Environmental Restoration Program at Bush Creek Bridge

Trans-Canada Highway
Oyster Bay I.R. #12
Vancouver Island, B.C.

March 30, 1999
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by

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ABSTRACT

The Ministry of Transportation and Highways is upgrading and widening the existing bridge at Bush Creek, adjacent to and on Oyster Bay Indian Reserve #12 north of Ladysmith, British Columbia, as part of the Vancouver Island Highway Project. That has resulted in the loss of a small area of the creek’s riparian habitat. The reserve land is held by the Chemainus First Nation and Bush Creek is to them a highly regarded resource for spiritual and cultural purposes, as productive habitat for species of salmon and trout, and as an area with wildlife and biodiversity value. This report presents the environmental restoration program developed to mitigate the loss of creek habitat by creating a series of deep, off-channel fish rearing ponds and using native, traditional use and medicinal plants of significance to the Chemainus First Nation to revegetate the fringes of the newly constructed fish ponds. The approach taken for environmental restoration at Bush Creek is new for the Ministry, working outside of its more established approach to environmental mitigation work in highway construction. It is also new for the Ministry to be doing environmental restoration work in partnership with a First Nation on reserve land. Partnering with the Chemainus First Nation to explore the potential benefits of environmental restoration on a smaller scale for this highway project raises the fundamental question of whether this approach is a viable precedent for the Ministry to apply to similar opportunities with First Nations in the future.
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INTRODUCTION

1.1 Highway Construction

The Ministry of Transportation and Highways (MoTH) is currently upgrading a 2.6 km section of Highway #1 north of Ladysmith, BC, from the existing two lane highway to a four lane divided highway with concrete median barrier. This project is part of the Vancouver Island Highway Project (VIHP). VIHP is a component of MoTH, but is considered to be a major project therefore it has its own budget, decision making capability and staff. The project, started in mid-1998, begins at the south boundary of Oyster Bay Indian Reserve #12 (IR #12) near Jones Road and ends at the north boundary of the reserve (Tab 1). The project will be completed in 2000.

The reserve land is held by the Chemainus First Nation (CFN). The CFN are part of the linguistic group Salishan. The name “Chemainus” is derived from the Island Halkomelem word ‘Tsa-mee-nis’ meaning ‘bitten breast’. The horseshoe shape of Oyster Bay and the range of hills near the reserve have the appearance of a man lying prone with deep cleft in his chest. The CFN are members of the Hul’qumi’num Treaty Group, and are at Stage 4 of the Treaty Process (agreement in principle stage).

An important component of the highway project, both from a design and environmental perspective, is the widening and upgrade of the bridge at Bush Creek. The highway crosses Bush Creek about 500 m north of Jones Road. The creek flows northeast through IR #12 into Ladysmith Harbour through a moderately large vegetated estuary (approximately 6 hectares). Both the creek and the estuary are highly regarded resources for the CFN for spiritual and cultural purposes, as productive habitat for species of salmon and trout, and as an area with wildlife and biodiversity value (Par Terre Design, 1998). The area also supports wetland plants because of seasonal flooding and high water table levels.
Since the bridge upgrade would result in the loss of a small area of the creek’s riparian vegetation and habitat, and right-of-way clearing would provide a suitable flat landscape, federal and provincial fisheries biologists determined that the most effective way to mitigate the loss would be by creating a series of deep off-channel fish rearing ponds (D. Polster, pers. comm.).

1.2 Restoration Program

As the first component of the environmental restoration program ('restoration program'), VIHP chose to construct four large off-channel fish rearing ponds of a combined area of approximately 1000 m², on both the north (two ponds) and south (two ponds) sides of Bush Creek at Bush Creek Bridge ('the site'). This network of ponds is located on land in the highway right-of-way and on IR #12. The ponds offer refuge for over-wintering coho salmon (Oncorhynchus kisutch) and cutthroat trout fry (O. clarki clarki) present in Bush Creek (T. Harding, pers. comm.). Each pond is enhanced by the placement of large woody debris (e.g., root wads), and the planting of aquatic plants. At one pond, a small area of spawning gravels has been deposited. The recreation of habitat results in "no net loss" of fish rearing habitat, and offers the potential for a significant increase in fish production, particularly of coho salmon (T. Harding, pers. comm.).

As the second component of the restoration program, the pond fringes at the site are being enhanced by planting native vegetation, traditional use and medicinal plants of significance to the CFN, to provide cover for fish, food for wildlife and people, and organic matter. Because of the construction of the ponds and the keen interest of the CFN in the habitat around Bush Creek, this component of the restoration program was required not only to mitigate construction impacts but also to revegetate an area of importance to the CFN community. The entire restoration program had to be planned and implemented to meet the scheduling, financial, and other demands of a major highway construction project.
2.1 Objectives

The objectives of this report are to describe the restoration program for the site as part of the Bush Creek Bridge upgrade project by:

(A) setting out the approach taken to develop the ponds and the revegetation plan;

(B) presenting the plan to revegetate the fringes of the newly constructed ponds; and,

(C) describing the implementation of the fish pond construction and the revegetation plan.

The objectives of the restoration program are (1) to construct off-channel fish rearing ponds to protect and enhance existing coho and other fish populations in Bush Creek; (2) to use native, traditional use and medicinal plants of interest to the CFN, and (3) to provide a self-sustaining, no maintenance vegetation cover which will enhance and protect the fisheries value of Bush Creek and the ponds.

3.1 Steps to Agreement

Approximately 220 kilometres of highway are being built or upgraded on Vancouver Island from Victoria to Campbell River, as part of the $1.2 billion VIHP.

Since 1991, VIHP has been assessing alignment alternatives for reconstructing the section of highway through IR #12. In addition to the usual concerns about engineering feasibility and cost, key considerations in this work have been: potential environmental impacts of the project on fisheries, wildlife, coastline, watercourses (e.g. creeks) and other resources; and, the need for the full support of the CFN for the design work because the highway upgrade
requires land from IR #12. Several alignment alternatives were investigated by VIHP and developed in collaboration with the CFN.

In 1993/94, VIHP proceeded with a design which would include upgrading and widening of the existing Bush Creek Bridge, creation of two full movement intersections and widening of the existing highway at specific sections from the south to north boundaries of IR #12 (Stanley Associates Engineering Ltd., 1994).

Between 1994 and 1997, the CFN and VIHP negotiated to determine adequate compensation to be paid to the CFN for the lands on IR #12 necessary for the highway upgrade. On April 27, 1997, the CFN and VIHP signed an agreement that included monetary compensation to the CFN and an exchange of lands to facilitate the upgrade. The map in Tab 2 illustrates the location of the reserve lands which are being (1) transferred to the Province for highway purposes, (2) used for temporary work and storage sites (not transferred to the Province), and (3) transferred from the Province to Canada, for the use and benefit of the CFN and for inclusion in IR #12.

3.2 Federal/Provincial Land Transfer

In order to build and maintain the highway across IR #12, the Province had to acquire from Canada the right to do so. Title to Indian reserve lands is vested in the federal Crown in trust for First Nations. Uses of reserve lands are governed by the Indian Act which is administered by Department of Indian Affairs Canada (DIAND). The Province does not have the jurisdiction to occupy or expropriate such land under federal jurisdiction without approval from the CFN and DIAND. For this project, VIHP first reached the agreement with CFN to obtain some reserve land (in return for monetary compensation and other land from the Province), and then applied to Canada for transfer of those reserve lands to the Province by federal Privy Council Order (PCO) under s. 35 of the Indian Act. In addition to the land transfer, VIHP was required to obtain approval from the CFN and permits from
DIAND for timber removal, and interim use of reserve lands for temporary work and storage areas, under s. 73(3) and s. 28(2) respectively, of the Indian Act.

In order to expedite the land transfer process and the acquisition of permits, a “s. 35 Transfer Team” was established by me, Manager, Road Tenure and Research, Aboriginal Relations Branch, MoTH, and comprised of CFN Councillors, consultants and staff from VIHP and DIAND. The group meet monthly after the signing of the agreement to work cooperatively to coordinate and facilitate all federal and provincial requirements necessary for the transfer of administration and control of the land on IR #12 and the land being provided by the Province in exchange (e.g., surveys, environmental assessments, land appraisals, temporary permits, timber permits to remove trees, and a provincial Order-in-Council).

In January 1999, MoTH obtained a provincial Order-in-Council transferring Crown land to Canada to complete all provincial requirements for the s. 35 transfer. In early February 1999, Canada transferred those portions of reserve land for highway purposes and other works of public utility to the Province under PCO 1999-143, and at that point, work on constructing the two intersections and widening the highway could begin. Prior to the land transfer, work had begun on clearing and grubbing the approaches to Bush Creek Bridge and on the Bush Creek Bridge upgrade because these areas were within existing highway right-of-way under the jurisdiction of MoTH.

3.3  Bush Creek

Bush Creek is bordered by the Haslam and Chemainus watersheds to the north and south, respectively, and flows northeast into Ladysmith Harbour with a catchment area of approximately 22.4 km² and channel length of 13 km. It is a small non-navigable creek characterized by in-creek and riparian vegetation, gravel beds and pools. In-creek water quality remains above average with low levels of suspended sediment.
The area that includes Bush Creek is located within the Nanaimo Lowlands Ecossection and is part of the drier Maritime subzone of the Coastal Douglas-fir biogeoclimatic zone of BC (Pojar and MacKinnon, 1994).

The area impacted by the bridge upgrade is characterized as a mid-to-mature seral stand dominated by Red Alder (*Alnus rubra*) and Blackcotton (*Populus balsamifera*) (Blood, 1998). Understories are dominated by Salal (*Gaultheria shallon*); Dull Oregon Grape (*Mahonia nervosa*); Oceanspray (*Holodiscus discolor*), ferns and numerous moss species. The entire old growth forest within the watershed has been logged and the watershed now supports mature second growth timber (SHIP Environmental Consultants, 1998). Some of the second growth has been logged, however water quality in the creek appears to have remained above average.

The Bush Creek riparian area has habitats of high wildlife and biodiversity value and provides habitat for a wide variety of riparian-associated mammals, birds, and amphibians, movement corridors for birds and mammals, shading and bank cover, as well as a source of browse and berry production, insect drop and detritus important to aquatic invertebrate production (Blood, 1998). A beaver is resident at Bush Creek, and dams a portion of the creek south of Bush Creek Bridge.

The lower 2.4 km of Bush Creek provides high quality spawning and productive rearing habitat for chum, coho and pink salmon, as well as steelhead and cutthroat trout, and has one of the highest rearing densities on the east coast of Vancouver Island (SHIP Environmental Consultants, 1998). Coronation Lake, at the head of an unnamed tributary to Bush Creek, was stocked with cutthroat fry by the Ministry of Environment, Lands and Parks (MELP) in 1986, 1994 and 1995. The first release was 5,000 fish and subsequent releases were 1,000 fish each. A small Salmonid Enhancement Project, Public Involvement Program, hatchery is located approximately 5.5 km upstream from the highway. It opened in September 1996.
and is operated by the Ladysmith Sportsmen’s Club. Salmon escapement records for Bush Creek are shown in Tab 3 (SHIP Environmental Consultants, 1998).

The riparian floodplain is infrequently flooded (e.g., > 5 year return interval) and is comprised of compact sandy gravels overlying soft - firm silty clay (Stanley Engineering Associates Ltd., 1992).

The terrain consists of the Bush Creek fan comprising compact sandy gravels overlying soft to firm clay. Adjacent to the soft silty clays are areas of dense gravelly sandy silt which are probably glacial tills. These tills are largely overlain by a thin veneer of marine silty gravels. In the wetland areas adjacent to Bush Creek, thick deposits of silty clay with organics dominate (Lister, 1992).

3.4 Bush Creek Bridge

The bridge being upgraded was constructed in 1951 and is a single span steel girder structure with a reinforced concrete deck, carrying two lanes of traffic on Highway #1 over Bush Creek. Since the bridge is within highway right-of-way under the jurisdiction of MoTH (not considered part of IR #12), work to upgrade the bridge was started in mid-July 1998 and completed in December 1998. The old bridge (8.23 m wide with a span of 21.3 m), has been widened to the west (6.9 m) and east (10.8 m) to accommodate the additional lanes (Stanley Associates Engineering Ltd., 1992). Although the span remains the same, the existing in-stream bridge abutments were extended to accommodate the widening.

The bridge upgrade eliminated a small but significant area (0.03 ha) of highly rated riparian and wetland habitat along Bush Creek, immediately adjacent to the existing and proposed bridge abutments. Direct impacts involved the removal of riparian vegetation, some disturbance to the creek banks, and small encroachments on shallow wetland habitat and the stream channel. VIHP wanted to provide mitigation prior to the impacts so that the new habitat could stabilize and provide immediate benefits as off-channel fish rearing habitat.
Work to implement the mitigation measures which would have to be done on existing highway right-of-way and IR #12, also began prior to land transfers (which were legally completed in February 1999). The mitigation work on IR #12 required the consent of the CFN under a Band Council Resolution (BCR).

3.5 Environmental Assessment

MoTH is responsible for constructing and maintaining highways in an economically feasible and socially and environmentally acceptable manner. To achieve this, MoTH is required under a variety of federal and provincial legislation (e.g., federal Fisheries Act), to prepare environmental studies to ensure that direct and indirect impacts inherent in highway construction are considered, and that appropriate mitigative measures are implemented to avoid or minimize adverse consequences. For the Bush Creek upgrade, there were both formal and informal processes involved. The informal process involved discussions between Department of Fisheries and Oceans (DFO), MELP and VIHP regarding possible mitigation measures. These discussions began prior to the formal environmental assessment process and continued during that process.

As much of the Bush Creek upgrade is located on IR #12, the formal process was a review under the Canadian Environmental Assessment Act (CEAA). DIAND retains the legal responsibility for screening projects of this type, making it the responsible authority under CEAA. In accordance with CEAA regulations, proponents must submit an environmental assessment report (EA report) to the responsible authority to address the potential environmental impacts and mitigative measures associated with the project. DIAND will refer the report to various agencies (e.g., DFO and Department of Natural Resources Canada).

(disposal areas and gravel pit development), and highway operation and maintenance activities within IR #12. The reports review a number of environmental matters including water quality, soil and sediment control, vegetation, wetlands, fisheries, wildlife, hazardous wastes, archaeological sites, floodplains and other environmental and socio-economic concerns significant to the CFN (e.g., noise, visual quality and recreation).

Both reports were based on information found in a number of related project reports (e.g., Stanley Engineering Associates Ltd., 1994 and 1992), site visits, data collection, and interviews with appropriate federal/provincial agencies and CFN members. In addition, VIHP conducted environmental audits of all lands that were transferred to Canada for the use and benefit of the CFN.

As part of the CEAA process, DIAND referred the reports for comment to various federal agencies, particularly DFO. The reports were accepted as complete by DIAND on July 7, 1998. On October 8, 1998, DIAND informed MoTH that its CEAA Screening for the project through IR #12 supported a screening decision code of 01 meaning: “Effects not likely significant (considering mitigation) and public concern does not warrant further assessment - project proceeds” (Alexis, 1998).

### 3.6 Proposed Mitigation

The main environmental concerns identified through informal discussion with DFO and the formal CEAA process were impacts on the land of IR #12 (e.g., timber removal for highway right-of-way), and some minor residual effects on wildlife, drainage and the water quality and fish habitat of Bush Creek and other small streams. Prior to construction work in or near Bush Creek, formal approval was required from DFO and MELP to ensure that adequate measures were undertaken to protect existing fish and fish habitat, and to mitigate incursions into the identified riparian and wetland areas. As well, all instream work was restricted to ‘fisheries windows’, from June 15 to September 15, to be enforced by MELP and DFO.
DFO recommended in early January 1998, that VIHP mitigate the encroachment of the Bush Creek bridge abutments on the high water wetted channel and the riparian zone by investigating the potential of enhancing habitat through construction of salmonid rearing ponds adjacent to the creek.

**RESTORATION PROGRAM ISSUES**

SECTION 4

Given this background, the following six key issues affected development of the restoration program. These issues required serious consideration in the development of the approach to the restoration program and in turn, the restoration program was required to address each of these issues in order to be successfully implemented. The six issues are:

1) CFN Involvement;
2) Native, Traditional and Medicinal Plants;
3) New Model;
4) Multiple Regulatory Jurisdictions;
5) First Nations Land; and,
6) Highway Construction.

**4.1 CFN Involvement**

The CFN requested an active role in all aspects of the highway construction, with specific attention to the construction impacts on Bush Creek. Providing a voice for the CFN in planning helped identify critical needs and concerns early in the design, construction and operation phases of the highway widening and the proposed environmental mitigation measures. This approach helped reduce potential misunderstandings and conflicts.

The CFN demonstrate experience in the area of environmental management and are participants in Forest Renewal BC and DFO Fish Enhancement Programs. They have staff
and residents qualified in the areas of archaeology, landscape planning, wildlife and ethnography. The CFN fisheries staff have surveyed the entire Bush Creek reach within IR #12 and are interested in stream restoration and the operation of the fish hatchery upstream from the bridge (J. Alexis, pers. comm.). These staff were invaluable in providing advice regarding appropriate measures for in-creek work as well as during construction of the ponds, the plant salvage and development of the revegetation plan.

More importantly, CFN Council activities have focused on recording community Elders’ knowledge of local plants, fish and wildlife resources. Various council members and Elders made VIHP aware of environmentally sensitive areas that are habitat to traditional use plants, for example, Devil’s Club (*Oplopanax horridus*) and Cascara (*Rhamnus purshiana*) in advance of construction activities. They also viewed the restoration program as an opportunity to promote environmental education and awareness of the fish ponds and revegetation plan among the CFN residents, schools and community organizations (*Tab 4*). It was critical that the CFN participate as a partner in the restoration planning team.

### 4.2 Native, Traditional Use and Medicinal Plants

The CFN viewed the revegetation plan as an opportunity to reintroduce native, traditional use, and medicinal plants to their community (Mitchell, 1998). A key element of the program was for the CFN and community Elders to assist VIHP identify plants to be established in suitable areas around the ponds and to provide the name of the plant in the Chemainus language of the CFN (*Tab 5*). They requested the inclusion of plants such as:

- Devil’s Club, Qwapu’l’p, (for food and medicine - the roots and stem were used to prepare treatments for arthritis, digestive problems, upper respiratory infection and diabetes);
- Big Leaf Maple, Qumumu’l’p, (known as the Paddle Tree and used for paddle making and ceremonial masks);
- Cascara, qey’h’u’l’p, (used for tools);
- Red Alder, *KwuLa Lu' u' L'p*, (an old legend tells that if it is present around a pond the water is good for drinking);
- Cottonwood, *tsuw'nu' L'p*, and Bitter Cherry, *tuLum' u' L'p* (bark used in tea for arthritis);
- Pacific Willow (a natural source of aspirin in the bark and used for barbecuing salmon);
- Cattails (used for weaving mats and baskets);
- Wild ginger (provides a cleansing bath); and,
- varieties of soapberry, red flowering currants and wild strawberry (berries were dried and eaten); and other food plants such as the bulbs of camas.

Therefore, in addition to incorporating plants native to the area, the restoration program had to try to obtain some of these specific traditional use and medicinal plants.

### 4.3 New Model

Typically, MoTH is required to plan, design, construct and maintain highways to ensure the proper implementation of environmental and mitigation measures to comply with environmental specifications prescribed by government agencies. However, in this situation, VIHP went beyond what is legally or technically required. VIHP used the ability to partner with CFN to minimize adverse effects on aquatic and riparian resources by constructing the fish ponds and revegetating the pond fringes using native, traditional use and medicinal plants of significance to the CFN.

This approach was new for MoTH, - to have a major project such as VIHP working "outside" of the more established approach to environmental protection work in highway construction projects. It was also new for VIHP to be doing restoration work on First Nation land. It required cooperation, and cultural sensitivity of VIHP staff, to carefully consider the unique philosophies and principles of the CFN with respect to their community's environment to avoid potential conflicts on issues of concern to the CFN. VIHP used the
partnership with CFN to set aside an “engineered approach” to environmental mitigation and to explore the potential benefits of habitat and riparian restoration on a smaller scale, and in a manner sensitive to the goals of the CFN community. There is pressure for the success of this project, so that it can be seen as a viable precedent for MoTH to apply to similar opportunities with First Nations in the future.

4.4 Multiple Regulatory Jurisdictions

This process was different from most highway construction projects because it involved two streams of approvals at the same time. One stream involved requirements under federal and provincial regulations to assess and mitigate potential environmental impacts from the highway project and to obtain formal approval from agencies such as DFO and MELP before undertaking any in-creek construction. The second stream of approvals involved meeting requirements of DIAND, DFO, Department of Environment, Public Works Canada and, most importantly, the CFN, in relation to the land transfer process and the mitigation work on IR #12.

In addition to the government approvals, the CFN has enacted bylaws that require disturbances to the environment to be minimized and appropriate mitigative measures to be implemented. These various requirements meant that VIHP had to undertake a restoration program that would meet the approval of both the CFN and government agencies.

4.5 First Nations Land

As noted, the title to IR #12 is legally the Federal government’s, and any matters dealing with reserve land fall under the Federal Indian Act. The consent of the CFN was required and obtained prior to all work conducted by VIHP on IR #12 lands. DIAND, because of its ‘fiduciary responsibility’, also had to approve the construction activities. In addition, being First Nation land meant that the rules for environmental mitigation on IR #12 were different than on adjacent provincial Crown or private land also impacted by highway construction.
4.6 **Highway Construction**

While MoTH has certain obligations for rehabilitation and mitigation, it is important to remember that the restoration program is only one small component of a much larger highway engineering project. The demands of the project (e.g., construction scheduling constraints, “budget bottom-lines”, political decisions to proceed) had impacts on the planning, field work and general development of the restoration program, as well as shaping the time frame for and the extent of its implementation. For example, the timing of the upgrade to Bush Creek Bridge was compressed from its original construction date of 2001 to 1998 for budget reasons, which in turn accelerated the need to construct the ponds and revegetate the fringes of these ponds.

The result of this pressure meant that in-depth analysis of base line data such as soil, hydrology and vegetation was not practical and instead, field studies involving talking with CFN Elders, general site inspections, recording of vegetation and interpreting hydrologic characteristics were completed. The restoration program had to be practical, “do-able”, and affordable.

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**METHODOLOGY**

To effectively plan and implement the restoration program, a ‘restoration team’ was established in early May 1998 comprised of Dolores Seymour and Percy Seymour, CFN; Dave Polster, VIHP Environmental Coordinator; Ed Van Osch, On-site Environmental Monitor, Van Osch Environmental Services; Ted Harding, Fisheries Consultant, SHIP Environmental Consultants; Dr. Nancy Turner, Ethnobiologist, University of Victoria; and me.
5.1 Site Visits and Field Assessments

Eighteen site visits were carried out between May 1998 and December 1998. During these early visits, issues involving potential revegetation treatments, drainage control, danger tree removal, plant salvage opportunities, operation and timing of equipment and human use of the area were discussed. Local vegetation type were recorded and evaluated for application in the revegetation recommendations. Basic site information (slope, aspect, soil moisture, elevation, surface shape, exposure, nutrient regime, etc) was recorded. Detailed soil descriptions were not done, but basic soil and terrain classifications were extrapolated from soil and terrain maps (Day et al, 1959). Further visits in later summer and winter focused on actual pond construction, equipment operation, and planting of the salvaged plants and nursery stock.

5.2 Discussion with CFN Elders

Between June and July 1998, three meetings of the ‘restoration team’ with CFN Elders were held at CFN offices to discuss construction of the fish ponds; native, traditional use and medicinal plants; and, the restoration program. One meeting involved a presentation by Dave Polster on native plants suitable or revegetating the fish ponds followed by discussion on plant species, availability and quantities, and, identification by the CFN Elders of the Chemainus language names of some of the plants being considered in the revegetation plan. The minutes of the meetings and presentation notes are in Tab 6. As noted previously, a list of some plants in Chemainus Language is in Tab 5.

During this period, members of the ‘restoration team’ also conducted two on-site visits to record and inventory existing vegetation; identify suitable salvage plants and plants of traditional significance to the CFN; identify plant gaps (e.g., traditional plants that had become rare in the area such as Devil’s Club); and discuss aspects of the proposed fish ponds necessary for optimal survival of specific native and traditional plants (e.g., planting locations, timing windows).
Existing site vegetation was identified during a site visit on September 22, 1998 using Pojar and MacKinnon (1994), Turner (1992), personal communication with CFN Elders, and the data from three vegetation plots (Blood, 1998). Dr. Nancy Turner’s field notes from the site visit are in (Tab 7).

5.3 Literature Review

Information on the physical character of the site was obtained from four sources: (1) aerial photographs from Maps BC; (2) photographs taken during site visits (Tab 12); (3) reports on soil type and hydrology from survey maps and VIHP consultant reports on geotechnical, fisheries, wildlife and environmental assessment; and (4) CFN newsletters and related publications (Tab 4).

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FISH POND CONSTRUCTION

The first component of the restoration program at the site was construction of the ponds. The following sets out the key steps in the pond planning and construction process.

6.1 December 1997 - January 1998

After an onsite inspection on December 19, 1997, DFO identified in early January 1998 three large areas of potential fish habitat adjacent to the creek (Eliasen, 1998). Fisheries consultants hired by VIHP reviewed the DFO recommendation and proposed the construction of off-channel fish rearing ponds in the three areas.

This approach was suggested not only to replace habitat impacted by construction work near Bush Creek Bridge, but also because a limiting factor for salmonid production in Bush Creek is a lack of off-channel winter rearing habitat (e.g., wetlands, side channels). Coho, because of a one year residence in the creek prior to going to sea, are in great need of this
type of habitat. At Bush Creek, heavy winter rains cause high velocity freshets and flooding. If the fry are caught in the creek, flood events can sweep them out through the estuary to the sea prematurely, losing them to predators (T. Harding, pers. comm.). The construction of off-channel habitat such as fish ponds and interconnecting channels was expected to provide warmer waters (salmonids prefer water temperatures between 6 - 7° C, but no greater than 20 - 24° C) and protect and enhance existing coho and other fish species populations in Bush Creek (E. Van Osch, pers. comm.). To identify possible areas for pond construction, the Bush Creek Bridge area was divided into 4 quadrants - northeast, northwest, southeast and southwest. For example, the southeast quadrant is south of Bush Creek on the east side of the highway.

6.2 February 1998 - March 1998

Field inspections by VIHP and fisheries consultants were done to revise the plans for the ponds and wetland rehabilitation projects. During this time, it was agreed that all ponds would be set back from the fill of the proposed widened highway, allowing for a vegetated buffer between the new highway and the ponds. The plans also showed that VIHP could use the area within the new highway right-of-way as a deposit area for material removed from the pond excavations (this was later rejected and the organic material was trucked off-site for use as non-structural fill at other sites).

6.3 May 1998

After direct input from CFN Fisheries Officers, in early May 1998 VIHP submitted to DFO and MELP plans for the ponds in the wetlands adjacent to the bridge, along with the proposal to construct the ponds during the current fisheries window, from June 15 to September 15, 1998. All ponds would be at least 1.0 m deep, large woody debris (e.g., conifer root wads greater than 1 m in diameter) would be placed in all the ponds to provide habitat and cover, and if appropriate, spawning gravel would be placed at some pond outlets.
to encourage spawning in the area (Ship Environmental Consultants, 1998). The proposed pond sites are discussed below and additional design specifications are outlined in *Tab 8*.

- **Southeast ponds (ponds #1 to #9):**
  The southeast drainage would be augmented by construction of a series of 9 shallow wetland habitats that drain into Ladysmith Harbour, but not into Bush Creek. During high flow, Bush Creek overflows into these wetlands. Construction of approximately 800m² of fish rearing ponds was proposed to mitigate a loss of approximately 300m² of riparian vegetation. The flow pattern in this wetland would be reversed by a weir to divert the water into Bush Creek, and not have Bush Creek flow into it.

- **Northeast ponds (ponds #10 and #11):**
  Construction of the two northeast ponds would result in a net gain of fish habitat. It was proposed that the ponds be excavated in an existing seepage channel to create approximately 60m² of fish rearing habitat. An outlet culvert would be modified to provide fish passage into the ponds.

- **Northwest ponds (ponds #12 and #13):**
  As in the northeast drainage, the fish habitat was considered insignificant. It was proposed that two ponds be excavated to provide a total of 200m² of habitat. An outlet culvert would be modified to improve fish access into the ponds.

In late May 1998, DFO approved in principle the ponds with the following conditions (Eliasen, 1998):

1) excavate the ponds to 2 meters deep;
2) consolidate the 13 ponds into larger ponds to achieve a 2 meter depth;
3) store or plant all spoil materials;
4) monitor the outlet channels to ensure they allow for free passage of fish;
5) implement a monitoring program to ensure the ponds function properly; and,
6) install spawning gravels only if sufficient channel gradient between the pond or in the outlet channels can be achieved.
Highway construction had now begun within the existing highway right-of-way with clearing, grubbing and stripping underway within all quadrants of Bush Creek. At the same time, tree removal, clearing and grubbing at all Bush Creek Bridge approaches were underway or nearing completion and the areas identified for fish ponds were delineated and cleared. An engineered wetland pond was constructed in the northeast quadrant to collect storm water and sediment from construction. This wetland area is not considered a fish pond and fish access is restricted. However, in periods of high water in Bush Creek (e.g., flooding), some fish stranding in the wetland pond could occur.


Several meetings were held with the ‘restoration team’ to discuss and refine the pond design and to begin preliminary work on planning the revegetation program for the pond fringes. On June 3, 1998, the CFN Council passed a BCR supporting the construction of the ponds and associated habitat within the existing MoTH right-of-way through IR #12 and on a small portion of IR #12 (Tab 9).

Part of the plan was for VIHP to provide the construction expertise and equipment for development of the fish ponds as well as environmental monitoring during construction. CFN Fisheries Officers were to ‘shadow’ construction of the fish ponds to add to their environmental knowledge of Bush Creek fisheries and to develop ongoing management expertise of the fish pond habitat.

At this time, the ‘restoration team’ also began to focus attention on the revegetation plan for the areas disturbed during construction of the ponds. The ‘restoration team’ agreed that creating three ‘dry gravel and earth mounds’ interspaced between the south facing fish ponds would be a valuable addition to the restoration program and would provide a raised environment out of the wetland for drought resistant plants such as Garry Oak (Quercus garryana) and Kinnikinnick (Arctostaphylos uva-ursi). In addition, a Camas bank (with
Garry Oak) was designed for the north side of the highway fill approaching Bush Creek from Ladysmith. Because of the coarse shallow soils, natural drainage and aspect (dry summers - cool wet winters) of the cut bank, it appeared likely that a mix of Camas and Garry Oak could be successfully established. These two features of the revegetation plan were in keeping with the CFN request to create an environment suitable for the planting of traditional use plants.


The Bush Creek Bridge approaches were finally cleared and grubbed, and woody debris (e.g., coniferous root wads) was stockpiled for use in the ponds as shade and cover. Three youth members of the CFN were employed by VIHP to salvage plants, mainly slough sedge (Carex obnupta) prior to excavation of the ponds. Because the youths would be operating within a construction zone, they received basic instruction on recognizing and reducing potential risks (e.g., working around heavy equipment, each was provided with a hard hat, vest and required to wear steel-toed boots on site).

At this time, a significant decision was reached by the ‘restoration team’ that four large Ponds, of variable depth (e.g., up to 3m deep) and completed with large woody debris, would be the best design. This design would maximize the area available to improve habitat, ensure optimal survival of the planted materials, maximize construction efficiencies (easier to dig) and provide a larger, deeper and more stable habitat for fish. The four Ponds are labeled A, B, C, and D. (Tab 10).

6.6 July 1998

Construction of Ponds A and B started on July 8, 1998 in the southeast quadrant, with work progressing over a period of two weeks through to Pond C located in the northeast and Pond D located in the northwest quadrant. The four Ponds were completed by mid-July 1998. This network of ponds was then connected to Bush Creek once the ponds were stable and
any sediment caused by construction had settled. As the four ponds are all within a natural wetland area, they are also recharged by seepage from groundwater (year round) and flooding from Bush Creek in times of high water (e.g. winter).

**Ponds A and B** are connected by a 600 mm diameter galvanized steel culvert to allow for water and fish passage through from each pond. In turn, in the northeast corner of Pond B, a small channel connects the pond to Bush Creek. This hand-dug channel is approximately 0.5 m deep and 1 m wide, and provides a flow of water into the ponds during normal winter flow conditions. This two-pond system is activated by a small dam in the southeast corner of Pond A that prevents surface water from flowing south out of the pond and forces a positive outflow of the warmer water from the ponds through the channel into Bush Creek during the winter period.

In the southeast corner of Pond C, a 600 mm diameter culvert connects the pond to Bush Creek. A 30m long channel was excavated to link Pond D in the northwest quadrant with the creek. A 50/50 mix of 3/8 inch pea gravel and washed, non-crushed 3/4 inch gravel was placed in this channel to provide potential spawning habitat for coho and cutthroat trout. **Pond D** is located in an area of groundwater seepage which promotes good water exchange through the pond.

In terms of water temperature, the groundwater in winter ensures slightly warmer temperature in the ponds than in Bush Creek. This promotes re-migration of juvenile salmonids from the creek. The warmer water also aids in food production - resulting in feeding and greater size of juvenile salmonids prior to smolting and going to sea. Groundwater in summer should lower the water temperature in the ponds relative to the creek creating better summer rearing habitat as well (E. Van Osch, pers. comm.). However, coho juveniles will have gone to sea and not be resident in the creek at this time (as the ponds were primarily constructed to provide over-wintering fish rearing habitat).
Between 50 and 60 coniferous root wads were then placed in the ponds along with smaller logs, branches and woody debris. These structures were stacked in a ‘pyramid style’ to provide maximum shade, cover and refuge for overwintering fish. In August and September 1998, small groups of threespine stickleback (Gasterosteus aculeatus) were seen in Ponds B and C. In late November 1998, three traps were placed in Pond D - 2 traps in the large woody debris and 1 trap near the woody debris closer to the pond edge. A total of 24 juvenile coho were caught and sampled from the 2 traps in the large woody debris (this was probably due to the fish seeking refuge in the debris, which seems to validate the use of root wads and woody debris in constructed fish ponds). No fish were caught in the one trap near the pond edge. Pond C was also sampled but no fish were caught (E. Van Osch, pers. comm.). The resident beaver has been observed in Ponds A and B (E. Van Osch, pers. comm.).

6.7 Equipment and Supervision

The ponds were constructed using a CAT 120 Excavator with an extended arm attached with a wrist pin or "wrist and twist" bucket. The bucket capacity was approximately 1m$^3$. Three key components contributing to the quality of the habitat constructed were (1) the skill and sensitivity of the equipment operator to the surrounding environment which minimized damage to adjacent trees or plants; (2) the experience of the operator gained from constructing off-channel fish ponds at other construction sites (the operator’s skill greatly contributed to maximizing the volume and quality of the excavated ponds); and, (3) the extended arm with a wrist pin bucket which provided better access to the pond sites from a limited number of working areas and allowed for better contouring and sloping of the fish pond sides.

Nearly all of the sediment generated during pond construction was retained within the excavated ponds. Pond waste material was trucked and disposed off-site where it was dried, de-watered and then used as side slope fill. The ponds were completed in approximately 12 working days averaging 10 hours per day. The cost, including construction, labour and the
placement of root wads was approximately $25,000 - $30,000. A combination of hard fescue (grass seed) and fertilizer were later hand broadcast over the slopes around the four ponds to provide a quick seasonal cover and to prevent erosion. The salvaged plants (e.g., sedges) were replanted around the pond fringes.

On-site supervision during construction of the ponds was provided by restoration program team member, Ed Van Osch, to help guide the equipment operator, ensure the work met the general design plan and resolve technical construction issues. Regular bi-weekly progress reports were filed with Environmental Services, VIHP. All work conducted conformed to Workers Compensation Board regulations for job safety with certified first aid attendants and supplies available on site.

**REVEGETATION PLAN**

This section describes the second component of the restoration program - the revegetation plan for **Ponds A, B, C and D**. It includes the steps taken to implement the plan (e.g., planting).

### 7.1 Revegetation Plan

The revegetation plan covers an area of approximately 0.75 ha and has been divided into **five vegetation zones** - two distinct zones identified as (1) gravel mounds (3 mounds) and, (2) Camas bank; and zones (3) wetland, (4) open edge moist and, (5) interior forest moist that surround the fringes of the four ponds. It is suggested that the reader use the plan at **Tab I3** as a guide while reading this section of the paper.

A plant list for each zone was compiled by the restoration team at a meeting on September 22, 1998 at the CFN Council offices. Plant numbers were later added to the draft plant list on October 13, 1998 by myself, Dave Polster, and Gene Mazza, Landscape Design
Coordinator, VIHP, based on the latter two's experience and the goal of planting sufficient numbers of plants to ensure survival (Tab 11).

No specific plant-to-area ratio or predetermined formula for plant numbers or spacing was used. The plants were obtained from Robert Glenn Native Plant Nursery, Matsqui, BC. The budget is approximately $5000.00 for plants and $2000.00 for labour.

The five zones and four ponds are shown in plan view in (Tab 13), along with the plants and quantities.

From mid-November 1998 to early January 1999 plant availability and suitable weather meant the initial phase of planting began in four of the zones (excluding the Camas bank). Three members of the CFN, under the supervision of Ed Van Osch, Environmental Monitor, were hired to hand plant the nursery stock with small shovels and trowels. No fertilizer or irrigation was applied to the plantings. Planting took place over a 6 week period (approximately) and further planting will occur in Spring 1999 as nursery stock becomes available and the weather improves.

In total, the revegetation plan for the four fish ponds calls for the planting of 2125 bulbs and plants of 61 different species to be supplemented with some salvaged plants and infill plantings of willow and red-osier dogwood.

The following 10 plants were requested by VIHP but at the time of this report have not been sourced or delivered by the nursery. These plants will be billed for when delivered; they are:

- **Zone 1** - Indian Consumption Plant (*Lomatium nudicaule*)
- **Zone 3** - Yellow Pond Lily (*Nuphar polysepalum*) and Bulrush (*Scirpus lacustris*)
- **Zone 4** - Rattlesnake Plantain (*Goodyera oblongifolia*), Field Mint (*Mentha arvensis*), Bitter Cherry (*Prunus emarginata*), White Bog-Orchid (*Platanthera dilatata*), Red-Osier Dogwood (*Cornus stolonifera*) and Yerbe Buena (*Satureja douglasii*)

- **Zone 5** - Wild Lily-of-the-Valley (*Maianthemum dilatatum*) and Devil’s Club

### 7.2 Zone 1 - Gravel Mounds

Three coarse sand and gravel mounds approximately 3m long by 1m high have been placed on the edges of **Ponds A and B**. One mound is located at the east end of **Pond A** and two mounds have been placed in the middle and at the northwest end of **Pond B**. Each mound will be planted with 153 plants of 12 different species of dry, drought resistant plants.

Plantings were done of Kinnikinnick, Oceanspray (*Holodiscus discolor*), Garry Oak, Nootka Rose (*Rosa nutkana*) and Mock-orange (*Philadelphus lewisii*). In addition, clumps of 10 bulbs per mound of mixed Camas (*Camassia quamash* and *C. leichlinii*) were planted. One plant for which a source has not been found is Indian Consumption Plant.

### 7.3 Zone 2 - Camas Bank

The camas/Garry Oak bank is next to **Ponds A and B** and is on the northeast fill slope of the highway. Planting will occur here in late spring 1999 because areas of the bank have slumped or been eroded by heavy rains experienced throughout the fall and winter of 1998/1999. In addition, MoTH will be working with the CFN to construct a path from Bush Creek bridge, down the Camas bank slope and across into the Chemainus reserve. The exact location of the path needs to be determined and the bank area requires repair and stabilization, prior to the planting.

Four plant species planned for the site are bulbs of Mixed Camas (*C. quamash* and *C. leichlinii*), Chocolate Lily (*Fritillaria lanceolata*), Nodding Onion (*Allium cernuum*) and
Garry Oak. The Chocolate Lily and Nodding Onion have been delivered and have been stored off-site for Spring 1999 planting.

The bulbs and plants will be located in clumps along the edge of the slope to achieve a natural rather than a landscaped setting. The Garry Oak saplings will be protected from wildlife browse with plastic collars and if necessary, supported by wood stakes.

7.4 Zone 3 - Wetland

A wetland area has been established in each of the four ponds. Based on numerous site visits, this is an area likely inundated during high water conditions which retains moisture in dry or drought conditions (e.g., periods of standing water). In Ponds A and B, the wetland areas are south facing and exposed because of the removal of vegetation for highway construction. As vegetation reintroduces itself to the area, these wetlands will become more shaded. The wetland areas of Ponds C and D are located in shady, moist conditions that are expected to be buffered from light and heat by existing vegetation year-round. Some of the salvaged plants (sedges) have been planted along with 296 plants comprising 8 species of native wetland plants.

Six species were planted during December 1998 and January 1999: Slough Sedge (Carex oshumpta), Deer Cabbage (Fauria crista-galli); Skunk Cabbage (Lysichiton americanum); Bogbean (Menyanthes trifoliata); Arrowhead (Sagittaria latifolia); and, Cattail (Typha latifolia). As noted above, Bulrush and Yellow pond lily have not been sourced or delivered. The plants were selected not only because of their wetland characteristics, but because they provide good habitat for small birds and amphibians. They also act as filters, filtering pollutants from the water and giving sediment time to settle, while the clean filtered water flows through the ponds to the creek. In addition, cattails and bulrush have been used by Southern Vancouver Island First Nations for weaving mats or baskets (D. Louie, pers. comm.).
7.5 Zone 4 - Open Edge Moist

All ponds are to be revegetated with a mixture of over 876 plants of 26 species typically found in an open edge moist environment. At ponds A, B and C, this area is found on the southwest side of each pond, and at Pond D on the northeast side. These areas were extensively impacted by construction of the ponds (e.g., total vegetation removal, compaction of soil by equipment, and exposure to heat, light and other stresses due to the proximity to the highway), and by construction activities related to the new approaches to Bush Creek. All ponds will be revegetated with the following 5 plants: Red Columbine (*Aquilegia formosa*); Rattlesnake Plantain; White Bog-orchard; Field Mint; and, Yerba Buena. Only Red Columbine has been planted; the remaining four plants noted above have not been sourced or delivered.

In addition to these 5 species, 21 other plants have been planted at one or more of the ponds depending on the suitability of the plant to the site conditions. The exposed nature of all sides of Pond A required a series of fill plantings of Red-Osier Dogwood (*Cornus stolonifera*) and Willow (*Salix species*) to supplement the other plantings. Approximately 125 willows have been live staked around the nursery stock. No Red-Osier Dogwood has currently been harvested for infill planting at the pond sites, however harvesting and planting is expected in Spring 1999.

Because of the drier and exposed conditions at ponds A and B, plantings have included Goatsbeard (*Aruncus sylvester*), Black Hawthorne (*Crataegus douglasii*), Blackcap (*Rubus leucodermis*), and Pacific Crabapple (*Pyrus (Malus) fusca*). One plant not available at this time is Bitter Cherry.

At pond B, Silverweed (*Potentilla pacifica*), Blue Elderberry (*Sambucus caerulea*) and Highbush Cranberry (*Viburnum edule*) have been planted to provide cover and food for wildlife, and litter and insect drop for the fish ponds. At pond C two other species, Pacific Ninebark (*Physocarpus capitatus*) and Salal (*Gaultheria shallon*) were planted for cover
and wildlife food. At pond D, Thimbleberry (*Rubus parviflorus*), Salmonberry (*Rubus spectabilis*), and a limited ground cover of Wild Strawberry (*Fragaria virginiana*) have been planted. At ponds C and D, Vanilla-Leaf (*Achlys triphylla*) were used because of the cool, moist and shady conditions generally found at these two ponds.

7.6 Zone 5 - Interior Forest Moist

Surrounding the ponds, except for Pond A, is a dense layer of interior forest moist environment. The construction of Ponds B, C and D resulted in the destruction of some existing vegetation in this environment. Because of the configuration of Pond A, there were no plants or vegetation of this environment impacted by the pond construction. In general, this environment is dominated by tall trees such as Amabilis fir (*Abies amabilis*) and a dense understory of herbaceous plants including invasive Himalayan Blackberry (*Rubus discolor*) and some Daphne (*Daphne laureola*). The soil is cool and moist year-round, except for periods of extended drought (generally July and August). Where small depressions are found, standing water can occur after periods of heavy rain, indicating a high water table. At Ponds B and C, the area of this environment is located at the northeast side of the pond, and at Pond D on the southwest side.

These areas were planted with 390 plants comprising 11 different species of plants commonly found in an interior moist forest environment. As noted above, Wild lily-of-the-valley has not been sourced or delivered. Species planted included Western Yew (*Taxus brevifolia*), Wild Bleeding Heart (*Dicentra formosa*), Cascara (*Rhamnus purshiana*) and Dwarf Wild Rose (*Rosa gymnocarpa*). As noted previously, the CFN Elders specifically requested the planting of Wild Ginger (*Asarum caudatum*) and Devil’s Club for medicinal and traditional use.

Unfortunately, only eighteen of fifty Devils’ Club plants were delivered and these plants were stolen prior to planting. An additional fifty Devil’s Club plants have been ordered for Spring 1999 planting (E. Van Osch, pers. comm.).
8.1 Monitoring and Evaluation

Monitoring and evaluation is a critical and acclaimed (but often neglected) component of natural areas restoration. In restoration initiatives related to major construction projects, such as VIHP, monitoring may be overlooked after this phase of the project is completed. Those involved quickly turn to the demands of planning and completing the next phase of construction.

Post-construction fisheries assessments are often conducted by consultants to VIHP for the purpose of assessing whether mitigation/compensation measures have offset the project’s negative effects on fish and fish habitat. On certain projects, where creek beds have been completely relocated and new channels or back channels have been constructed to replace habitat impacted by highway construction, MoTH has implemented long term post-construction monitoring programs to assess the success and failure of mitigation measures (e.g., Craigflower Creek - Post Construction Fisheries Monitoring Program 1996/97 Annual Report).

MoTH is not required by DFO to implement a formal post-construction monitoring program for this restoration program. DFO did recommend as part of the approval for the pond construction that MoTH implement a monitoring program to ensure the ponds function properly. VIHP did have an environmental monitor on site while construction of the ponds was underway to ensure the ponds are functioning. Since they are functioning VIHP takes the view that they have satisfied the monitoring program.

At Bush Creek, because of the small localized impacts to the creek banks and riparian vegetation from the bridge upgrade and the minimal impacts on in-stream fisheries, it was deemed unnecessary by DFO and VIHP to implement a formal post-construction monitoring program. VIHP has and will continue to conduct sporadic site inspections to assess the
condition and health of the pond habitat and plant materials (e.g., Ed Van Osch sampling fish as noted earlier). VIHP fisheries consultants are planning to sample the four ponds in Spring 1999 for coho and cutthroat trout.

The absence of a formal monitoring program will make it difficult to quantify and verify success or failure in achieving the objectives of the restoration program; such information would be invaluable in guiding similar projects. It will make it difficult to identify unanticipated threats (e.g., ecological or anthropogenic disturbances) that can alter the progress of the restoration program, and without monitoring to document such disturbances, information about the need for active manipulation of the site or implementation of remedial actions could come too late (e.g., replanting of material that fails to survive or grow; deteriorating water quality in the ponds; the need for erosion control from highway drainage). As well, sporadic inspections will likely be insufficient to monitor and control invasive plants (e.g., Blackberry) which could take over while the planted vegetation establishes itself.

To truly achieve the goal of partnering with the CFN in a restoration program, the opportunity exists for CFN and VIHP to work together to develop an appropriate monitoring program, based on the CFN doing the bulk of the monitoring and maintaining of the restoration program. VIHP could provide a small amount of funding (for a 3-5 year period) expertise and training to the CFN to implement a monitoring program that could include providing short-term funding for monitors, training CFN members in monitoring procedures, assisting in data analysis, providing replacement plants, if required, and providing advice on data collection procedures (e.g., data collection forms) to permit standardized data collection and to permit repetition of data collected by different people in different years. The success of this approach would depend on the CFN's interest in taking on the long-term responsibility for monitoring.
There is also a need to avoid the possibility that the restoration work at Bush Creek on IR #12 remains in isolation from the rest of the creek and surrounding environs. There is a long term need to integrate the restoration program into the overall conservation of Bush Creek from headwaters to estuary. Monitoring of the restoration program at Bush Creek becomes an important component in better understanding the health of the Bush Creek watershed.

As the restoration program is approximately 80% complete (Zone 2 - Camas bank/Garry Oak and further plantings are to occur in Spring 1999), it is recommended that the CFN and VIHP consider implementing the monitoring program noted below. The first step in implementing the program could be for members of the restoration team to meet to discuss the need for monitoring; confirm CFN’s interest in taking on this role; confirm the type of support VIHP is prepared to provide; and agree on the key components of the monitoring program.

8.2 Recommended Approach

A three year site maintenance and monitoring program is recommended to assess and document the fish pond habitat and the revegetation success of the restoration program. Biannual site inspections would be used to monitor the use of the ponds by fish (density sampling), water temperature and quality, and condition and health of the plant material. These site inspections could identify if additional plant maintenance activities are required, as well as assessing the performance of the pond culverts and channels to Bush Creek (e.g., culverts blocked by debris). For example, fish sampling completed at year one would establish a base line which could be compared with post-construction assessments.

Site visits would include data collection and analysis such as the following:

- check the entire site by inspecting all ponds for sedimentation/erosion, fish (density sampling), and hydrologic issues (e.g. low water level, temperature) and by inspecting the planted material for disease or damage;
✓ record plant survival and species composition at each of the five zones, and compare survival rates and growth rates of the original plantings over a one, two and three year period;
✓ undertake maintenance activities and treatments (e.g., culvert and channel cleaning, pruning or replanting of vegetation);
✓ document monitoring activities (e.g., recording of information, video, photographs);
✓ remove invasive species (e.g., blackberry) from encroaching on the site and impacting the planted stock; and,
✓ recommend treatments for the fish ponds and revegetation program, if required.

Data would be collected on a pre-formatted data collection form and the records stored with the CFN and MoTH, to provide a data base for future restoration programs.

The opportunity exists for the CFN to involve CFN Elders, school children and community members in the monitoring and maintenance program (e.g., ‘adopt a plant program’). The restored site could be used as a ‘living class-room’ for the community to re-establish interest in traditional use plants and natural environmental systems. As noted, the CFN are interested in developing a pedestrian trail to link up the Chemainus Community College and the CFN Council Offices, and integrating the trail into the newly constructed fish ponds (e.g., down the Camas bank slope), to provide an educational and tourism opportunity involving native, traditional use and medicinal plant identification for both CFN members and non-members. The CFN have applied to the Environment Youth Team for funding assistance to construct the trail.
LESSONS LEARNED

Even though the restoration program is not complete, a number of positive and negative results of the program have already been identified, including:

**Positives:**

✓ the cooperative effort and partnership developed among the restoration team, the CFN Chief and Council and VIHP to work towards a restoration program, including the use of native, traditional use and medicinal plants to revegetate the site;

✓ the opportunity now exists for MoTH and VIHP to initiate other restoration programs with First Nations whose land may be impacted by highway construction (this restoration program offers a new paradigm);

✓ the willingness of the CFN Elders to share traditional knowledge and language about medicinal and native plants important to CFN and particularly, the cooperation of Percy and Delores Seymour, CFN, in being part of the restoration team and participating in the production of an upcoming video on the Bush Creek Environmental Restoration Program;

✓ as is often the case with the development of off-channel ponds, the full potential of the site is usually not realized until the site is opened up and the materials in which the excavation is taking place are assessed. The expertise of both the equipment operator and Ed Van Osch, On-site Environmental Monitor, meant that site modifications could be made immediately during pond excavation to maximize the available area to create long term, stable fish habitat;

✓ the sensitivity of the equipment operator in digging the ponds to limit environmental impacts and to create habitat that ‘fit’ the local area with limited disturbance;

✓ the flow characteristics of the pond culverts and channels with Bush Creek, especially Pond D where coho entered in late November 1998 (E. Van Osch, pers. comm.); and,
✓ the care and attention of the CFN plant salvagers and planters to ensure that the plants were given the best opportunity to survive (e.g., stored salvaged plants were regularly watered prior to planting).

**Negatives:**

✗ the planting program came on quickly and sporadically in December 1998 due to considerations relating to construction budget and schedules. Planting to date was completed over a 6 week period. The plants were placed in their proper zones, however, it became very difficult with the passage of time to recall exact locations of the individual plants, especially since most plants were at a thin ‘bare stem’ stage at the time of planting;

✗ some instability problems occurred at the pond fringes and the southeast highway fill slope adjacent to the ponds A and B in the southeast quadrants, likely reducing the survival of some plantings;

✗ some of the pond sides are very steep - this, along with the deep water and aquatic invertebrate production, provides excellent overwintering habitat for fish, however, shallow water habitat for wetland plants is reduced;

✗ the gravel mounds should have been larger and coarser to provide a drier site in wet conditions (D. Polster, pers. comm.);

✗ the combination of fresh cut conifer rootwads, organic soils and standing water in the ponds has led to a short term problem of poor dissolved oxygen - this combination of factors turned the water in some ponds clear but deep black (e.g., “pond tea”) in August - October 1998. The water temperatures consequently rose. There is some concern that until the plantings at some ponds (e.g., Ponds A and B) mature, summer water temperature may remain high (e.g., 30 degrees which is at least 6 - 10 degrees above the mortality temperature for salmonids). The production of “pond tea” is likely to diminish over time as the large woody debris is no longer leaching organic acids (E. Van Osch, pers. comm); and,
failure of the restoration team to plan for a formal monitoring program earlier in the development of the restoration program.

SUMMARY

The restoration program undertaken as part of the Bush Creek Bridge upgrade is in many ways unique. It is a program undertaken on First Nations land; it is part of a major highway construction project; and it has been undertaken cooperatively between VIHP, CFN and provincial and federal regulatory agencies. The opportunity for VIHP to ‘partner’ with the CFN on a restoration program that involves consultation with community Elders, CFN Fisheries officers, and the use of traditional use, medicinal and native plants to re-vegetate fish ponds will perhaps assist MoTH, in the right circumstances, to put aside the more ‘engineered approaches’ to environmental mitigation and to integrate approaches learned at Bush Creek into future highway projects.

What remains is the fundamental question of whether this approach is a viable precedent for MoTH to apply to similar opportunities with First Nations in future highway projects. At this point, the answer appears to be a qualified ‘yes’. The planning and development of the fish ponds and the revegetation plan effectively brought together the technical expertise of highway engineers, fisheries biologists and environmental consultants with traditional knowledge and practical fisheries and environmental experience of the CFN. The plants used in the revegetation plan reflected both the cultural and community needs of the CFN and the environmental imperative to use native plants. As well, the construction of the fish ponds was done in a way that made the new habitat ‘fit’ into the local environment. All this was accomplished within the construction schedule and budget of the highway project.

Whether the implementation of the revegetation plan is a viable precedent remains to be seen. The planting is not yet complete, and it will be some time after completion until it is
known whether the revegetation is a success. Determining success would be assisted by a formal post-construction monitoring program, and such monitoring should be included in future restoration programs.

In conclusion, this restoration program could be a significant first step for MoTH in recognizing the benefits of small scale, cooperative environmental restoration that meets the needs of a community.
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Tab 1 - Map - Project Area Overview

Tab 2 - Map - Land Exchange For Highway Construction

Tab 3 - List - Salmon Escapement Records - Bush Creek

Tab 4 - Newsletter - CFN Newsletter

Tab 5 - List - CFN names for plants

Tab 6 - Minutes - Meeting Minutes and Presentation Notes

Tab 7 - List - Existing Onsite Vegetation and 3 Vegetation Plot Data (Blood, 1998).

Tab 8 - List - Early Design Specification for Proposed Ponds

Tab 9 - Form - Band Council Resolution - CFN Fish Pond Approval

Tab 10 - Plan - Conceptual Plan of the Four Ponds

Tab 11 - List - Plant Species and Quantities for the Five Planting Zones

Tab 12 - Photos - 29 photographs at the Bush Creek Bridge and Four Ponds.

Tab 13 - Plan - Environmental Restoration Program - Five Planting Zones, Four Ponds and Plant Species