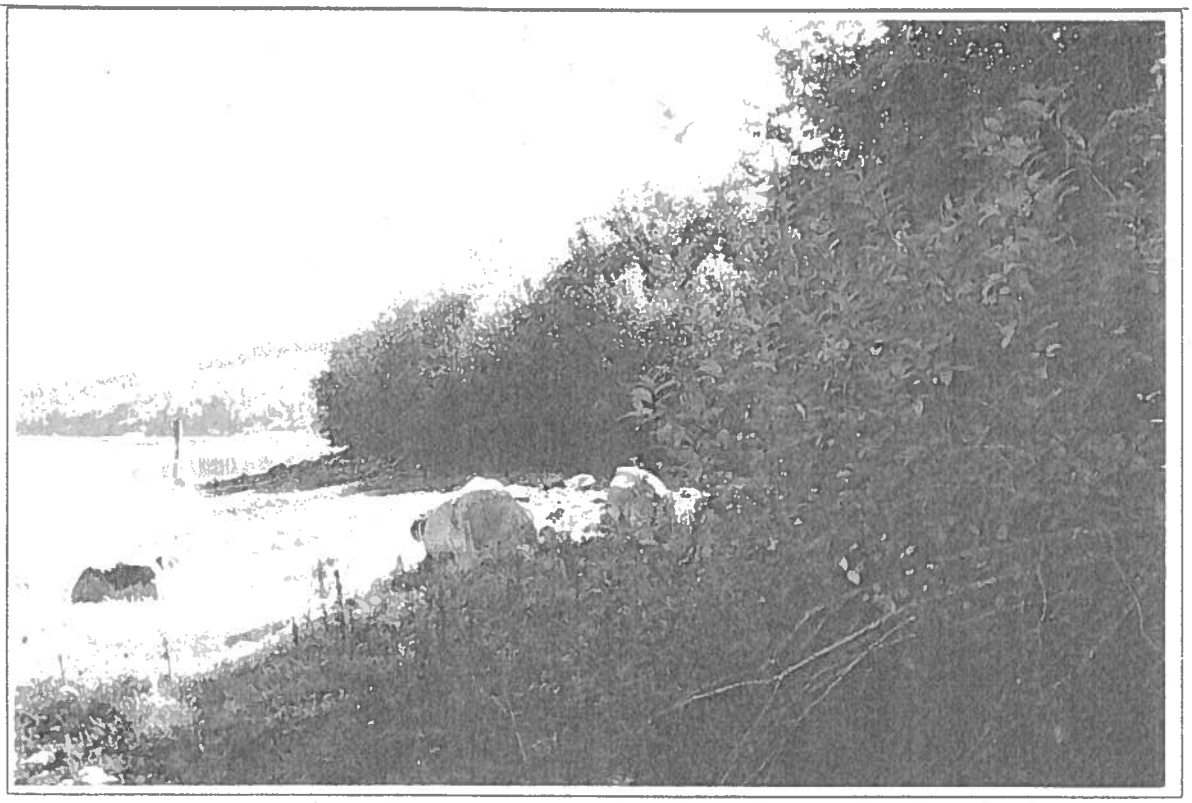


Photo 1. Marine foreshore and riparian leave-strip of dense regenerating red alder on the SE side of Lot G, viewed to the south. Vegetation is growing on decomposed wood waste. 2-Sep-99.

Photo 2. Inland (W) side of covenanted riparian leave strip along the marine foreshore of Lot G. Fence is approximately 2 m high. Vegetation on left is outside of covenanted area. 2-Sep-99.

Photo 3. Marine foreshore and riparian leave strip on the NE side of Lot G, viewed to the north. Mill of Howe Sound Pulp & Paper Ltd. at Port Mellon is in background. 2-Sep-99.

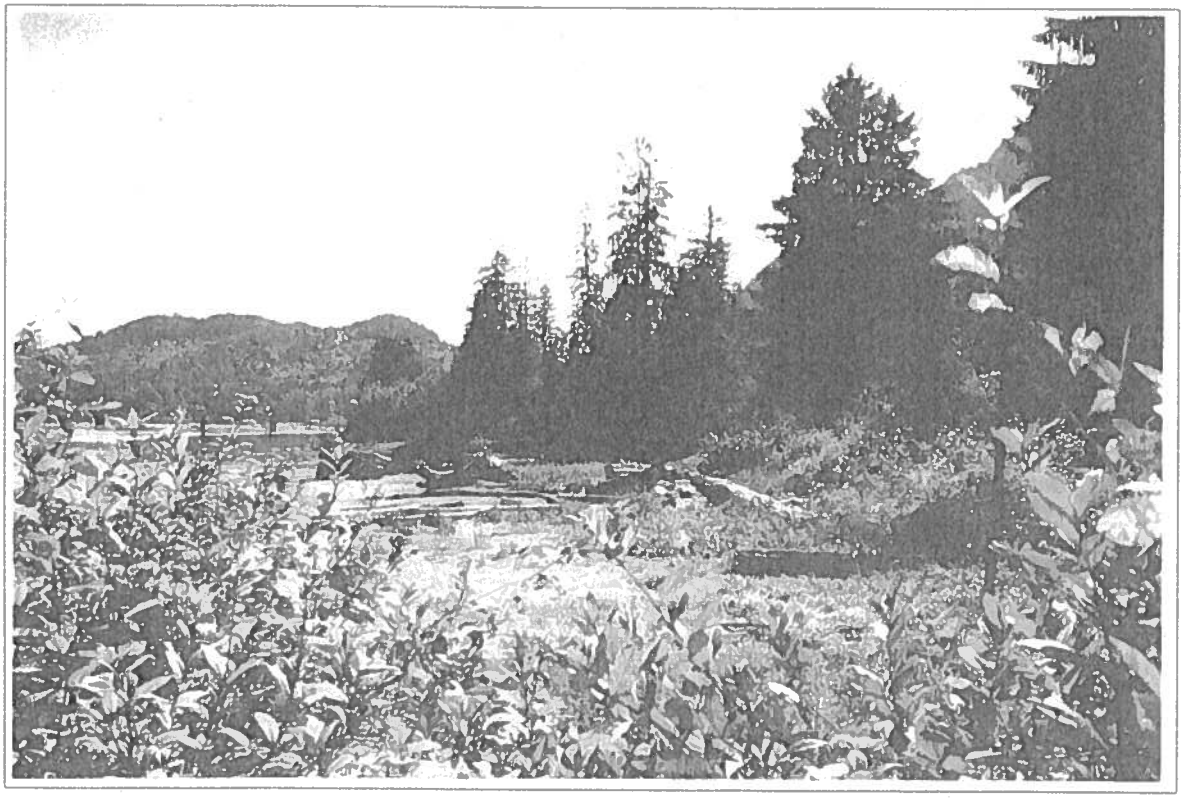


Photo 4. Marine foreshore of Lot G, looking south from the mouth of Dakota Creek at the NE corner. Note band of conifers within covenanted leave strip. 2-Sep-99.

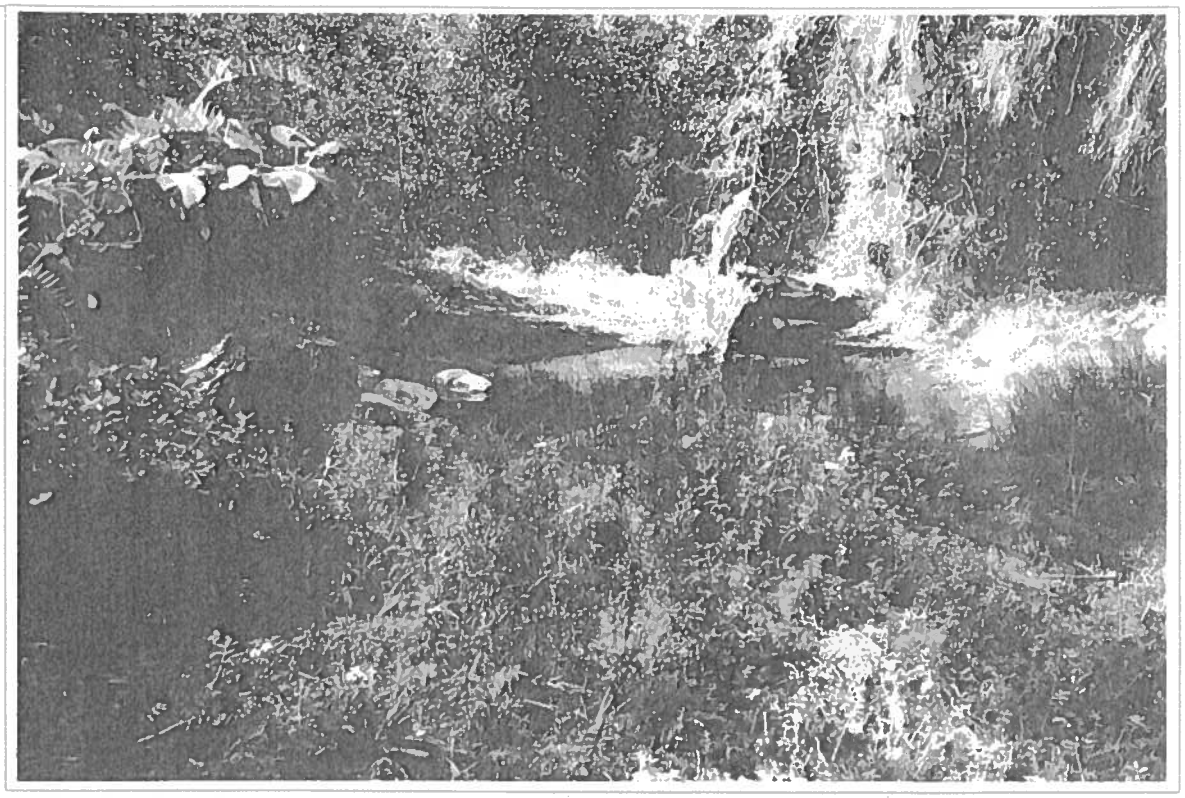


Photo 5. Pool and vegetated habitat compensation saltmarsh constructed in the NE corner of Lot G, viewed to west. Pool is filled during higher tides. 2-Sep-99

Photo 6. Central portion of constructed habitat compensation saltmarsh at NE corner of Lot G. The entire saltmarsh lies within the covenanted riparian leave strip of this lot. 2-Sep-99.

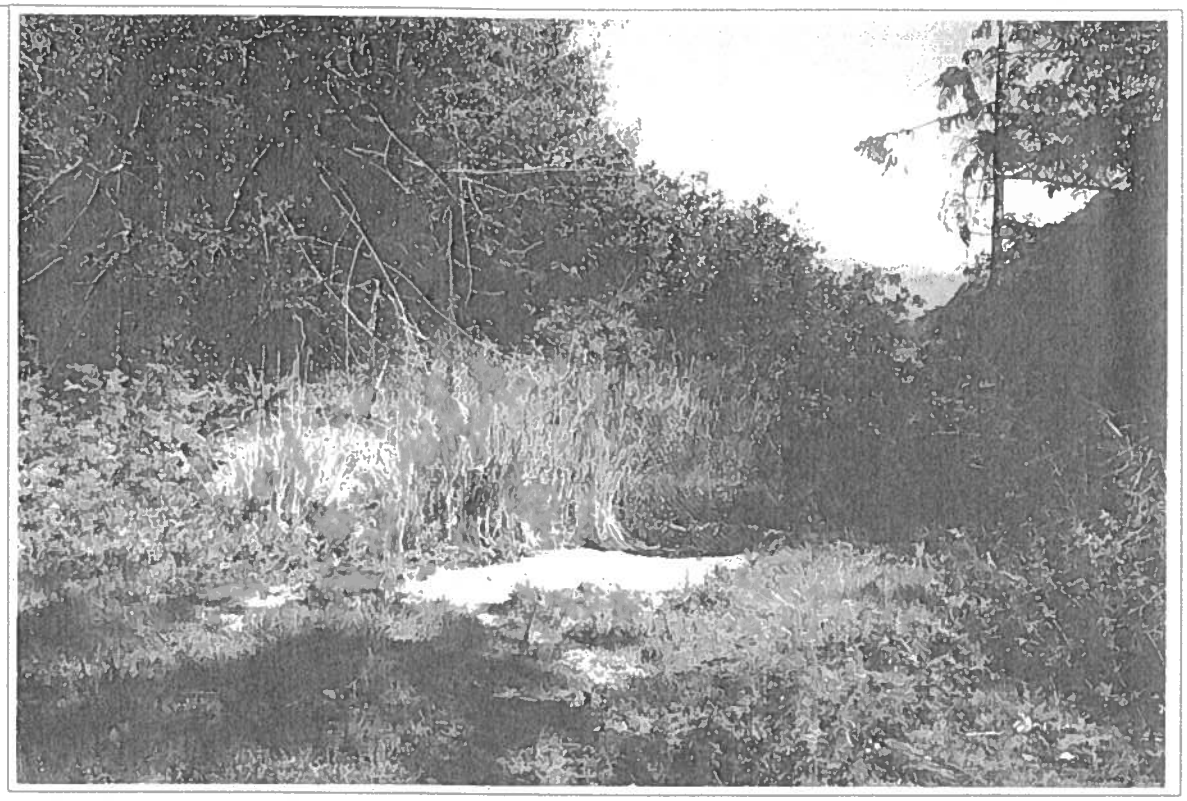


Photo 7. Seaward side of the constructed saltmarsh in Lot G, viewed to NE. Fencing was originally installed to protect sensitive transplants from tidal debris. 2-Sep-99.

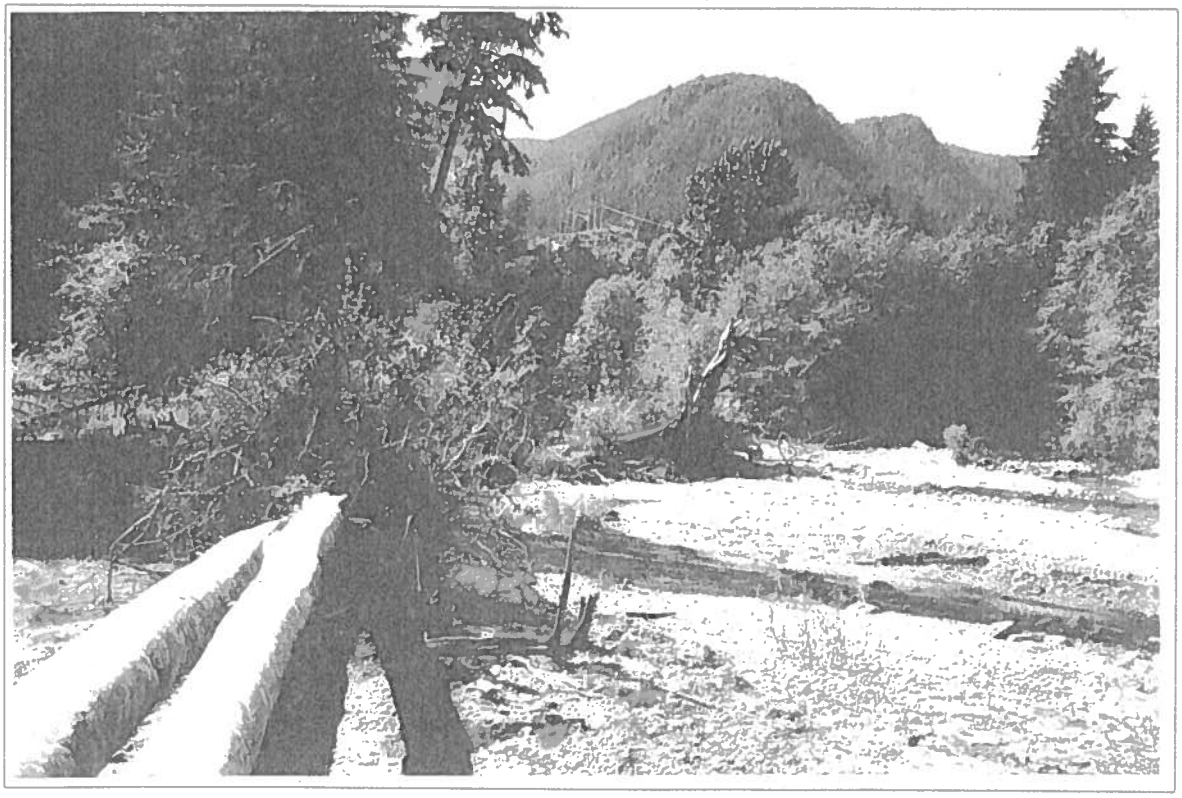


Photo 8. Mouth of Dakota (left) and McNair (right) creeks, viewed to west from NE corner of Lot G. 2-Sep-99.

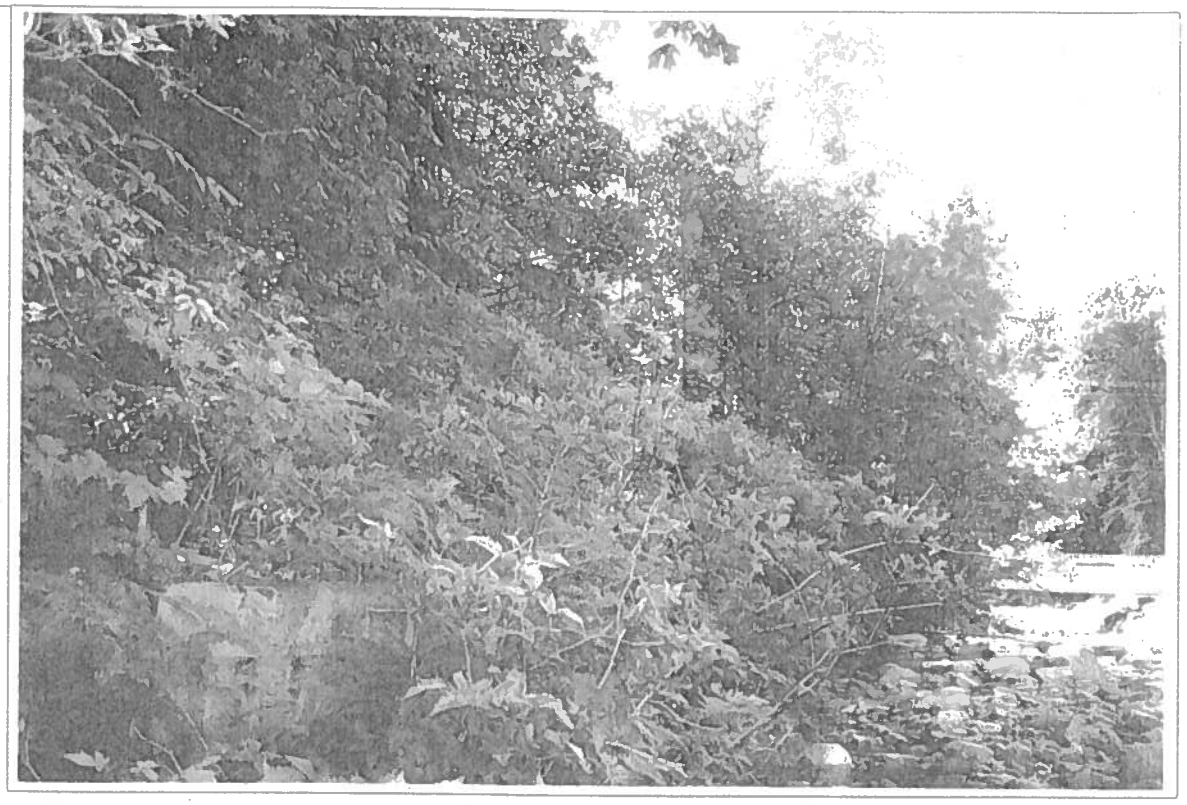


Photo 9. Riparian vegetation along N side of Lot G. Note boulder-cobble channel, Forest Service Road bridge upstream and old car body on lower left. 2-Sep-99.

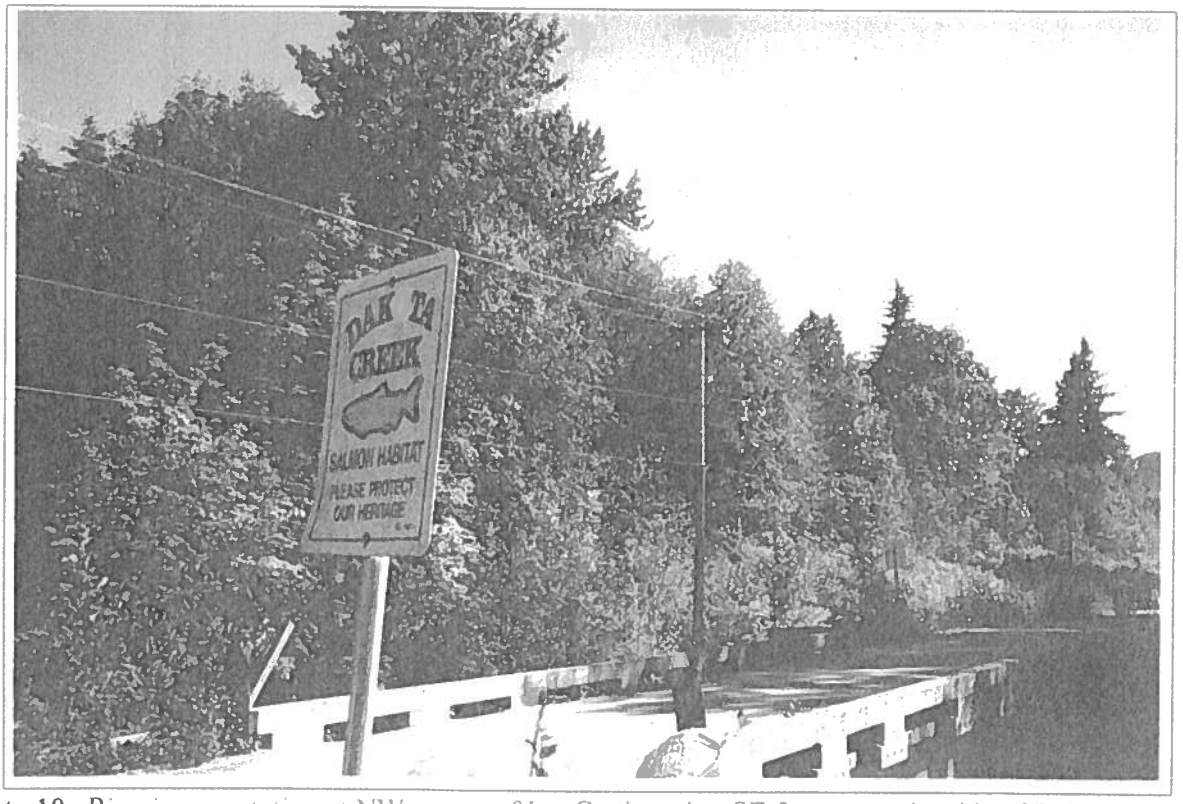


Photo 10. Riparian vegetation at NW corner of Lot G, viewed to SE from opposite side of Dakota Creek. Note Forest Service Rd. bridge, fish sign and tall cottonwood tree. 2-Sep-99.

Photo 11. Riparian vegetation next to Dakota Creek at north end of Lot J, viewed to SW from Forest Service Road. Abandoned channel is in lower centre. 2-Sep-99.

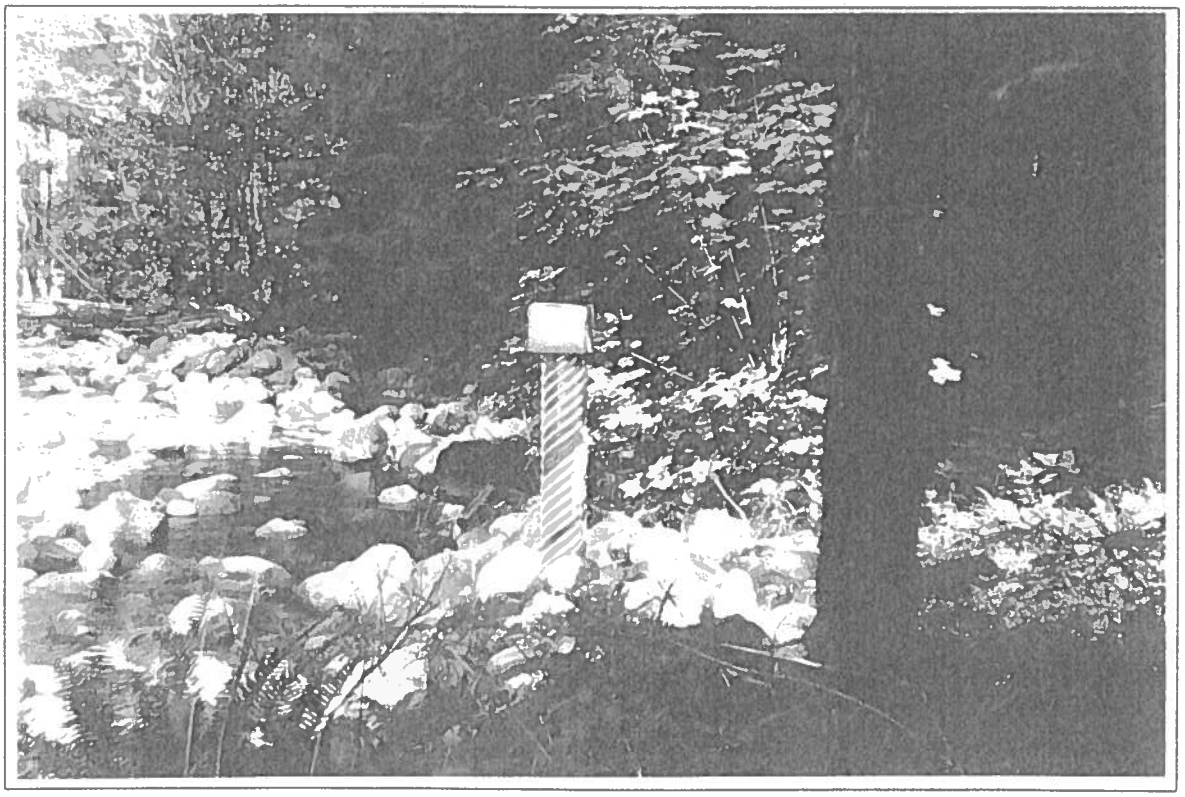


Photo 12. Dakota Creek and riparian habitat at N end of Lot J, viewed downstream from near Highway 101. Structure is a hydrometric station for CanFor/FRBC Inventory project. 2-Sep-99.

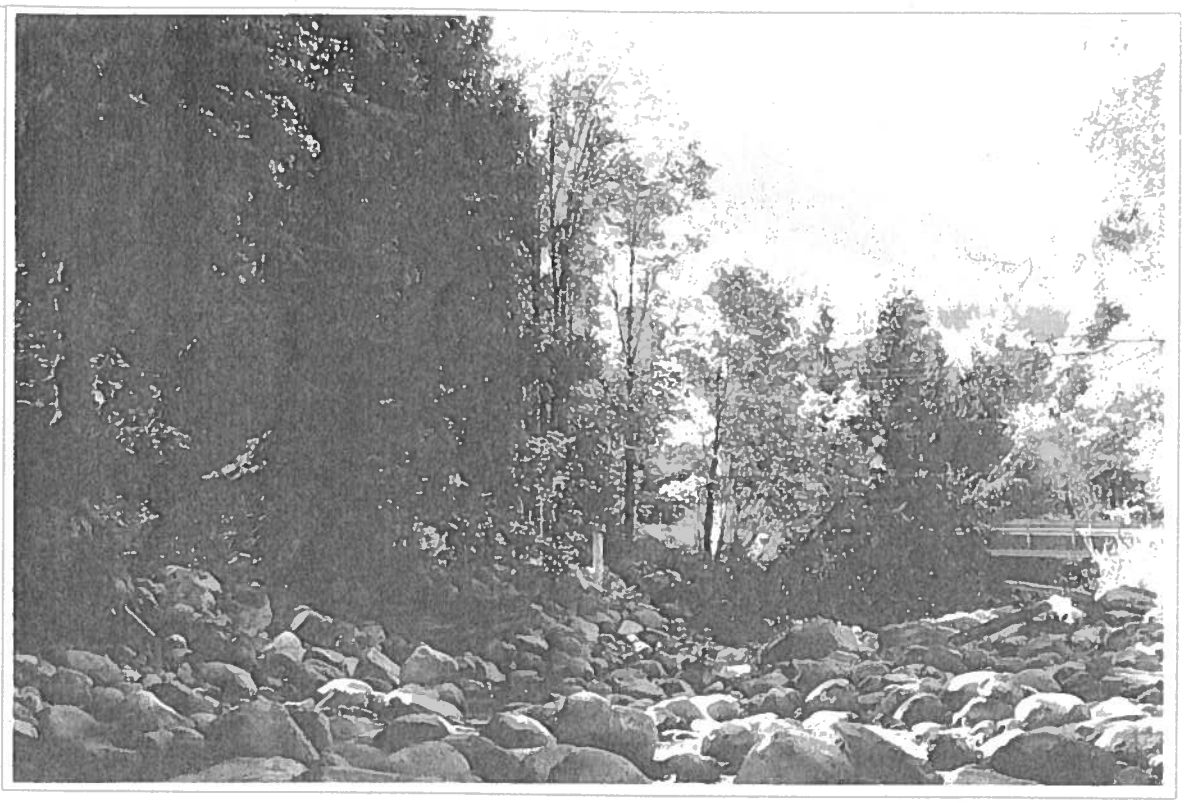


Photo 13. Dakota Creek and riparian habitat at N end of Lot J, viewed from downstream toward Highway 101 bridge. Seasonal overflow into Little Dakota is through boulder berm at left. 2-Sep-99.

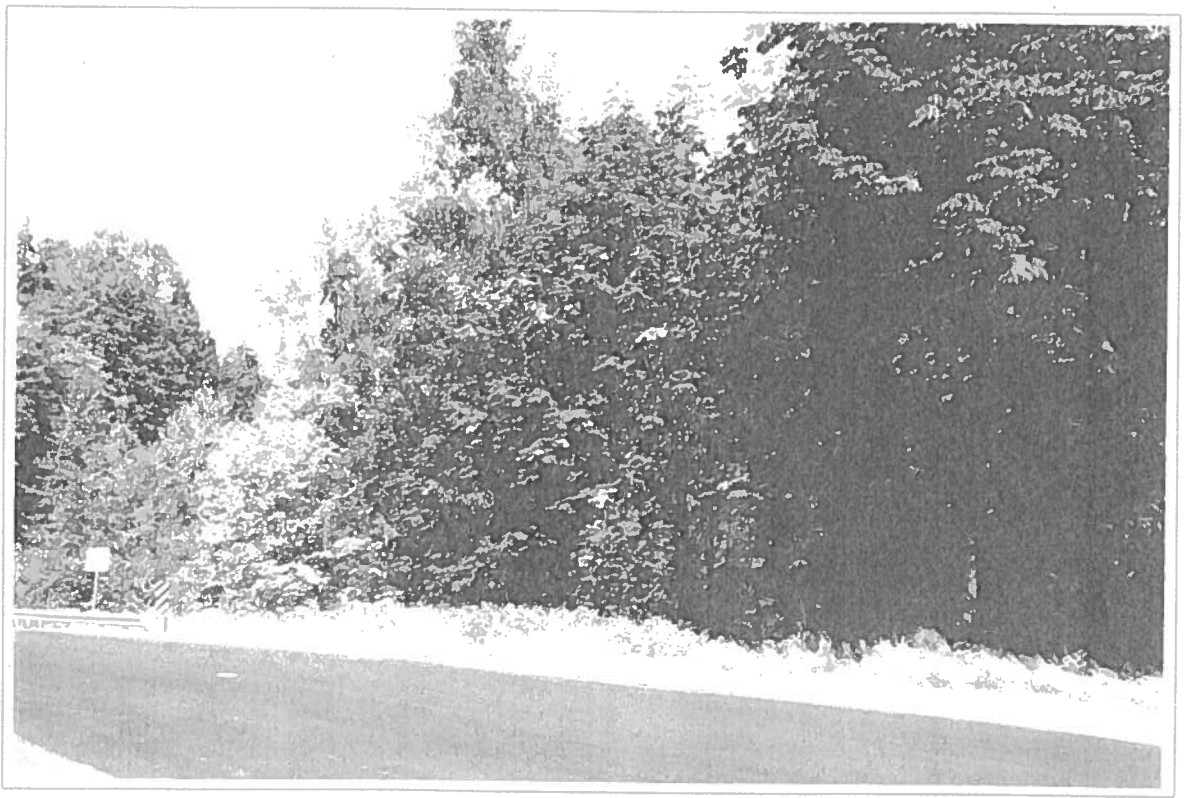


Photo 14. Riparian habitat at NW corner of Lot J, viewed from Highway 101 toward Dakota Creek bridge. 2-Sep-99

Photo 15. Fence along covenanted riparian area at north end of Lot J, next to Hwy 101. Minimum fenced distance from Dakota Creek is 30 m. 2-Sep-99. Signs were installed on fencing by 7-Oct-99.

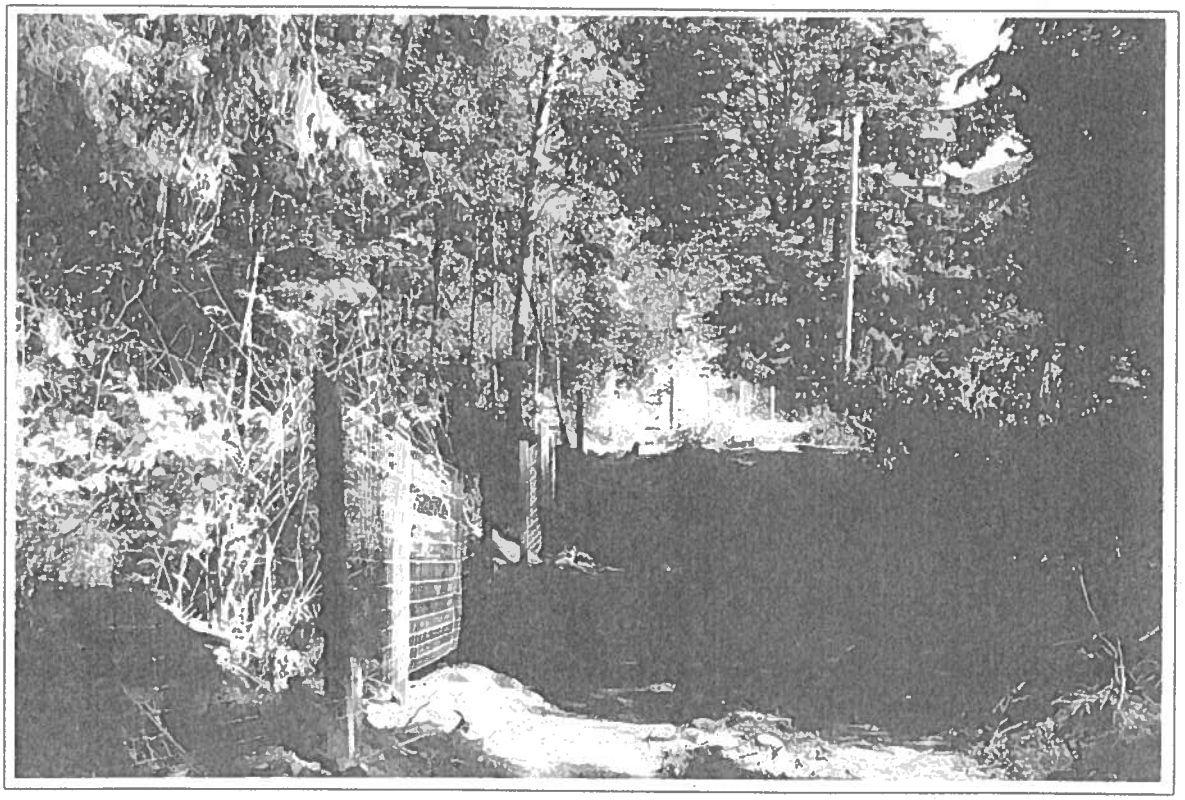


Photo 16. Fence along south side of covenanted are at NE end of Lot J. Power line and fence in background are on Forest Service Road and Lot G, respectively. 2-Sep-99.

Photo 17. Stormwater channel in abandoned roadway within Lot J to south of the fenced covenanted area. (Scale: orange notebook is 0.2 m high.) 8-Oct -99.

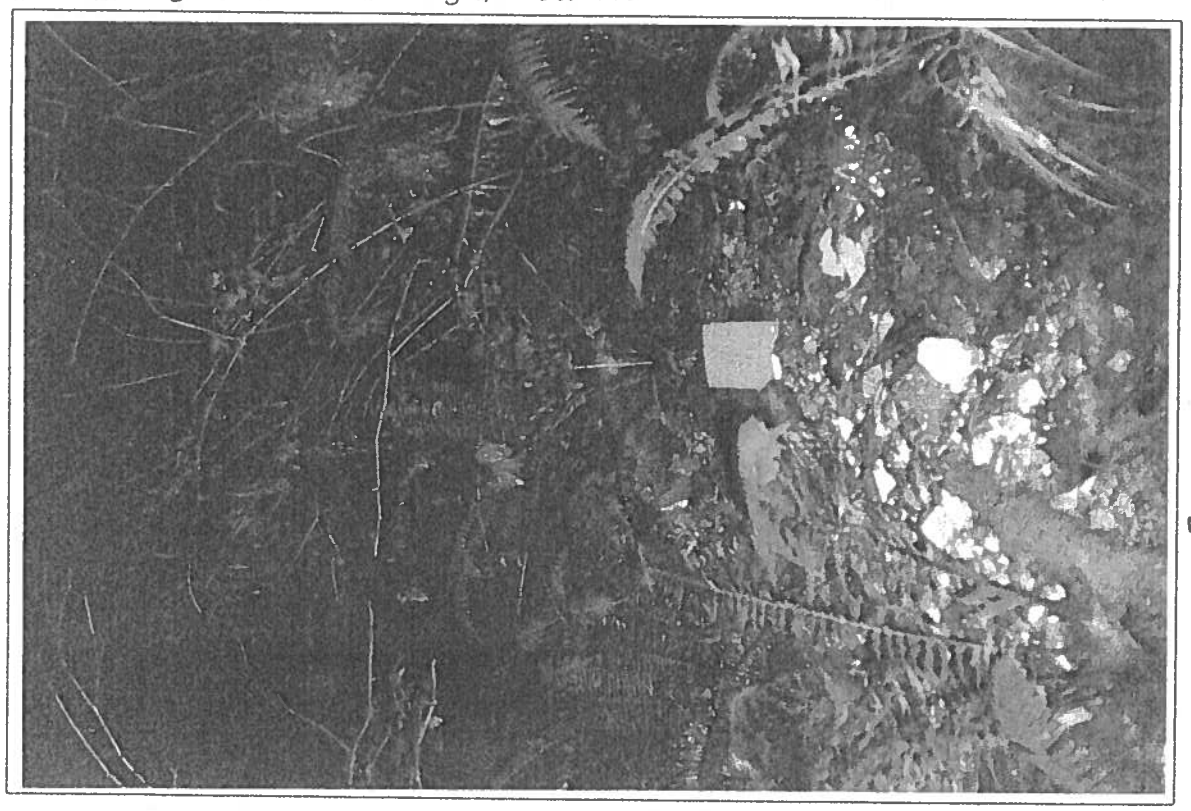


Photo 18. Stormwater channel in abandoned roadway within Lot J to south of the fenced covenanted area. Note moss cover on rocks in channel, suggesting ceased or very infrequent flow. 8-Oct -99.

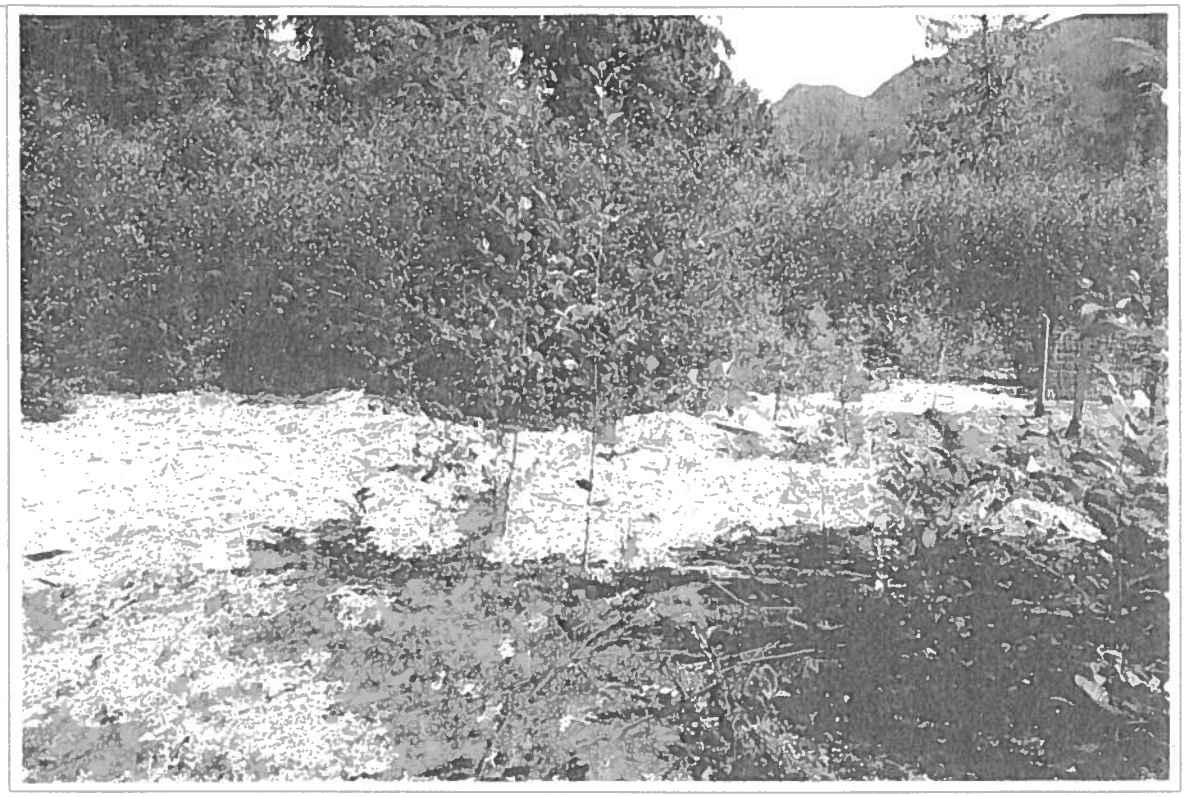


Photo 19. Covenanted area at NW corner of Lot G, within reclaimed woodwaste area. Natural revegetation is sparse and transplant success is poor in areas with deeper residual wood waste. 2-Sep-99

Photo 20. Dense alder thicket within covenanted area at north end of Lot G, viewed to east. Sufficient mineralization of residual woodwaste allows natural successful revegetation. 2-Sep-99.

Photo 21. Upper pond constructed for fish habitat enhancement at upper end of Little Dakota creek in Lot J, viewed downstream. Pond is fed by spring outside lower corner of photo. 2-Sep-99.

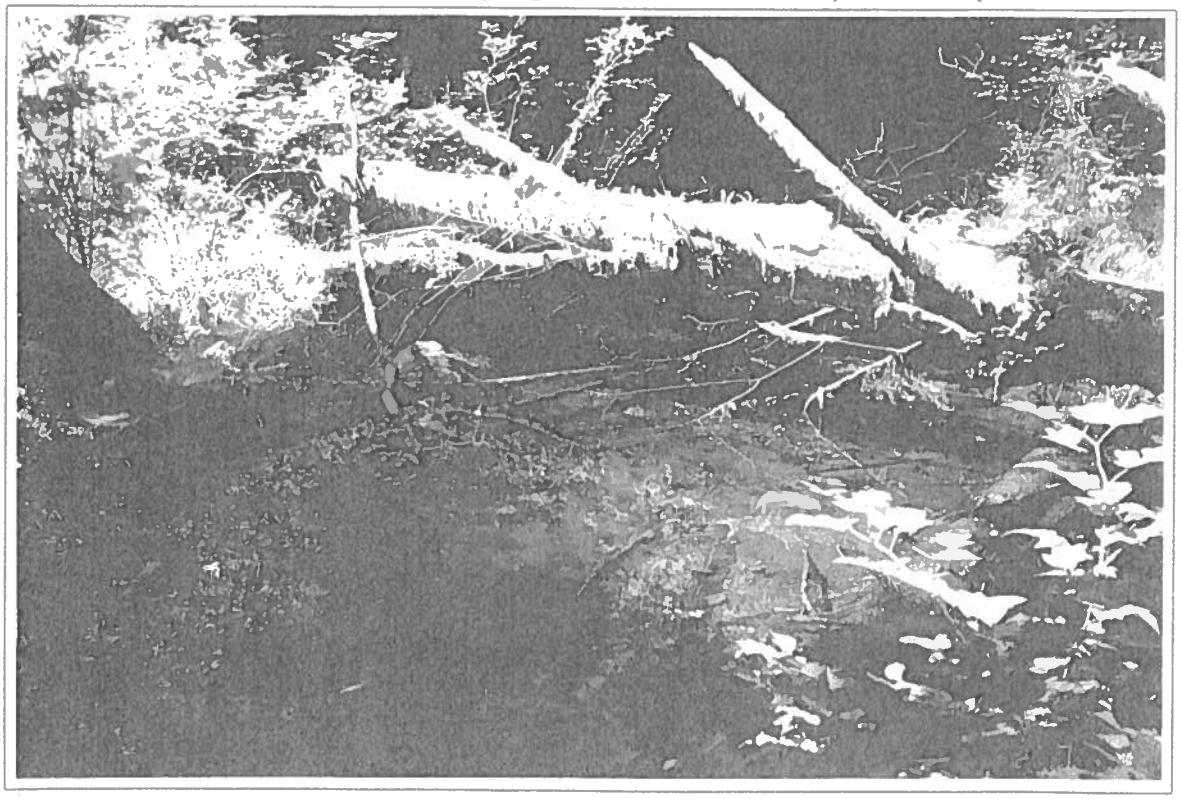


Photo 22. Main enhancement pond on Little Dakota Creek at north east end of Lot J. Overflow from Dakota Creek enters this pond at upper right during very high flows. 2-Sep-99.

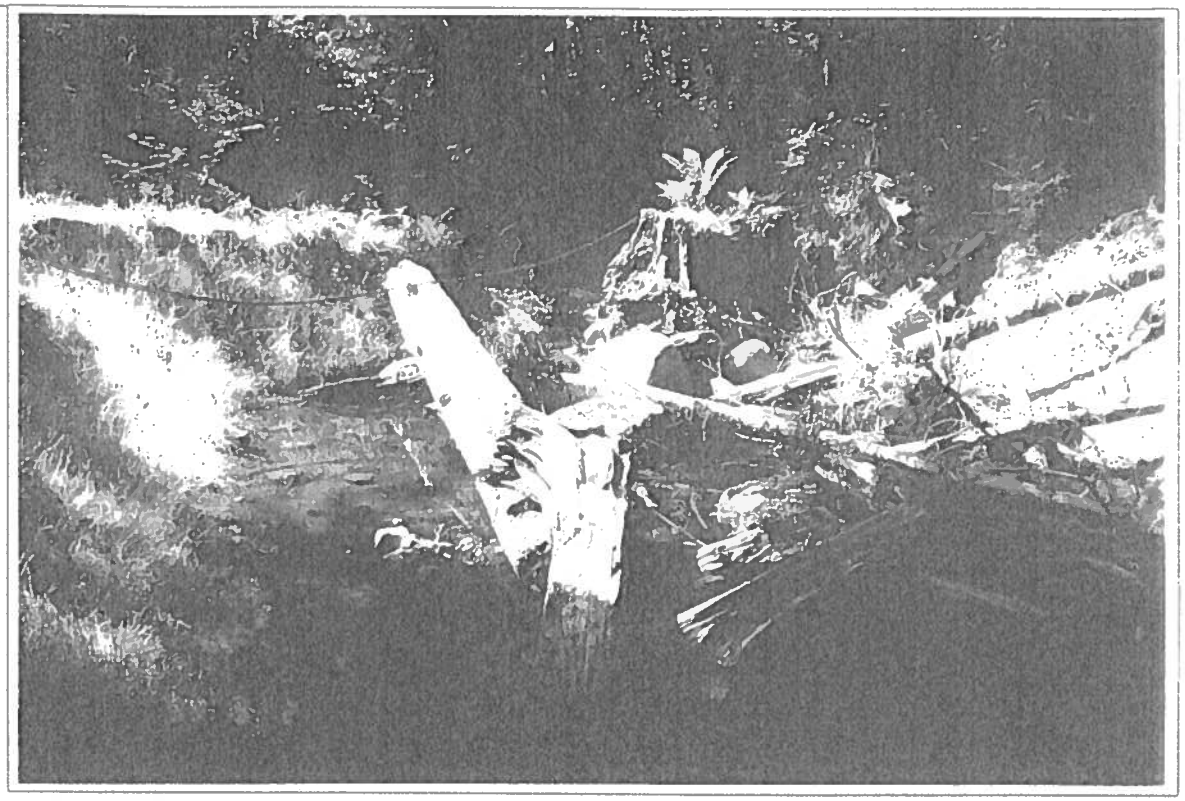


Photo 23. Expanded portion of enhancement pond on Little Dakota Creek at NE corner of Lot J. Note LWD and cable to hydrometric station. Frogs but no fish were observed. 2-Sep-99.

Photo 24. Enhanced pool and rock berm on Little Dakota Creek below Forest Service Rd culvert, in Lot G, viewed upstream. Salmonid fry were abundant. 2-Sep-99.

Photo 25. Dry channel of Little Dakota Creek below the Forest Service Rd viewed downstream. Channel receives water during winter storms and/or highest tides. 2-Sep-99.

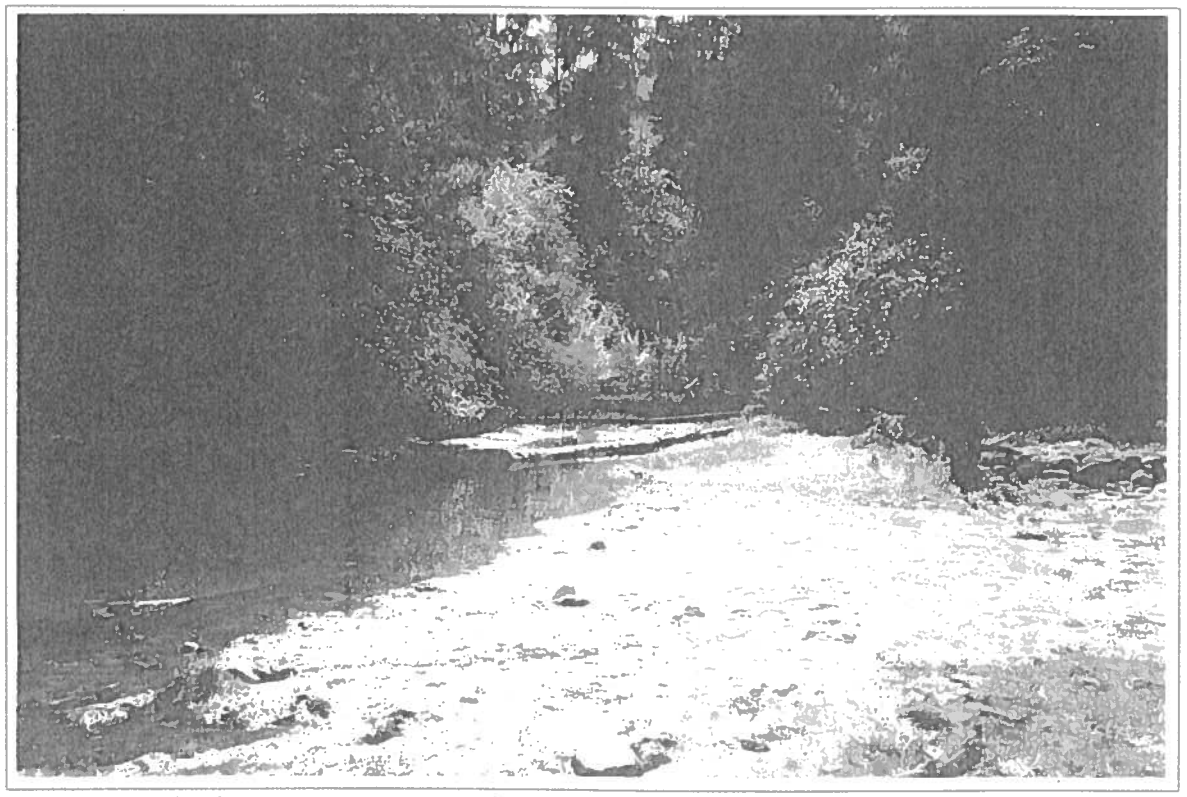


Photo 26. Mouth of Little Dakota Creek within the estuary of the main stem at NE end of Lot G. 2-Sep-99.

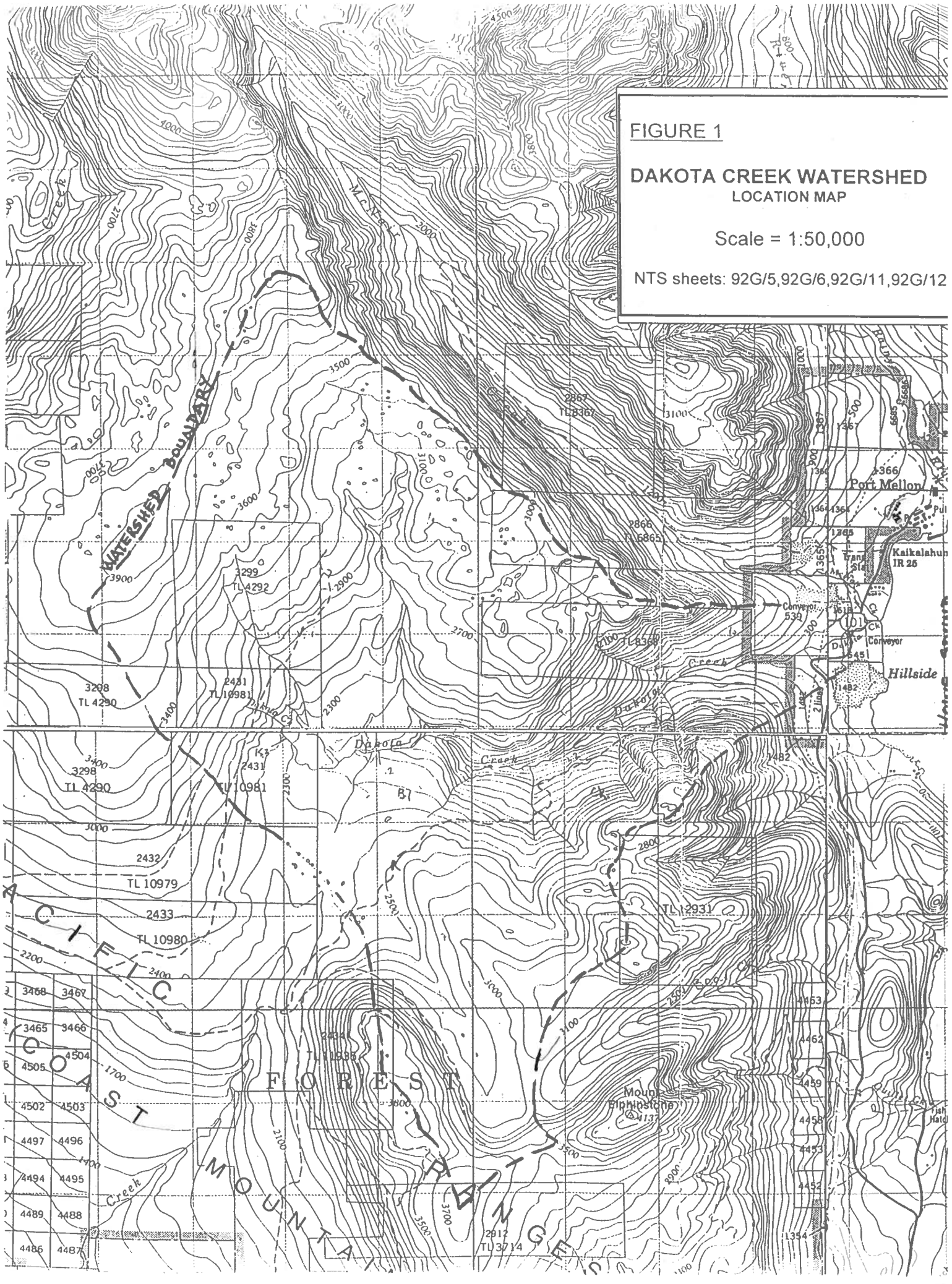


FIGURE 1
DAKOTA CREEK WATERSHED
LOCATION MAP
Scale = 1:50,000
NTS sheets: 92G/5,92G/6,92G/11,92G/12
WATERSHED BOUNDARY
Port Mellon
Hillside
Kaikalahun IR 25
Dakota Creek
Mount Elphinstone
PACIFIC COAST MOUNTAIN RANGES
FOREST

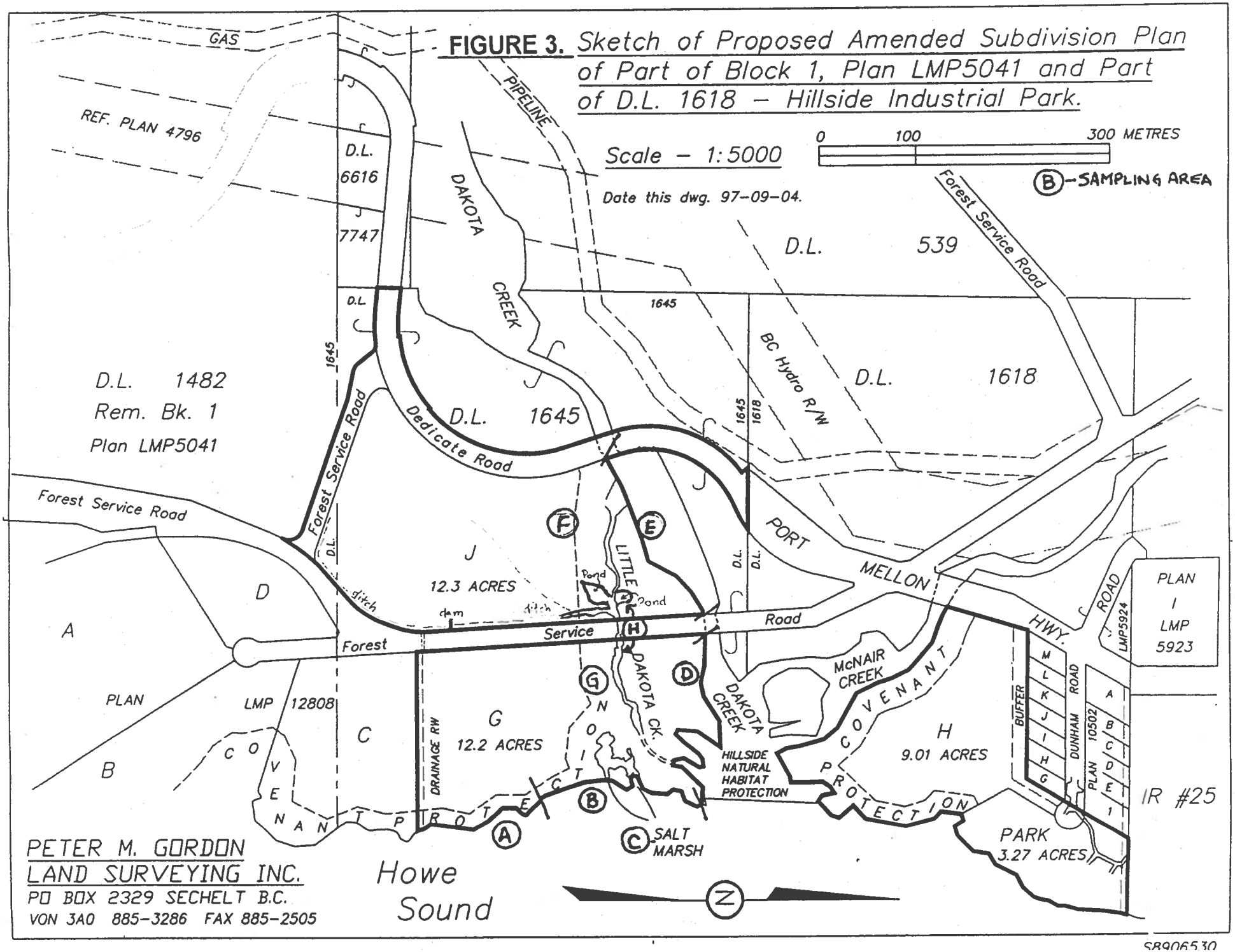


FIGURE 3. Sketch of Proposed Amended Subdivision Plan of Part of Block 1, Plan LMP5041 and Part of D.L. 1618 – Hillside Industrial Park.
Scale – 1:5000
0 100 300 METRES
Date this dwg. 97-09-04.
B – SAMPLING AREA
GAS
PIPELINE
REF. PLAN 4796
D.L. 6616
J
7747
DAKOTA CREEK
D.L. 539
Forest Service Road
D.L.
1645
BC Hydro R/W
D.L. 1618
D.L. 1482
Rem. Bk. 1
Plan LMP5041
Dedicate Road
D.L. 1645
Forest Service Road
Forest Service Road
J
12.3 ACRES
Pond
LITTLE
Pond
ditch
dam
ditch
PORT MELLON
HWY.
ROAD
LMP5924
PLAN I LMP 5923
A
D
Forest Service Road
PLAN LMP 12808
B
C
COVENANT
DRAINAGE RW
G
12.2 ACRES
DAKOTA CK.
DAKOTA CREEK
McNAIR CREEK
COVENANT PROTECTION
HILLSIDE NATURAL HABITAT PROTECTION
H
9.01 ACRES
BUFFER
DUNHAM ROAD
PLAN 10502
A
B
C
D
E
1
M
L
K
J
I
H
G
IR #25
PARK
3.27 ACRES
SALT MARSH
Howe Sound
PETER M. GORDON
LAND SURVEYING INC.
PO BOX 2329 SECHELT B.C.
VON 3A0 885-3286 FAX 885-2505
SR906530

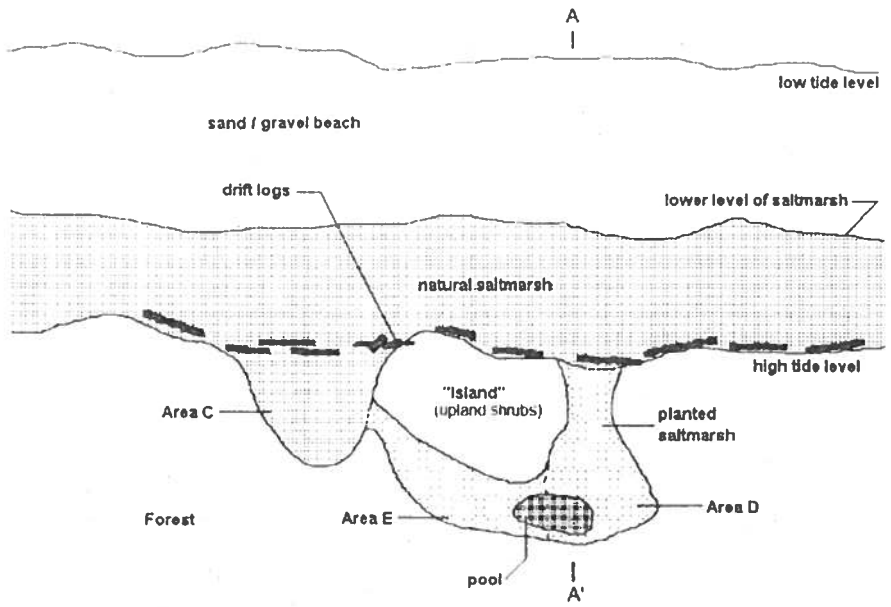


FIGURE 4a. Schematic plan view of the constructed saltmarsh habitat
Not to scale. Section A - A' is shown in Figure 6.

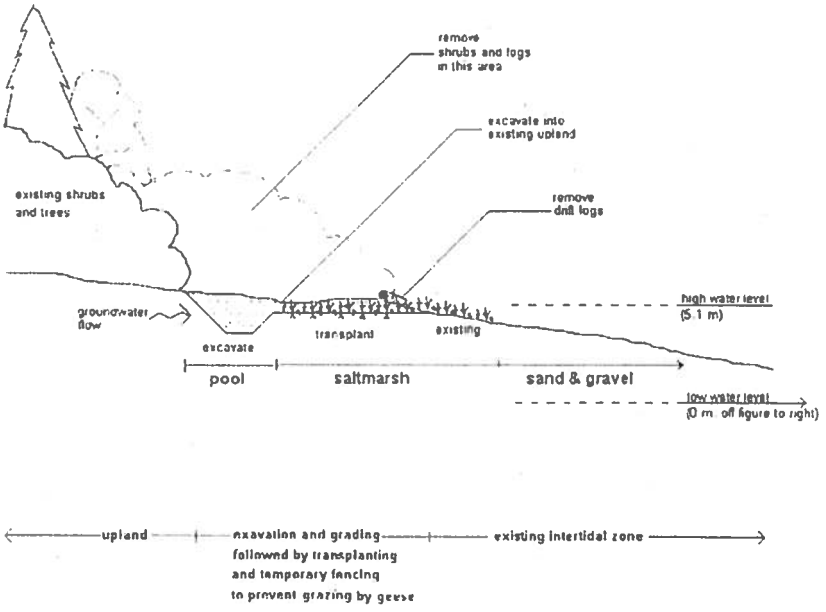
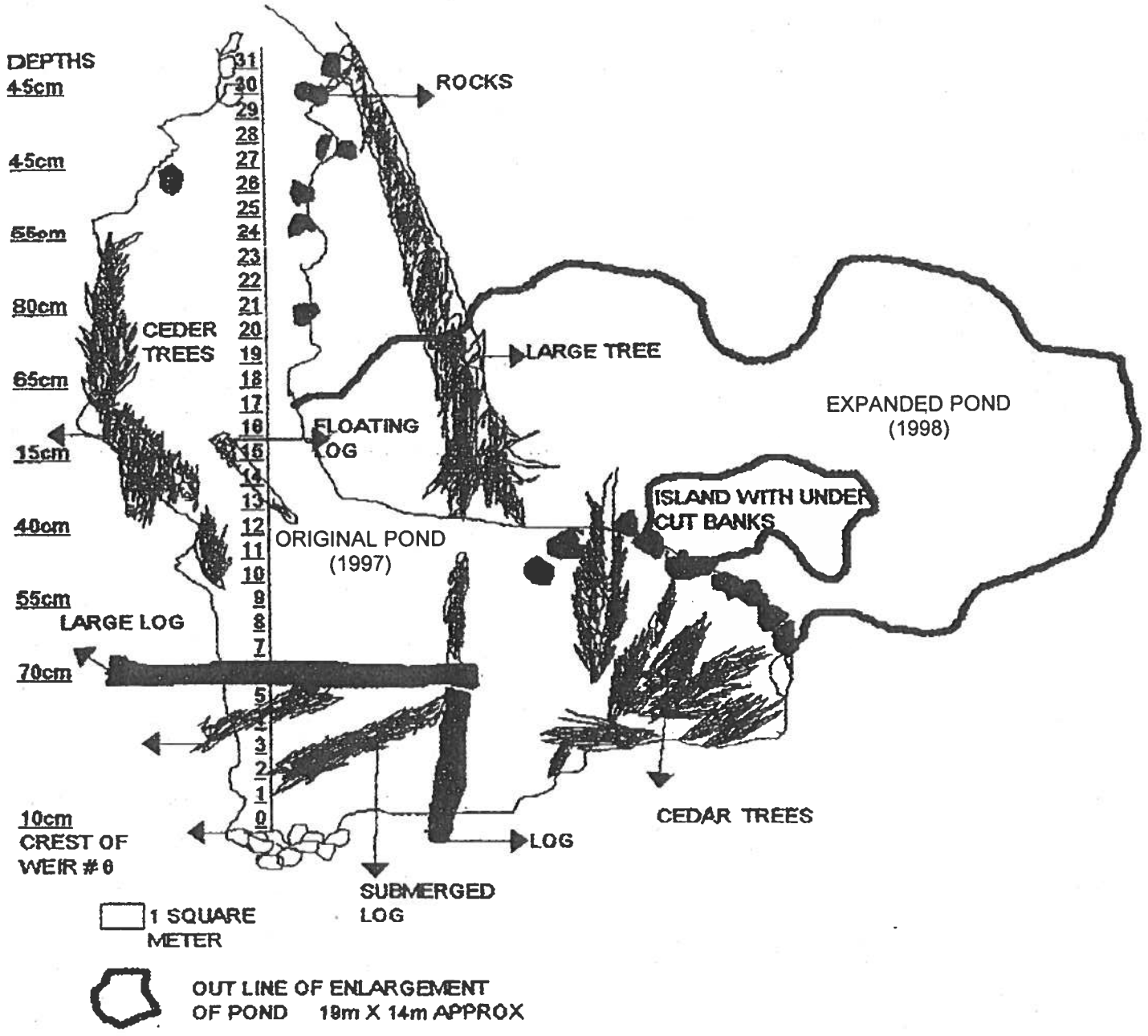


FIGURE 4b. Schematic cross-section through constructed saltmarsh habitat (Not to scale)
Note: tidal elevation range is based on a large tide at Gibsons, B.C. (DFO 1993)

FIGURE 5.
ADDITION TO OVERWINTERING POND
LITTLE DAKOTA CREEK ABOVE WEIR #6



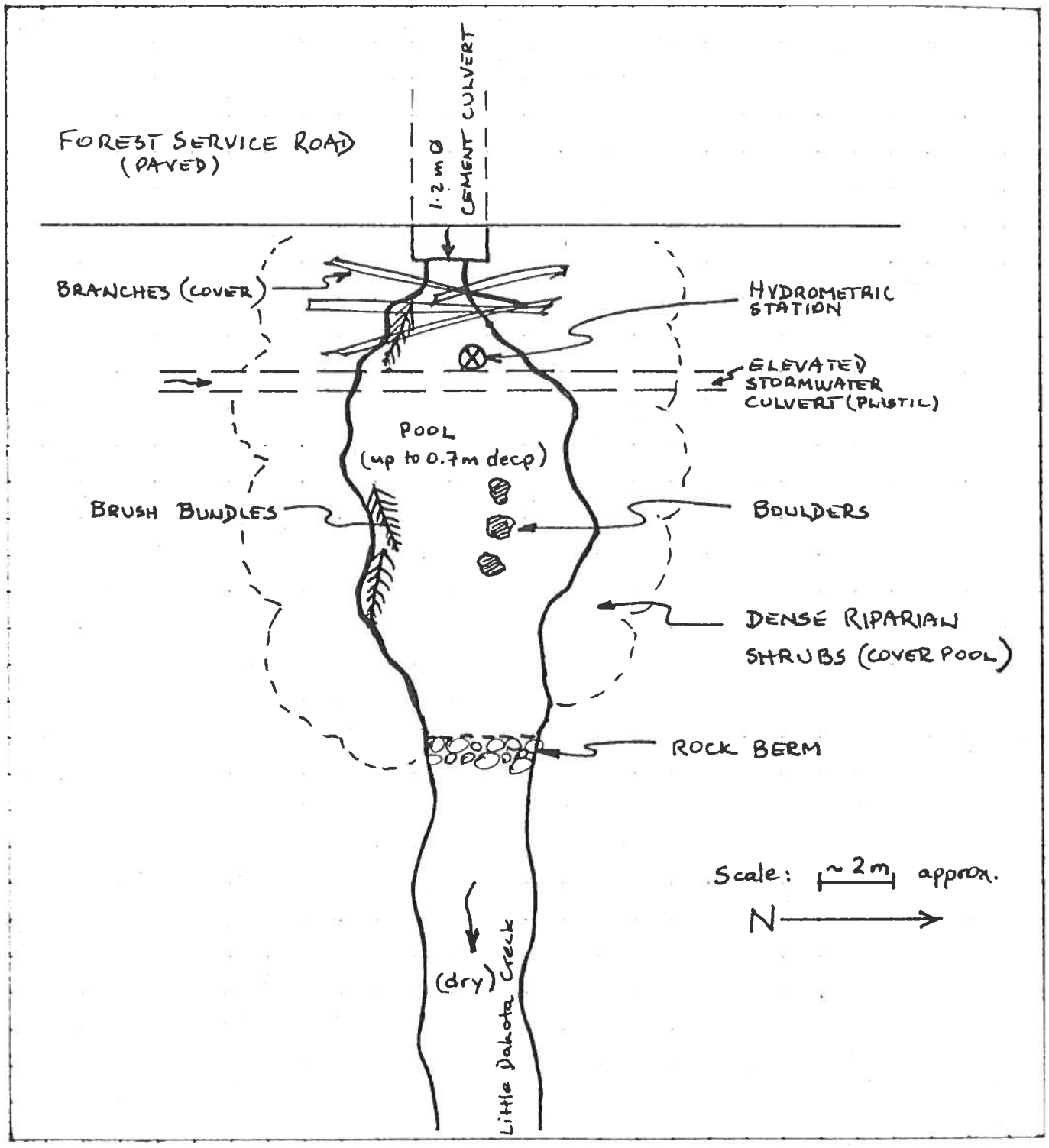


FIGURE 6. LITTLE DAKOTA CREEK - LOWER POOL BELOW FOREST SERVICE ROAD

APPENDIX A

BRITISH COLUMBIA

June 19, 1998

Your File: 01-005-13385
Our File: 72000-25/98.SCD
(28-00-90-027)

Ministry of Transportation & Highways
PO Box 950
Sechelt BC V0N 3A0

Attention: Jack Leighton

Dear Sir:

Re: Proposed 2 Lot Industrial Subdivision at Port Mellon -
Block 1, Except Part in Plans LMP12498, LMP12808, LMP20640 &
LMP31511, D.L. 1482, 1645, and 7748, Plan LMP5041, Group 1, N.W.D.

Reference is made to your April 29, 1998 referral of the above.

The information submitted has been reviewed with respect to the interests of all regional programs and the following comments are offered.

The attached letter of conditional consent to the subdivision (MOTH referral #01-005-11974) pursuant to Section 82 of the *Land Title Act* from Land and Water Management of this office, dated March 31, 1998.

John Summers of this office conducted an onsite of the property. Fish, Wildlife and Habitat Protection offer the following interim comments/conditions:

- Snow fence installed on the west side at 30.0 metres - a permanent fence and signage must be installed prior to any further works on this site (information on fencing and signage is available if required), and
- Hogfuel/woodwaste within the leavestrip area - woodwaste must be removed from the leavestrip area prior to any further works on this site, and
- Care must be taken when removing woodwaste from the site in order to protect the recently planted cedar seedlings, and
- A number of watercourses were noted crossing the property - a watercourse bioinventory of the site must be conducted - all watercourses (permanent or ephemeral) must be mapped, and

../2

Ministry of Environment, Lands and Parks
Environment and Lands
Lower Mainland Region
Mailing/Location Address:
10470 152 Street
SURREY BC V3R 0Y3
Telephone: (604) 582-5200
Facsimile: (604) 930-7119

- Please provide a copy of any fish and wildlife covenants registered on the property to the undersigned, and
- On completion of the watercourse bioinventory, fish and wildlife may request a further restrictive covenant or protection measures for watercourses not currently protected by a fish and wildlife restrictive covenant.

General Land Development Conditions

1. All work on the site is to be undertaken and completed in such a manner so as to prevent the release of silt, sediment, sediment-laden water or any other substance deleterious to aquatic life to any watercourse, ravine, floodplain or storm sewer system. The standards for erosion and sediment control and site development practices in the "Land Development Guidelines for the Protection of Aquatic Habitat" (DFO/MELP, 1993) must be adhered to.

2. Construction and excavation wastes, overburden, soil or other substances deleterious to aquatic life must be disposed of or placed in such a manner so as to prevent their entry into any watercourse, ravine, floodplain or storm sewer system.

3. Trees bearing the nests of certain raptors (hawks, owls, eagles, falcons etc.) and great blue herons are protected under Section 34(b) of the *Wildlife Act* and must be retained. Furthermore, active nests require protection from excessive disturbance in the vicinity. It is the responsibility of the proponent to determine if such trees are present on the property. Where raptor or heron nest trees are present, this office must be consulted for protective requirements prior to land clearing or any other site development activities.

4. Section 34(c) of the *Wildlife Act* provides for the protection of active nests (i.e. occupied by a bird or its egg(s)) of birds other than those covered by section 34(b). As many nests are not readily visible, *land clearing must not be undertaken during the period of April 1 through July 31 of any year to avoid contravention of the Act.*

5. Bark mulch, hog fuel or other woodwaste material must <u>not</u> be deposited within *thirty (30.0) metres* of any watercourse, ditch or wetland area as woodwaste leachate is highly toxic to fish and other aquatic organisms.

6. Any fill used for this project must be inert material free of contaminants and must be placed so that it will not gain entry into any watercourse, ravine, floodplain or storm sewer system.

7. *Any proposal to work in or adjacent to any watercourse* must be approved by Environment and Lands Planning and Assessment and the Federal Department of Fisheries and Oceans Canada. In this regard, plans (4 copies) of the proposed work must be forwarded to the Planning and Assessment section of Environment and Lands for distribution to the reviewing agencies (applications are available from the undersigned on request). Work is not to proceed until written approval from Planning and Assessment is received.

../3

8. Please ensure that our File Number (**72000-25/01-005-13385**) appears on ALL correspondence, documents and plans submitted to Environment and Lands.

Thank you for consideration of our concerns. If you have any questions, please contact the undersigned at 582-5235.

Sincerely,

Jean A. Cook, Habitat Officer
Regional Referral Technician
Planning and Assessment

/jac

attachments (2)

cc: John Summers, Fish, Wildlife and Habitat Protection, Surrey
Joe MacInnes, Land and Water Management, Surrey (28-00-90-027)
Maurice Egan, S.C.R.D., Box 800, Sechelt BC V0N 3A0
Pat Harvey, DFO, Powell River

APPENDIX B

Appendix 1.

Dakota and Little Dakota Creek: Fish Monitoring, 1998-1999

Prepared by:
Jim Wilson, Fisheries Technician
RR#4, S-3 C-12,
Gibsons BC,
V0N 1V0
(604) 886-2623

Introduction

The main purpose of this project was to obtain a population assessment and inventory of juvenile salmonids in Little Dakota Creek. This survey included species identification and biomass averaging. Another element to this assessment was to determine if main stem Dakota Creek juvenile fish would use Little Dakota as a place of refuge during the winter floods. This report also provides a record of other incidental observations of spawning by adult salmon in Little Dakota Creek.

Methods

The population inventory was accomplished by the setting of minnow traps in the two main pools on Little Dakota creek. A total of ten traps were set every two weeks for a 48-hour soaking period during the months of January and February 1999. Only the two pools were trapped because of Little Dakota Creek's ability to go subsurface on low flow days, and also because I wanted to rule out the possibility of stranding fish. All fish captured were divided into species, then clipped on the right maxillary for recapture identification. A random sample of lengths and weights were taken and the fish released.

The monitoring of fish movement from the main stem of lower Dakota to Little Dakota was accomplished by the following technique. Traps were set in the culvert pools on Dakota creek several times both in the late summer and early fall [the exact number of sets was not recorded].

All fish captured were divided into species and they were maxillary clipped on the right side and released. Random measurements of lengths and weights were taken at this time.

Results and Discussion

Little Dakota Creek Fish Inventory

Table 1 shows the number, type and average biomass of fish captured in all five trappings of Little Dakota Creek. Individual length-weight data are shown in Table 2.

Table 1.
Fish species, number, average length and weight, Dakota Creek, January - February 1999.

species	Number	avg. LT (mm)	avg. Wt (g)
• coho salmon	20	93.8	10.6
• cutthroat trout	82	103.4	13.8
• trout (undetermined)	29	70.2	3.8
• steelhead trout	2	119	20.4
• Dolly Varden char	1	117	18.8
Total fish caught	134		

The first trapping produced 77 fish and the second produced 59 fish, of which 39 were previously marked. Using the mark-recapture formula N = MC/R, provided by MELP and DFO (Anon. 1980) the population of Little Dakota (N) was estimated to be 137.7 fish, as shown below:

- M = 77 (# of fish initially caught and marked)
- C = 59 (total # of fish captured in second trapping)
- R = 33 (# of marked fish recaptured)

$\Rightarrow$ N = 77 x 59 ÷ 33 = 137.7 $\approx$ 138 fish

The total usable habitat in the two constructed pools is 276.1 square meters. Based on this available habitat area and the trapping results, the standing stock of fish per square meter is

approximately 0.48, or one fish for every two square meters. This value seems to fit well with data collected on other Sunshine Coast streams and over-wintering ponds.

The fish captured were all visually in good health. The coho and cutthroat trout were at the length and weight usually associated with the smolting process. All fish captured were released in the upper pond of Little Dakota creek to allow for recruitment into the lower section. Fish were observed moving back down to the lower pond after there had been higher volumes of water in the creek. This could be the result of overcrowding in the upper pond or of fish returning to their preferred habitat.

Only one Dolly Varden was captured and a tissue sample was sent to Dave Bates for DNA testing to verify the species. The results will be forwarded as soon as they are known.

Fish Movement from Dakota Creek main stem to Little Dakota Creek

A total of 32 fish were captured in the Dakota Creek main stem and marked (Table 3). The results of the five trapping events in the Little Dakota creek over-wintering ponds are shown in Tables 4 through 8.

All fish captured and recaptured in Little Dakota were checked for the maxillary clip but none were found. After the population assessment was complete, trapping was again done in the culvert pools of main Dakota Creek, with the purpose of seeing if there had been any movement of the maxillary clipped fish. Only 16 of the clipped fish were recaptured in the Dakota main stem. The whereabouts of the other marked fish is unknown; they may have remained in the same area but were not re-captured, relocated to other areas, or succumbed to predation or other causes of mortality.

Table 3.
Species and numbers of fish captured and marked in lower Dakota Creek, September – October 1998.

species	Number
• coho salmon	6
• trout (undetermined)	9
• cutthroat trout	17
Total number of fish captured:	32

Salmon Spawning

In the fall of 1998, both coho and chum adults were observed spawning on the crests of the lower weirs in Little Dakota Creek, and redds were observed in the gravel of the upper weirs.

Conclusion

All construction and rehabilitation in the Little Dakota creek system seems to have had a positive impact. The new habitat has been fully colonized, the pools have maintained depth, and the

amount of large woody cover is above average. Several large trees have fallen into the system this winter adding to the complexity.

The lower reach of Little Dakota Creek, when retaining water, now allows easy access to the larger pools in reach two for both juvenile and adult salmonids.

In conclusion, the information gathered in this survey confirmed that there is a healthy population of salmonids living in Little Dakota creek. However, the monitoring program was unable to find evidence of fish movement from the Dakota main stem into Little Dakota Creek.

TABLE 2

LITTLE DAKOTA CREEK
BIO-MASS CHART

SPECIES	LTmm	WTg
cutthroat	126	22.8
"	128	23.5
"	105	12.4
"	80	5.5
"	128	24.5
"	97	9.5
"	122	18.8
"	115	18.5
"	129	23.7
"	89	6.8
"	109	14.1
"	126	26.6
"	123	19.6
"	80	5.4
"	81	6.1
"	108	17.5
"	105	12.1
"	88	8.5
"	84	6.6
"	92	9.3
"	130	22.3
"	82	6.5
"	153	40.2
"	118	18
"	80	5.7
"	88	7.4
"	95	9.1
"	85	7.5
"	81	6.5
"	98	7.8
"	90	8
"	83	7.5
"	113	18.1
average	103.4	13.8

SPECIES	LTmm	WTg
trout	69	3.2
"	68	3.3
"	76	5.3
"	70	3.5
"	78	4.9
"	76	5.1
"	74	7.2
"	68	3.2
"	64	2.8
"	78	4.9
"	68	3.1
"	72	3.9
"	70	3.4
"	71	3.9
"	59	2.4
"	62	2,8
average	70.2	3.8

SPECIES	LTmm	WTg
coho	97	11.3
"	114	17.3
"	98	10.9
"	90	8.6
"	88	9.2
"	83	7.3
"	95	10.8
"	84	7.3
"	86	8.4
"	105	14.8
"	85	8.7
"	110	15.3
"	84	7.5
average	93.8	10.6

SPECIES	LTmm	WTg
Steelhead	135	27.3
	103	13.5
average	119	20.4

SPECIES	LTmm	WTg
Dolly	117	18.8

TABLE 4

TRAPPING OVER WINTERING PONDS

NAME : L' DAKOTA	TEMP : 4
DATE : 05-Jan 1999	
GAUGE - START :	TRAPS : 10
FINISH :	TIME IN : 48hrs

WEATHER DURING TRAPPING	CLOUD
CREEK VOLUME	LOW

NUMBER OF FISH CAUGHT :	77
NUMBER UNCLIPPED :	77
PREVIOUS TOTAL :	0
TOTAL ESTIMATE IN POND :	77

COHO	13	TROUT	12
CUTS	52	SCULPIN	
STEEL		DOLLY	

NUMBER OF FISH SAMPLED	15

SP	Lt	WT	SP	LT	WT
CO	97	11.3	TR	69	3.2
CO	114	17.3	TR	68	3.3
CO	98	10.9	TR	76	5.3
C0	90	8.6	TR	70	3.5
CT	126	22.8	CT	80	5.5
CT	128	23.5	C0	88	9.2
CT	105	12.4	TR	78	4.9
DO	117	18.8			

TABLE 5

TRAPPING OVER WINTERING PONDS

NAME : L' DAKOTA	TEMP : 7
DATE : 18-Jan 1999	
GAUGE - START :	TRAPS : 10
FINISH :	TIME IN : 48hrs

WEATHER DURING TRAPPING	RAIN
CREEK VOLUME	UP

NUMBER OF FISH CAUGHT :	59
NUMBER UNCLIPPED :	26
PREVIOUS TOTAL :	77
TOTAL ESTIMATE IN POND :	103

SPECIES OF NEW FISH CAUGHT			
COHO	2	TROUT	9
CUTS	12	SCULPIN	0
STEEL	2	DOLLY	1

NUMBER OF FISH SAMPLED	21

SP	Lt	WT	SP	LT	WT
ST	135	27.3	CT	115	18.5
ST	103	13.5	CT	129	23.7
CO	83	7.3	TR	68	3.2
CO	95	10.8	CT	89	6.8
TR	7.6	5.1	CT	109	14.1
CT	128	24.5	CT	126	26.6
CO	84	7.3	CT	123	19.6
CO	117	18.8	CO	86	8.4
TR	74	7.2	TR	64	2.8
CT	97	9.5	TR	78	4.9
CT	122	18.8			

TABLE 6

TRAPPING OVER WINTERING PONDS

NAME : L' DAKOTA	TEMP : 6
DATE : 03-Feb 1999	
GAUGE - START :	TRAPS : 10
FINISH :	TIME IN : 48hrs

WEATHER DURING TRAPPING	rain
CREEK VOLUME	up

NUMBER OF FISH CAUGHT :	33
NUMBER UNCLIPPED :	14
PREVIOUS TOTAL :	103
TOTAL ESTIMATE IN POND :	117

SPECIES OF NEW FISH CAUGHT			
COHO	3	TROUT	4
CUTS	7	SCULPIN	
STEEL		DOLLY	

*DNA SAMPLE

NUMBER OF FISH SAMPLED	13

SP	Lt	WT	SP	LT	WT
CT	80	5.4	CT	88	8.5
CT	81	6.1	CT	84	6.6
CT	108	17.5	CT	92	9.3
CT	105	12.1	CT	130	22.3
CO	105	14.8	TR	72	3.9
CO	85	8.7	CT	82	6.5
TR	68	3.1			

TABLE 7

TRAPPING OVER WINTERING PONDS

NAME : L' DAKOTA	
DATE : 17-Feb	1999

TEMP :	6.5

GAUGE - START :	
FINISH :	

TRAPS :	10
TIME IN :	48hrs

WEATHER DURING TRAPPING	RAIN
CREEK VOLUME	UP

NUMBER OF FISH CAUGHT :	45
NUMBER UNCLIPPED :	11
PREVIOUS TOTAL :	117
TOTAL ESTIMATE IN POND :	128

SPECIES OF NEW FISH CAUGHT			
COHO	2	TROUT	2
CUTS	7	SCULPIN	
STEEL		DOLLY	

NUMBER OF FISH SAMPLED	11

SP	Lt	WT	SP	LT	WT
CT	153	40.2	TR	71	3.9
CO	110	15.3	CT	95	9.1
CT	118	18	CO	84	7.5
CT	80	5.7	CT	85	7.5
CT	88	7.4	CT	81	6..5
TR	70	3.4			

TABLE 8

TRAPPING OVER WINTERING PONDS

NAME : L' DAKOTA	TEMP : 7
DATE : 03-Mar 1999	
GAUGE - START :	TRAPS : 10
FINISH :	TIME IN : 48hrs

WEATHER DURING TRAPPING	rain
CREEK VOLUME	up

NUMBER OF FISH CAUGHT :	30
NUMBER UNCLIPPED :	6
PREVIOUS TOTAL :	128
TOTAL ESTIMATE IN POND :	134

SPECIES OF NEW FISH CAUGHT			
COHO		TROUT	2
CUTS	4	SCULPIN	
STEEL		DOLLY	

NUMBER OF FISH SAMPLED	6

SP	Lt	WT	SP	LT	WT
TR	59	2.4	CT	90	8
TR	62	2.8	CT	83	7.5
CT	98	7.8	CT	113	18.1

Sheet1

TRAPS + SALVAGE L'DAKOTA CREEK
PRE-CONSTRUCTION 1996

TUE	Sep-17	71 COHO
		15 CUTS
		5 TROUT
WED	Sep-18	16 COHO
		7 CUTS
		2 TROUT
THURS	Sep-19	1 COHO
MON	Sep-23	2 COHO
		2 TROUT

TRAPS REMOVED

TUE	Oct-29	37 COHO
		2 1+CUTS

OCT 30 CONSTRUCTION

TOTALS	127 COHO	
	22 CUTS	
	9 TROUT	
	2 CUTS 1+	

1 DOLLY VARDEN TRAPPED ABOVE WEIR # 6 Lt 132mm.

TRAPS + SALVAGE L' DAKOTA CREEK
Jan-05 1998
ABOVE WEIR # 6
40 COHO 9 CUTS
6 TROUT
OF FISH SAMPLED 10

SP	Lt	Wt	SP	Lt	Wt
CO	82mm	5.6g	CO	69mm	3.4g
CO	83mm	5.7g	CO	78mm	5.9g
CT	131mm	20.6g	CO	82mm	6.2g
CT	132mm	24.0g	TR	71mm	3.9g
CT	152mm	33.0g	TR	66mm	3.1g

ABOVE WEIR # 6
18 COHO 2 TROUT
1 CUT
OF FISH SAMPLED 21

SP	Lt	WT	SP	Lt	Wt
CT	173mm	42.4g	CO	81mm	5.9G
CO	72mm	4.2g	CO	77mm	6.1G
CO	82mm	7.4g	CO	84mm	6.2G
CO	89mm	7.7g	CO	85mm	6.9G
CO	89mm	8.0g	CO	90mm	8.7G
CO	86mm	7.4g	CO		8.5G
CO	85mm	6.2g	CO	78mm	5.1G
CO	82mm	5.9g	TR	68mm	3.5G
CO	83mm	6.1g	TR	68mm	3.5G
CO	84mm	7.4g	TR	66mm	3.2G
CO	85mm	7.4G			

TRAPS+SALVAGE L' DAKOTA CREEK
Jun-11 1997
ABOVE WEIR # 6
10 CUTS
0 COHO

SP	Lt	Wt
CT	91mm	7.5g
CT	96mm	10.3g
CT	93mm	6.7g
CT	96mm	10.1g
CT	115mm	15.5g
CT	132mm	24.8g
CT	119mm	19.2g
CT	108mm	12.1g
CT	91mm	7.9g
CT	94mm	10.5g

ABOVE WEIR # 5
no fish
ABOVE WEIR # 4
no fish
'REST OF CREEK DRY

HABITAT ASSESSMENT

Date: JAN 8 1997 Time: 9:15 Crew:

Stream/Reach: L. DAKOTA CREEK

Unit type	R	P	G	R	P	R	P	R	P	R	P	R	P	R
Unit #	W-1	2	3	W/4	5	W/6	7	W/8	9	W/10	11	W/12	13	W/14
Grad %	6	1	1	8.5	1	10	1	10	1.5	8	1	10	1.5	7
Length (m)	4.2	17	4.8	8	15	8.3	18.3	54	16.8	7.3	11	16	30	7.7
W.Width (m)	.4	3	2.5	1	3.2	.7	5.7	10	6.8	.5	4	.75	7m	.5
Ch.Wdth (m)	1.3	3.5	2.5	1.5	4.2	1.2	6m	1.5	7.3	1m	4.7	1.5	7m	1m
Area (m^2)														
Bank Full depth	+.05	.30	+.35	+.4	+.4	+.15	+.35	.38	.14	+.62	+.25	+.09	+.07	+.04
Mean depth	.07	.5	.3	.05	.74	.15	.57	.5	.25	.45	.85	.07	1.2	.05
Crest Height	/	.2	/	/	.06	/	.25	/	.13	/	.2	/	.2	/
Total L.W.D.	Ø	1	1	Ø	2	Ø	2	Ø	1	Ø	2	Ø	2	1
Fun L.W.D.	Ø	1	1	Ø	2	Ø	2	Ø	1	Ø	1	Ø	2	1
Instream Bldr %	25	2%	5	10%	2	30	20	10	5	5	5	5	5	10
Instream Veg %	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	0	Ø	Ø	Ø	Ø	Ø
Overstrm Veg%	10	2	15%	10%	2%	1%	5	Ø	5	0	10	15	5	0
Canopy	30	30	30	20	1%	1%	5	10	15	Ø	Ø	0	20	15
Riparian Type	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F	S/F
Cutbanks %	0	4	5%	Ø	Ø	Ø	10	2%	1%	Ø	5	Ø	2	Ø
Fines %	5	30	50	10	30	10	30	10	30	10	30	15	40	15
Sm Gravel %	5	30	35	20	30	10	30	10	30	10	30	10	20	10
Lrg Gravel %	25	25	5	30	25	10	25	10	25	10	25	10	20	25
Cobbles %	25	10	5	20	10	10	10	20	10	20	10	20	10	20
Boulders %	40	5	5	20	5	60	5	50	5	50	5	30	10	30
Bedrock %	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Compact (0-1)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Turbidity (0-1)	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99
Temp °C	6°	6°	6°	6°	6°	6°	6°	6°	6°	6°	6°	6°	6°	6°
Velocity sec/1m	4	16	10	2	11	4	19	4.5	17	2	6	3	?	2
Spawning	10%	10%	/	5%	3%	10%	5%	/	/	10%	5	5	/	5

1) 8) Comment

2) 9) *

3) 10) *

4) 11) *

5) 12) *

6) 13) *

7) 14) *

HABITAT ASSESSMENT

Date: FEB 12 1998 Time: 8.30 a.m. Crew:

Stream/Reach: L. OKANAGAN CREEK

Unit type	R	P	W-2	P	G	W-3	P	G	W-4	P	G	W-5	P	R	P
Unit #	LNOT	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Grad %		1	1	8	1.5	11	1	1.5	8.5	1	2	7	1	8	.5
Length (m)		18.6	4.6	7.5	4.8	5.3	7.4	10.2	3.4	3.8	6.9	6.7	13	19	31
W.Width (m)		3.5	1.6	2.4	2.2	.5	3.3	4.6	.7	4.2	5.2	.5	4.2	.2	7
Ch.Wdth (m)		3.7	2.8	2.4	2.2	3.1	3 3	5.1	3.4	4 2	5.4	1.8	4.4	.2	7
Area (m²)															
Bank Full depth		+.35	.40	+.4	+.33	+.41	+.35	+.25	+.35	+.14	1.5	+.61	+.35	+25	+.25
Mean depth		.25	.10	.58	.28	.4	.31	.35	.25	.2	.12	1m	.08	1.3	1.4
Crest Height		.18	/	.4	/	/	.15	/	/	.13	/	/	.28	/	.18
Total L.W.D.		1	Ø	2	1	Ø	1	2	2	2	1	Ø	3	Ø	13
Fun L.W.D.		1	Ø	2	1	Ø	1	1	Ø	1	1	Ø	3	Ø	9
Instream Bldr %		Ø	15	5	2	60	10	1	60	2	Ø	60	15	45	5
Instream Veg %		0	0	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Overstrm Veg%		20	5	3	Ø	5	2	2	1	5	2	2	20	2	2
Canopy		30	30	Ø	2	1	10	30	10	10	2	1	Ø	30	20
Riparian Type		YF	YF	YF	YF	YF	YF	YF	YF	YF	YF	YF	YF	YF	YF
Cutbanks %		Ø	Ø	5	1	Ø	2	5	5	5	1	Ø	5	0	5
Fines %		35	1	5	5	1	20	45	5	40	60	1	55	1	40
Sm Gravel %		20	24	20	10	9	30	20	15	30	20	9	10	4	10
Lrg Gravel %		20	25	30	20	10	30	20	10	10	10	10	10	30	20
Cobbles %		25	40	30	55	10	10	10	10	10	4	20	10	20	20
Boulders %		Ø	10	15	10	90	10	5	60	5	5	6	15	45	10
Bedrock %		Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Compact (0-1)															
Turbidity (0-1)		.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99
Temp °C		6°	6°	6	6	6	6	6	6	6	6	6	6	6	6°
Velocity		9	2	10	9	3	9	6	3	12	15	3	10	2	20
Spawning		2	Ø	3	25	20	5	10	10	5	5	10	5	5	1

Not possible as it was Tidal Pools

1) 2) 3) 4) 5) 6) 7)

8) 9) 10) 11) 12) 13) 14)

Comment

* DONE AS MED FLOW
* ALL WEIRS WERE ACTIVATED
*
* IN LOW FLOW CONDITIONS
* ONLY WEIR 5/UNIT 12 AND UP
* ARE FUNCTIONING WITH WATER

Low Flow cut off

APPENDIX C

Preliminary Evaluation of Juvenile Salmonid Populations and Aquatic Habitat in the Anadromous Section of Dakota Creek, Howe Sound, BC

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September 30, 1996

Abstract

An aquatic habitat and juvenile salmonid population assessment was conducted on Dakota Creek, Howe Sound, BC between August 11 and August 15, 1994. The assessment was restricted to the lower section of stream accessible to anadromous species of salmonids.

Results indicate that Dakota Creek provides rearing habitat for rainbow (steelhead) and cutthroat trout and coho salmon. Rainbow trout were the dominant species and distributed throughout the study section. Coho salmon juveniles were found only in the lower Reach 1 while confirmed cutthroat juveniles were found in Reach 3.

The total estimated available rearing habitat was approximately 5750 m^2 which provided for an estimated population of 567 rearing salmonids or 0.10 fish/m^2. Total calculated biomass for the anadromous section of Dakota Creek was only 6.09 kg, which resulted in a biomass density of 1.06 gms/m^2 .

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1.0 Introduction

In August 1994, the Sunshine Coast Salmonid Enhancement Society (SCSES) was awarded project funding from the Community Salmonid Enhancement and Restoration Fund (CSERF). This grant, administered through the Ministry of Agriculture, Fisheries and Food (MAFF) was part of the Provinces' BC 21 initiative.

In the proposal to the provincial government, seven Sechelt Peninsula streams were identified as candidates for detailed habitat assessment and fish population surveys. Surveys were conducted under the direct supervision of local Department of Fisheries and Oceans (DFO) staff with biological support from Capilano College in Sechelt, BC. Dakota Creek, located within the boundary of the Sunshine Coast Regional District and Crown Lands, is one of the streams identified.

The purpose of this paper is to summarise and document the results of the 1994 aquatic habitat, and salmonid population assessment of the anadromous section of Dakota Creek.

2.0 Study Area

Dakota Creek is a third order stream that flows eastward to Thornbrough Channel in Howe Sound (**Figure 1**). The watershed area is approximately 3,300 hectares, with 70% of the estimated catchment area below the 900 metre elevation. The highest elevation in the watershed is approximately 1,200 metres.

The study was confined to the anadromous section of stream between the confluence with Thornbrough Channel and a fish passage barrier located approximately 900 metres upstream. This length of stream was separated into 3 reaches based on the gradient profile and the homogeneity of existing habitat. Reach 1, with an average gradient of 1.2%, is the 300 metre section of stream between the high tide mark at the confluence with McNair Creek, and the highway bridge (**Figure 2**). Reach 2 is the 288 metre section of stream between the bridge with an average gradient of 2.5% and extends to 33 metres below the first falls (**Figure 3**). Reach 3 is the 315 metre section of stream below the crib dam with an average gradient of 3.2% (**Figure 4**). The crib dam acts as a passage barrier to anadromous fish.

3.0 Methods

The study section was divided into reaches based on the homogeneity of habitat. Sampling of habitat and salmonid populations was conducted between August 10 and September 30, 1994. Detailed habitat parameters were measured at each of 12 consecutive habitat units

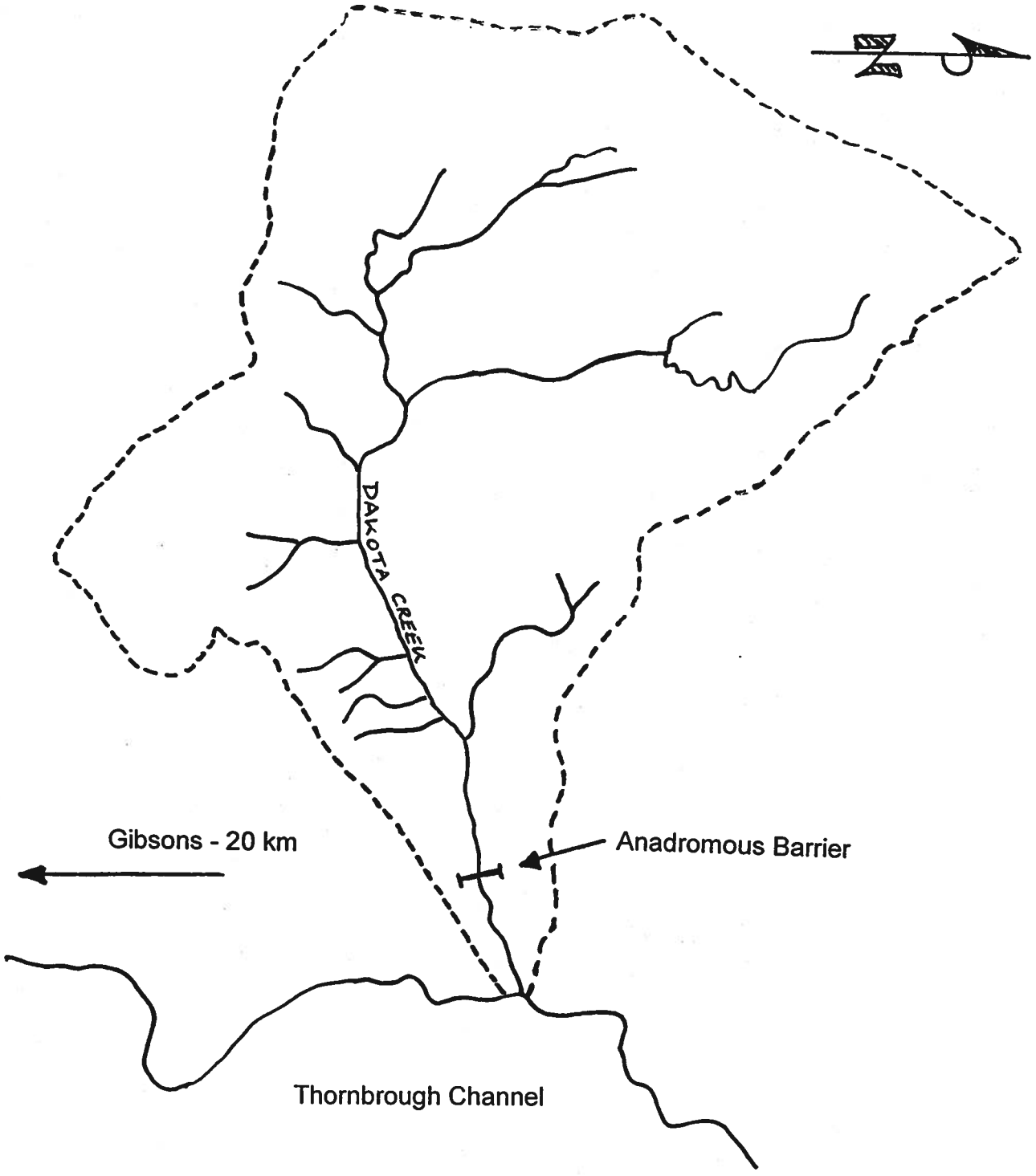

Figure 1: Location of Dakota Creek, Howe Sound, BC. Note the approximate location of the barrier to anadromous fish migration.

Figure 2: Photograph illustrating the type of habitat found in Reach 1 of Dakota Creek, Howe Sound, BC.

Figure 3: Photograph illustrating the type of habitat found in Reach 2 of Dakota Creek, Howe Sound, BC.

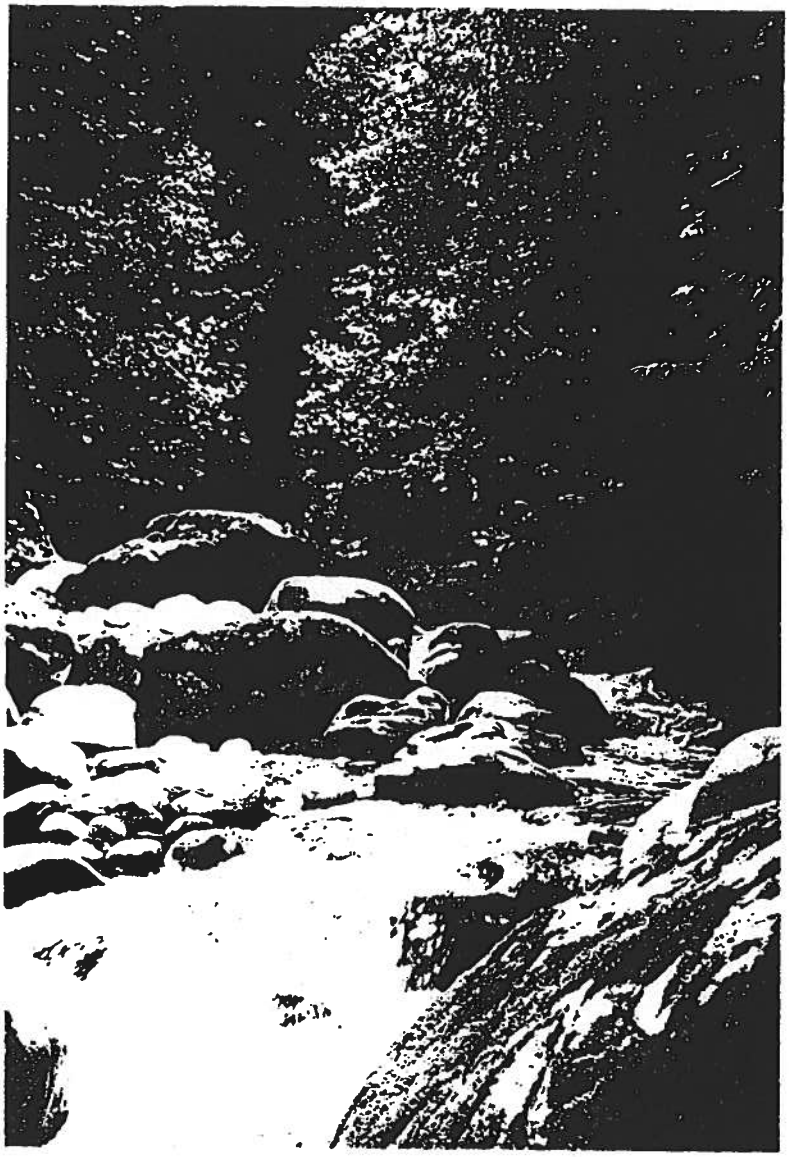

Figure 4: Photograph illustrating the type of habitat found in Reach 3 of Dakota Creek, Howe Sound, BC.

per reach and a total of 25 parameters measured in each hydraulic unit (*DeLeew,* 1981; *Bech,* 1994).

Representative units from each habitat type were subsequently isolated with stop seines at the upstream and downstream boundaries and sampled in order to determine current fish populations. Sample sites were electrofished using a Smith Root Type VIII electroshocker and the total removal technique described by *Seber and LeCren* (1967).

Due to a low level of confidence in total capture, caused by poor water conductivity, volume and substrate configuration only one pass was made with the electroshocker. In these areas and a 0.50 probability of catch was assigned in Reaches 2 and 3. In Reach 1, a minimum of two passes of the sample area was made and a probability of catch calculated as per *Deleeuw,* (1981).

Captured fish were subsequently anaesthetised with sodium bicarbonate and sampled individually for species, length (mm), and wet weight (gms). Age classes were determined using length frequency curves developed from the sample data and condition coefficients calculated.

4.0 Results/Discussion

4.1 Habitat Assessment

4.1.1 *Reach 1*

Reach 1 was determined to be approximately 300 meters in total length and had a total estimated area of 2150 m^2. The reach was calculated to be approximately 33% of the study area, and comprised of 54% riffle, 27% glide and 19% pool or 1160 m^2, 590 m^2 and 400 m^2 respectively. Physical characteristics are expressed as averages per habitat type in **Table I**.

The amount of available cover was measured for each unit and is expressed as average percent of wetted area per unit, and total area of each habitat type in **Table II**. The riffle habitat had the most available cover with an average of 31.2% or 363 m^2, made up of instream and overstream cover. The glide habitat also had a fair amount of cover which amounted to 21.6% of the area or 127 m^2. Like the riffle habitat this cover was primarily boulder clusters with a small amount of overstream cover provided along the stream edge. Cover in the pool habitat averaged 14.4% or 58 m^2 and also included both instream and overstream elements.

All classes of substrate were measured as a percent of wetted area for each unit, and are expressed as average percent per unit and total area in **Table III**. Substrate classes are

Table I: Summary of physical habitat characteristics sampled in Reach 1 of Dakota Creek, Howe Sound, BC, August 11, 1994.

Physical Characteristics	Habitat Type			
	Pool	Riffle	Glide	Total
No. Sampled	3	4	5	12
Ttl. Length (m)	41	162	76	279
Wetted Width m)	9.1	6.6	7.2	n/a
Channel Width	16.6	17.0	15.0	n/a
Sample Area (m^2)	374	1076	548	1998
% Total Reach	19	54	27	100
Total Rearing Units (100 m^2/unit)	4.0	11.6	5.9	21.5
Ave. Depth (m)	0.55	0.19	0.32	n/a

Table II: Summary of available cover in Reach 1 of Dakota Creek, Howe Sound, BC, August 11, 1994. Values are expressed as the average percent of available habitat from samples and expanded to represent the total reach expressed in units (1 unit = 100 m^2).

Cover Type	Pool		Riffle		Glide	
	%	Area	%	Area	%	Area
In-stream Log	6.7	0.27	0.75	0.09	3.8	0.22
In-stream Boulder	7.7	0.31	30.0	3.48	17.8	1.05
Overstream Cover	0	0	0	0	0	0
Cutbanks	0	0	0.5	0.06	0	0
Total		0.58		3.63		1.27

well distributed within each habitat type. Mid-sized material (large gravel and cobble) is the most abundant in most units however, boulder are equally abundant in the faster riffle environments. Generally habitat appears restrictive and suited to species such as steelhead trout. The dominance of larger substrate and lack of spawning gravels suggest survival and recruitment from spawning adults may be a problem.

Table III: Summary of substrate composition in Reach 1 of Dakota Creek, Howe Sound, BC, August 11, 1994. Values are expressed as an average percent coverage and total estimated area (m^2).

Substrate Type	Pool		Riffle		Glide	
	%	Area	%	Area	%	Area
Fines (<0.1cm)	12	48	4	46	6	35
Small Gravel (0.1 - 4.0 cm)	25	100	12	139	19	112
Large Gravel (4.0 - 10.0 cm)	30	120	24	278	35	206
Cobble (10.0 - 30.0 cm)	20	80	30	348	22	130
Boulder (>30.0 cm)	13	52	30	348	18	106
Bedrock	0	0	0	0	0	0

Table IV: Summary of physical habitat characteristics sampled in Reach 2 of Dakota Creek, Howe Sound, BC, August 11, 1994.

Physical Characteristics	Habitat Type			
	Pool	Riffle	Glide	Total
No. Sampled	3	6	3	12
Sampled Lgth (m)	14	169	18	201
Wetted Width m)	6.4	5.1	5.3	n/a
Channel Width	16.4	15.4	13.9	n/a
Sample Area (m^2)	90	860	96	1045
% Total Reach	9	82	9	100
Total Rearing Units (100 m^2/unit)	1.4	12.3	1.4	15.1
Ave. Depth (m)	0.65	0.26	0.35	n/a

4.1.2 *Reach 2*

Reach 2 was observed to be 288 m in total length with calculated total area of 1500 m^2, representing 32% of the study area. The reach was comprised of 82% or 1230 m^2 of riffle

habitat, 9% or 135 m^2 of pool and 9% or 135 m^2 of glide. Physical characteristics are expressed in averages per habitat type in **Table IV**.

The amount of available cover was measured for each unit and is expressed as average percent of wetted area per unit, and total area for each habitat type in **Table V**. All types of cover were observed in Reach 2 while the most abundant was provided by boulder clusters. Pool habitat had the highest average percent cover with 69% , while riffle environment had the largest area of available cover with 812 m^2 with instream boulder cover making up all but approximately 12 m^2. Cover in the glide habitat was observed to be 84 m^2 of the total habitat area suggesting additional cover may be appropriate.

All classes of substrate were measured as a percent of wetted area for each unit, and are expressed as average percent per unit and total area in **Table VI**. Boulders and cobbles were found to be the most abundant size classes in all habitat types, but smaller sized materials (gravels) are more abundant in the slower pool environment. Substrate may again provide limitations to spawning for anadromous salmonids. Pockets of suitable substrate are present , but appear to be limited. This general lack of spawning may also prove to be limiting in spawner recruitment by causing reduced spawner success.

Table V: Summary of available cover in Reach 2 of Dakota Creek, Howe Sound, BC, August 11, 1994. Values are expressed as the average percent of available habitat from field samples and expanded to represent the total reach expressed in units (1 unit = 100 m^2).

Cover Type	Pool		Riffle		Glide	
	%	Area	%	Area	%	Area
In-stream Log	0.3	<0.01	0.17	0.02	0	0
In-stream Boulder	66.7	0.87	65.0	8.0	60.0	0.84
Overstream Cover	1.7	0.02	0.83	0.10	0	0
Cutbanks	0.3	<0.01	0	0	0	0
Total		0.90		8.12		0.84

4.1.3 *Reach 3*

Reach 3 was observed to be 315 metres long with an estimated total area of 2010 m^2, representing 35% of the study area. The reach was comprised of 42% or 905 m^2 of glide habitat, 29% or 583 m^2 of riffle and 21% or 422 m^2 of riffle. The upper end of the reach was characterised by falls which accounted for approximately 5% of the reach. Physical characteristics are expressed in averages per habitat type in **Table VII**.

Table VI: Summary of substrate composition in Reach 2 of Dakota Creek, Howe Sound, BC, August 11, 1994. Values are expressed as an average percent coverage and total estimated area (m^2).

Substrate Type	Pool		Riffle		Glide	
	%	Area	%	Area	%	Area
Fines (<0.1cm)	5	6	4	49	3	4
Small Gravel (0.1 - 4.0 cm)	13	17	9	111	7	10
Large Gravel (4.0 - 10.0 cm)	23	30	13	160	8	11
Cobble (10.0 - 30.0 cm)	27	35	24	295	20	28
Boulder (>30.0 cm)	32	42	49	603	62	87
Bedrock	0	0	1	12	0	0

The amount of available cover was measured for each unit and is expressed as average percent of wetted area per unit, and total area for each habitat type in **Table VIII**. Instream boulder was the most abundant cover type in Reach 3, while small amounts of instream log and cutbanks present in some units. Riffle habitat had the highest average percent cover with approximately 48% (295 m^2) dominated by instream boulder. While glide habitat had an average of 28% (261 m^2) cover per unit, with instream boulders making up all but 8 m^2. Cover in the pool habitat was observed at an average of 15% (66 m^2) dominated by instream boulder.

All classes of substrate were measured as a percent of wetted area for each unit, and are expressed as average percent per unit and total area in **Table IX**. All classes of substrate are present in the reach, though fines are scarce in most units. Cobbles and boulders make up the majority of substrate in all environments except the polls which have large amounts of bedrock at the lower end of the reach.

4.2 Fish population and Biomass

Extrapolated estimates of total population and biomass are based on the assumptions that the sample sites were truly representative of the habitat types, and that equal recruitment occurred throughout the reach. Typically trout less than 1 year old (young of the year) are not readily identifiable by species and are recorded as age 0 trout. In addition steelhead and cutthroat trout aged 1 and 2 were also recorded as trout. Specific species identified are included in the catch records included in **Appendix II**.

Table VII: Summary of physical habitat characteristics sampled in Reach 3 of Dakota Creek, Howe Sound, BC, August 11, 1994.

Physical Characteristics	Habitat Type				
	Pool	Riffle	Glide	Falls	Total
No. Sampled	3	3	4	2	12
Ttl. Length (m)	15	28	37	6	86
Wetted Width m)	8.1	5.9	7.0	4.2	n/a
Channel Width	13.8	15.0	15.3	n/a	n/a
Sample Area (m^2)	121	166	258	25	570
% Total Reach	21	29	45	5	100
Total Rearing Units (100 m^2/unit)	4.4	6.1	19.5	0.9	20.9
Ave. Depth (m)	0.68	0.25	0.44	n/a	n/a

Table VIII: Summary of available cover in Reach 3 of Dakota Creek, Howe Sound, BC, August 11, 1994. Values are expressed as the average percent of available habitat from field samples and expanded to represent the total reach expressed in units (1 unit = 100 m^2).

Cover Type	Pool		Riffle		Glide	
	%	Area	%	Area	%	Area
In-stream Log	0	0	0	0	1.2	0.11
In-stream Boulder	15	0.66	48.3	2.95	27.5	2.61
Overstream Cover	0	0	0	0	0	0
Cutbanks	0	0	0	0	1.2	0.11
Total		0.66		2.95		2.83

4.2.1 *Reach 1*

Fish populations were sampled in each of the three habitat types. Results are expressed in density (no./m^2) for each habitat type and as an overall average density for the reach in **Table X**. Estimated total population for the reach is also expressed in **Table X**.

Table IX: Summary of substrate composition in Reach 3 of Dakota Creek, Howe Sound, BC, August 11, 1994. Values are expressed as an average percent coverage and total estimated area (m^2).

Substrate Type	Pool		Riffle		Glide	
	%	Area	%	Area	%	Area
Fines (<0.1cm)	5	22	5	31	5	98
Small Gravel (0.1 - 4.0 cm)	10	44	8	49	18	351
Large Gravel (4.0 - 10.0 cm)	12	53	13	79	19	370
Cobble (10.0 - 30.0 cm)	12	53	20	122	21	410
Boulder (>30.0 cm)	18	79	42	256	33	644
Bedrock	43	189	12	73	4	78

Four separate species/age classes were recorded for Reach 1. Trout (steelhead and cutthroat) are the most abundant species in the reach found in 3 year classes. The estimated total number of age 0 trout is 193 fish resulting in an estimated density of 0.09 fish/m^2 . Estimates for age 1 and 2 trout (steelhead and cutthroat) is 121 and 19, respectively, while the estimated densities are 0.06 fish/m^2 and 0.01 fish/m^2 , respectively. Coho salmon juveniles were only found in this reach at an estimated density of 0.03 fish/m^2 representing an estimated total of 65 fish for the reach.

Glide habitat was the most productive and supported 3 species and 3 age classes of salmonids with an estimated total density is 0.40 fish/m^2. Pool habitat supported an estimated 0.23 fish/m^2 while the riffle habitat only supported an estimated 0.08 fish/m^2.

Results for the biomass estimates in Reach 1 are expressed by area (gms/m^2) per habitat type and as a total estimate for the entire Reach (**Table XI**). The pool habitat had the highest density of biomass with an average of 3.30 gms/m^2 , followed by the glide and riffle environments at 0.87 gms/m^2 and 0.44 gms/m^2 respectively. There was an estimated total of 2343 gms in the reach at an estimated overall average of 1.09 gms/m^2.

4.2.2 *Reach 2*

Results of salmonid population sampling found only trout utilising Reach 2 and only age 1 and 2 (**Table X**). All trout collected were identified as rainbow (steelhead). Age 1

rainbow trout were the most abundant with rearing populations found in all habitat types. The age 2 trout were confined to the pool habitat only.

The estimated density for the age 1 and 2 was 0.05 fish/m^2 or 68 fish in the entire reach. Riffle habitat provided the highest density with an estimated 0.05 fish/m^2, followed by pool then glide with 0.05 fish/m^2 and 0.02 fish/m^2, respectively.

Estimated total biomass for the reach is shown in **Table XI**. The pool habitat had the highest estimated biomass density 0.86 gms/m^2 followed by riffle and glide habitat at 0.49 gms/m^2 and 0.16 gms/m^2, respectively. There was an estimated total biomass in Reach 2 of 734 gms in the reach for an overall average of 0.49 gms/m^2.

Table X: Summary of estimated salmonid density (No./m^2) and total number of juvenile salmonids in Reach 1,2 and 3 of Dakota Creek, Howe Sound, BC, August 11, 1994.

Habitat Type	Fish/Unit				Available Habitat			Total Number of Fish			
	Trout			Co	Trout		Co	Trout			Co
	0+	1+	2+	0+	fry	parr	fry	0+	1+	2+	0+
Reach 1											
Pool	5	26	0	5	2.0	2.8	1.8	10	73	0	9
Riffle	2	6	3	6	10.3	6.2	2.6	21	37	19	16
Glide	28	3	0	20	5.8	3.6	2.0	162	11	0	40
Reach 2											
Pool	0	4	2	0	1.0	1.1	0.7	0	4	2	0
Riffle	0	6	0	0	8.5	9.8	2.4	0	59	0	0
Glide	0	3	0	0	1.0	0.9	0.6	0	3	0	0
Reach 3											
Pool	0	0	0	0	1.9	5.6	2.7	0	0	0	0
Riffle	14	9	0	0	3.3	3.6	2.6	46	32	0	0
Glide	0	0	3*	0	6.6	7.5	5.4	0	9	23	0
Total								239	219	44	65

Trout = steelhead and cutthroat trout juveniles

In conclusion, the 1993 habitat and population assessment revealed that Dakota Creek is utilised by populations of juvenile steelhead trout, coho salmon and cutthroat trout. Steelhead were found to be the predominant species found in 3 age classes throughout the study area. Coho salmon were found only in Reach 1 and a single 2+ cutthroat was recorded in Reach 3. The total wetted area of 5750 m^2 provides habitat for an estimated 567 salmonids at a density of 0.10 fish/m^2 or an estimated biomass of 6.09 kg at 1.06 gms/m^2. Spawning records show that Dakota Creek is also utilised by chum salmon.

All three reaches in the study area appear to be significantly under seeded in comparison to other streams on the Sechelt Peninsula (*Bates,* unpub. data) .

6.0 References

Bech, P. 1994. Lower mainland region streams inventory/assessment methods. Reg. Fish. Rep. No. LM229. Fish and Wildlife Mgmt. BC MoELP, Surrey, BC.

DeLeeuw, A.D. 1981. A British Columbia Fish Habitat and Population Inventory System. Preliminary Report. Fish Habitat Improvement Section, BCFW Branch, MOE, BC.

Seber, G.A.F. and E.D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecol., 36:631-643.

APPENDIX D

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

STREAM INFORMATION

WATER SURVEY OF CANADA STATIONS

Map No. ID Station No.

Loc. Ref:

WATER QUALITY

Map No. ID Station No. Ref #

Loc. Ref:

ENHANCEMENT AND MANAGEMENT ACTIVITIES

RESOURCE USE INFORMATION

FISHERIES POTENTIAL AND CONSTRAINTS

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CAL	NS		NS	NS	S5	G5

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
092G12	137	P	OBL	ELECTROSHOCK	HQ0910

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

ENHANCEMENT AND MANAGEMENT ACTIVITIES

Map No.	ID	Type	Activity	Project	Start	Finish	Cmt	Ref #
		W	ECS	PROVSTOCK	1988			SUM-2
			Species					
			ACT					
			Activity	Project	Start	Finish	Cmt	Ref #
			EW	FRBC	1997	1998	WATER QUALITY DATA AVAILABLE	HQ0910
			Species					
			Activity	Project	Start	Finish	Cmt	Ref #
			MS	MOE	1979			2FBSRY
			Species					
			Activity	Project	Start	Finish	Cmt	Ref #
			MS	Not Spec	1984		(ESCAPEMENT DATA AVAILABLE. REF# = HQ0166)	HQ0166
			Species					
			CH	CM	PK			
			Activity	Project	Start	Finish	Cmt	Ref #
			MSB	Not Spec	1994		(SUNSHINE COAST SALMONID ENHANCEMENT SOCIETY (SCSES) AWARDED FUNDING TO COMPLETE HABITAT ASSESSMENTS INCLUDING DAKOTA CREEK. REF# = HQ0203)	HQ0203
			Species					
			Activity	Project	Start	Finish	Cmt	Ref #
			MSB	FRBC	1997	1998	BIOPHYSICAL STREAM INVENTORY	HQ0910
			Species					
			CAL	CO	CT	RB		
			Activity	Project	Start	Finish	Cmt	Ref #
			MSS	FRBC	1997	1998	FISH AND FISH HABITAT ASSESSMENT	HQ0910
			Species					
			CAL	CO	CT	RB		

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

FISHERIES POTENTIAL AND CONSTRAINTS

Map No.	ID	Type	Activity	P	L	Comment	Ref #
		W	H	C	N		HQ0506
			Species Code				
			Activity	P	L	Comment	Ref #
			HSA	C	N		2LM163
			Species Code				
			Activity	P	L	Comment	Ref #
			HSQ	C	N	(LACK OF SPAWNING GRAVEL. REF# = HQ0203)	HQ0203
			Species Code				
			Activity	P	L	Comment	Ref #
			WC	C	N		16-2
			Species Code				
			Activity	P	L	Comment	Ref #
			H	G	N		16-2
			Species Code				HQ0506
			Activity	P	L	Comment	Ref #
			EHR	P	N	(REARING HABITAT FOR STEELHEAD, CUTTHROAT AND COHO SALMON. REF# = HQ0203)	HQ0203
			Species Code				

OBSTRUCTIONS

Map No	ID	Type	OBS	Height	Length	Ref #
092G12	7	P	D	3	0	16-2
			Cmt			6N-6
			Species Blocked			
			CO	ST		

Map No	ID	Type	OBS	Height	Length	Ref #
092G11	554	P	F	0	0	HQ0203
			Cmt			
			(FALLS. REF# = HQ0203)			
			Species Blocked			

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

OBSTRUCTIONS

Map No	ID	Type	OBS	Height	Length	Ref #
092G12	121	P	D	0	0	HQ0203
			Cmt			HQ0910
			(CRIB DAM - FISH PASSAGE BARRIER. REF# = HQ0203)			
			Species Blocked			

LAND USE

Map No.	ID	Type	Land Use	Date	Ref #
		W	FO	01-JAN-99	16-2
			Comment		
			IP	01-JAN-99	16-2
			Comment		
			LD	01-JAN-99	16-2
			Comment		

Map No.	ID	Type	Land Use	Date	Ref #
092G11	553	P	BR	01-JAN-99	HQ0187
			Comment		
			(HIGHWAY BRIDGE CROSSES CREEK. REF# = HQ0187)		

VALUE COMMENTS

SENSITIVITY COMMENTS

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CM	AN		NS	NS	S5	G5

FISH DISTRIBUTION

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

Map No.	ID	Type	Activity	Comment	Ref #
		W	SPL		16-2

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CO	AN		NS	NS	S5	G5

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
092G12	7	U	GIS	RECORD ADDED FOR GIS DISPLAY PURPOSES	DFP001
			SPL		16-2

Map No.	ID	Type	Activity	Comment	Ref #
092G12	124	P	OBL		HQ0506

Map No.	ID	Type	Activity	Comment	Ref #
092G12	137	P	OBL	ELECTROSHOCK	HQ0910

Map No.	ID	Type	Activity	Comment	Ref #
		W	OBL	(65 COHO JUVENILES FOUND IN LOWER REACHES. REF# = HQ0203)	HQ0203

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CT	FL		NS	NS	S5	G5

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
		W	OBL		16-2 2FBSRY

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CT	NS		NS	NS	S5	G5

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
092G12	124	P	OBL		HQ0506
092G12	125	P	OBL		HQ0506
092G12	138	P	OBL	ELECTROSHOCK	HQ0910

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
DV	NS		NS	NS	S4	G5

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
092G05	55	P	OBL	ELECTROSHOCK	HQ0910

Map No.	ID	Type	Activity	Comment	Ref #
		W	OBL		2FBSRY

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
RB	NS		NS	NS	S5	G5

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
092G12	124	P	OBL		HQ0506

Map No.	ID	Type	Activity	Comment	Ref #
092G12	137	P	OBL	ELECTROSHOCK	HQ0910

Map No.	ID	Type	Activity	Comment	Ref #
092G12	138	P	OBL	ELECTROSHOCK	HQ0910

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
ST	AN		NS	NS		

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
092G12	7	U	GIS	RECORD ADDED FOR GIS DISPLAY PURPOSES	DFP001
			SPL		16-2

SPECIES / STOCK IDENTIFICATION

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
TR	AN		NS	NS		

FISH DISTRIBUTION

Map No.	ID	Type	Activity	Comment	Ref #
		W	OBL	(333 TROUT (STEELHEAD AND CUTTHROAT) FOUND IN LOWEST REACH, 68 TROUT FOUND IN MIDDLE REACH, AND 101 TROUT FOUND IN UPPER REACH. REF# = HQ0203)	HQ0203

HARVEST AND USE

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
ST	NS		NS	NS		

Map No.	ID	Type	Code	CATCH Mean	High	EFFORT Mean	High	CPU Mean	High
		W	REC	8		49			

Start	To	Finish	Cmt:
01-JAN-84		01-JAN-95	

Season	Ref #
	SUM-3

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

ESCAPEMENT

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CM	AN		NS	NS	S5	G5

10 YR. Period			10 YR. Mean	10 YR. Max.	Period of Record			Max.	Year
01-JAN-85	to	01-JAN-94	73	200	01-JAN-70	to	01-JAN-94	200	01-JAN-89

Target	Comments	Ref #
0		DFO_ESC

ESCAPEMENT

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
CO	AN		NS	NS	S5	G5

10 YR. Period			10 YR. Mean	10 YR. Max.	Period of Record			Max.	Year
01-JAN-85	to	01-JAN-94	11	30	01-JAN-70	to	01-JAN-94	30	01-JAN-87

Target	Comments	Ref #
0		DFO_ESC

ESCAPEMENT

Species	Char	Stock	Stock Type	Mgt Cls	CDC Local	CDC Global
PK	AN		O	NS	S5	G5

10 YR. Period			10 YR. Mean	10 YR. Max.	Period of Record			Max.	Year
01-JAN-81	to	01-JAN-89	6	6	01-JAN-71	to	01-JAN-89	6	01-JAN-83

Target	Comments	Ref #
0		DFO_ESC

Lake and Stream Information

REFERENCING INFORMATION

Stream Name:
DAKOTA CREEK

Alias

Watershed Code:
900-109700-00200-00000-0000-0000-000-000-000-000-000-000

WB ID
00000J
ERV

SISS/RAB Code:
WB.SISS_RAB_CODE

LIFE HISTORY AND TIMING

REFERENCES

Reference # 16-2

Description	AF; enhancement; fish sampling; gradient; land use; migration; morphology; obstructions; physical habitat; spawning; substrate; water quality; water use
Abstract	
Title	FISHERY OFFICER, MADEIRA PARK, B.C.. PERSONAL COMMUNICATIONS.
Location	DFO - SUBDISTRICT 16: Pender Harbour
Location Comments	
Type	Personal Information/Communication
Published Year	
Author Name	TANCOCK, R.

Reference # 2FBSRY

Description	UNPUBLISHED GOVERNMENT RECORDS
Abstract	
Title	FISHERIES BRANCH, SURREY: FISHERIES FILES: INVENTORY; ENHANCEMENT; BIOPHYSICAL DATA; & RECORDS OF PERSONAL COMMUNICATION
Location	MOELP, FISHERIES BRANCH, SURREY
Location Comments	
Type	Personal Information/Communication
Published Year	01-JAN-95
Author Name	MELP

Reference # 2LM163

Description	WATERSHED: FRASER
Abstract	
Title	FRASER RIVER ESTUARY MONITORING REPORT OF THE 1988 FISH MONITORING PROGRAM.
Location	MOE SURREY
Location Comments	
Type	Unpublished Government Report
Published Year	01-APR-89
Author Name	SWAIN L.G. WALTON D.G.

Lake and Stream Information

Reference # 6N-6

Description	AF; fish sampling; habitat sampling; physical habitat
Abstract	
Title	Aquatic Biophysical Maps. 1:50,000 SCALE. M.O.E. RESOURCE ANALYSIS BRANCH. Thematic maps displaying fish habitat and distribution information, based on field and data surveys, and displayed on a reach basis.
Location	MOE - FISHERIES BRANCH - VICTORIA
Location Comments	
Type	Government Report
Published Year	
Author Name	RESOURCE ANALYSIS BRANCH

Reference # DFO_ESC

Description	DFO_ESC_SUMMARY
Abstract	
Title	
Location	
Location Comments	
Type	Government Database
Published Year	
Author Name	

Reference # DFP001

Description	Addition of zones & points re: FISS maps for fish distribution for G.I.S. display purposes
Abstract	
Title	Addition of zones & points re: FISS maps for fish distribution for G.I.S. display purposes
Location	MELP, Fisheries Branch, Victoria
Location Comments	
Type	Government Report
Published Year	01-JAN-95
Author Name	PHILIP, DONALD F.

Reference # HQ0166

Description	PREPARED FOR: PAUL HIGGINS, SAFETY AND ENVIRONMENT, B.C. HYDRO AND POWER AUTHORITY
Abstract	
Title	SELECTION OF CONTROL RIVERS FOR THE CHEAKAMUS RIVER MONITORING PROGRAM: A COMPARATIVE ANALYSIS BASED ON TIME SERIES OF SALMON AND STEELHEAD ABUNDANCE INDICIES
Location	HEADQUARTERS VICTORIA, B.C.
Location Comments	
Type	Consultant Report
Published Year	01-SEP-95
Author Name	JOSH KORMAN

Lake and Stream Information

Reference # HQ0187

Description	AN INVESTIGATION INTO THE WATER QUALITY, FISH SPECIES, RIPARIAN HABITAT, ETC... FOR TRIBUTARIES OF THE FRASER RIVER.
Abstract	
Title	FRASER DELTA STRATEGIC ENVIRONMENTAL MAMAGEMENT PLAN.
Location	HEADQUARTERS: VICTORIA, B.C.
Location Comments	
Type	Government Report
Published Year	01-SEP-85
Author Name	ENVIRONMENT.
	PROVINCE OF BRITIS COLUMBIA MINISTRY OF

Reference # HQ0203

Description	AN AQATIC HABITAT AND JUVENILE SALMONID POPULATION ASSESSMENT CONDUCTEDON DAKOTA CREEK. ASSESSMENT WAS RESTRICTED TO THE LOWER SECTION OF THE STREAM ACCESSIBLE TO ANANDROMOUS SPECIES OF SALMONIDS.
Abstract	
Title	PRELIMINARY EVALUATION OF JUVENILE SALMONID POPULATIONS AND AQUATIC HABITAT IN THE ANADROMOUS SECTION OF DAKOTA CREEK, HOWE SOUND, B.C.
Location	HEADQUARTERS - VICTORIA, B.C.
Location Comments	
Type	Consultant Report
Published Year	01-SEP-96
Author Name	BATES, D.J.
	ELLIS, J.

Reference # HQ0506

Description	B.C. FISH AND WILDLIFE BRANCH. 21 PAGES PLUS APPENDICES.
Abstract	
Title	FISH AND WILDLIFE VALUES: HOWE SOUND AREA
Location	
Location Comments	
Type	Government Report
Published Year	01-JAN-79
Author Name	PEATT, A.

Reference # HQ0910

Description	PREPARED FOR: CANADIAN FOREST PRODUCTS LTD.
Abstract	
Title	RECONNAISANCE (1:20000) FISH AND FISH HABITAT INVENTORY OF RAINY RIVER, MCNAIR CREEK AND DAKOTA CREEK WATERSHEDS
Location	BC FISHERIES, VICTORIA, BC
Location Comments	
Type	Consultant Report
Published Year	01-NOV-98
Author Name	HATFIELD CONSULTANTS LTD

Lake and Stream Information

Reference # SUM-2

Description	RL_SUMMARY
Abstract	
Title	
Location	
Location Comments	
Type	Government Database
Published Year	
Author Name	RL_SUMMARY

Reference # SUM-3

Description	EC_SUMMARY
Abstract	
Title	Summary from FSHWHSE
Location	FSHWHSE
Location Comments	FSHWHSE
Type	Government Database
Published Year	01-JAN-97
Author Name	EC_SUMMARY