

APPENDIX "B"

Environmental Screening Report of Various  
Water Supply Development Alternatives

**PRELIMINARY ENVIRONMENTAL SCREENING  
OF POTENTIAL WATER SUPPLY DEVELOPMENT  
PROJECTS FOR THE TOWN OF LADYSMITH**

**Prepared for: Earth Tech (Canada Inc.)**

**Prepared by: P. A. Harder and Associates Ltd.**

**October 2002**

## TABLE OF CONTENTS

1.0 Introduction.....	1
1.1 Study Area .....	1
1.2 Background .....	1
1.3 Study Objectives .....	1
1.4 Study Scope.....	2
2.0 RESOURCE OVERVIEW .....	2
2.1 Banon Creek.....	2
2.1.1 Habitat Conditions .....	3
2.1.2 Fish Distribution .....	3
2.2 Stocking Creek.....	3
2.2.1 Habitat Conditions .....	3
2.2.1.1 Stocking Lake Reservoir.....	4
2.2.1.2 Stocking Creek.....	4
2.2.2 Fish Resources .....	4
2.3 Holland Creek .....	5
2.2.1 Habitat Conditions .....	5
2.2.1.1 Holland Lake Reservoir .....	5
2.2.1.2 Holland Creek .....	5
2.2.1.3 Heart Lake.....	7
2.2.2 Fish Resources .....	7
3.0 POTENTIAL IMPACTS .....	8
3.1 Description of Water Supply Development Plans .....	8
3.2 Options A and B: Water Treatment Facility Upgrades .....	9
3.2.1 Preliminary Impact Assessment.....	9
3.2.2 Additional Environmental Study Requirements .....	9
3.2.3 Environmental Regulatory Requirements .....	9
3.3 Option C: Diversion of Holland Creek to Stocking Lake Reservoir .....	10
3.3.1 Preliminary Impact Assessment.....	10
3.3.1.1 Stream Habitat Impacts.....	10
3.3.1.2 Fish and Fish Parasite Transfers .....	10
3.3.1.3 Changes in Water Temperature.....	11
3.3.2 Information Deficiencies.....	11
3.3.3 Environmental Regulatory Requirements .....	11
3.4 Option D: Diversion of Stocking Lake to Holland Creek.....	12
3.4.1 Preliminary Impact Assessment.....	12
3.4.1.1 Stocking Lake Reservoir .....	12

**TABLE OF CONTENTS (cont)**

3.4 Option D: Diversion of Stocking Lake to Holland Creek (cont)

- 3.4.1.2 Heart Lake .....12
- 3.4.1.3 Fish and Fish Parasite Transfers .....12
- 3.4.2 Information Deficiencies.....13
- 3.4.3 Environmental Regulatory Requirements .....13

4.0 CONCLUSIONS AND RECOMMENDATIONS .....14

5.0 REFERENCES .....	16
----------------------	----

## **1.0 Introduction**

### **1.1 Study Area**

The study area encompasses three watersheds on the east coast of Vancouver Island. These include Holland Creek, Stocking Creek and Banon Creek. Holland and Stocking Creek flow into Ladysmith Harbour south from the town of Ladysmith. Banon Creek is a tributary to the Chemainus River that flows into Cowichan Bay near Duncan

## **1.2 Background**

The Town of Ladysmith is examining available options to improve and expand the existing drinking water supply for the town and adjacent community of Saltair. The existing drinking water supply system extracts water from the Stocking and Holland creek drainages. The Stocking Lake reservoir is located in the headwater reach of the Stocking Creek drainage. Water from this reservoir is piped to an existing balancing reservoir and water treatment facility at Saltair. Water from Holland Creek is diverted at Chicken Ladder, located approximately 4.2 km upstream from the mouth of Holland Creek, and is piped to the Arbutus Reservoir and treatment facility. The Holland Lake reservoir, located near the headwaters of the South Fork of Holland Creek, provides water storage and flow control in lower Holland Creek. The reservoir straddles the former watershed divide between Holland and Banon creeks. Banon Creek is part of the Chemainus River watershed. Water storage in the Holland Lake reservoir is augmented by a licensed diversion from the headwaters of Banon Creek that is operational from November to May each year.

The Town of Ladysmith has retained the services of Earth Tech (Canada) Inc. to identify and develop plans for improving and expanding the existing water supply system. P. A. Harder and Associates Ltd. was retained by Earth Tech (Canada) Inc. to provide a preliminary environmental assessment of the proposed water supply improvement options under consideration.

## **1.3 Study Objectives**

The specific objectives of this study are to:

1. Provide an overview of fish resource values in the three watersheds that could potentially be affected by proposed improvements to the water supply system for the Town of Ladysmith.
2. Provide a preliminary environmental screening of the various water supply improvement projects under consideration.
3. Review Provincial and Federal regulatory requirements for each of the proposed options.
4. Identify any environmental data deficiencies and additional study requirements for the options under consideration.

## **1.4 Study Scope**

The scope of our study was limited to a review of existing data for the affected watersheds, a site inspection of the study area during August 2002 and examination of engineering plans for the proposed water supply improvement options.

A description of the affected watersheds and overview of existing fish resources is presented in the following section. This is followed by an assessment of potential environmental impacts and a summary of data deficiencies and regulatory requirements for each development option.

## **2.0 RESOURCE OVERVIEW**

### **2.1 Banon Creek**

Banon Creek is a major tributary of the Chemainus River that flows south east into the Chemainus River approximately 9 km upstream of Chemainus Bay. A portion of the headwater drainage area was re-directed into the Holland Creek drainage when the Holland Lake reservoir was constructed in 1979. The south east end of the Holland Lake reservoir is located approximately 35 m to the north of the Banon Creek channel. There is a water intake structure in the main channel of Banon Creek that captures and diverts Banon Creek flow into the Holland Lake when the gate valve is open. The District of Ladysmith has a water licence to annually divert up to 1,049,000 m<sup>3</sup>/sec from Banon Creek to Holland Lake between November and April. The existing diversion structure between Banon Creek and the Holland Lake reservoir allows for potential fish transfers between the two watersheds.

#### **2.1.1 Habitat Conditions**

The headwater reach of Banon Creek adjacent to the Holland lake reservoir has a moderately high channel gradient with a bed material of large cobble sand boulders. Instream habitat is characterized by riffle and stepped pool habitat. The average active channel width is approximately 12 m and the wetted width during summer flow conditions varied between 3.5 and 4.5 m. Maximum pool depth during late summer was approximately 40 cm.

### **2.1.2 Fish Distribution**

Indigenous cutthroat trout are present throughout the Banon Creek drainage and have been reported to be present upstream of the Holland Lake diversion intake (Webber and Young 1992). No fish were observed or captured in this section of Banon Creek during this study. The existing diversion structure appears to be passable to fish from Banon Creek to the Holland Lake reservoir.

## **2.2 Stocking Creek**

The Stocking Creek drainage is located between the Holland and Chemainus River (Banon Creek) watersheds. The mainstem creek is approximately 6 km long and flows east into Davis lagoon in Ladysmith Harbour. The headwater reach of the mainstem creek was dammed in the late 1960's to form the Stocking Lake reservoir. The reservoir drainage area is approximately 165 ha and accounts for close to 10% of the total watershed area.

### **2.2.1 Habitat Conditions**

#### **2.2.1.1 Stocking Lake Reservoir**

The Stocking Lake reservoir is situated at an elevation of 361 m and has a total surface area of 23 ha with a maximum depth of 19 m at full supply level (BC MELP 1996). There is one poorly defined inlet channel with low flow volume located at the northwest corner of the reservoir (Chudyk and Erickson 1971). The total lake shore perimeter is approximately 3300 m. The shoreline is vegetated with mixed hemlock and douglas fir forest and is characterized by mountainous terrain.

Some terrestrial vegetation was flooded when the reservoir was constructed.

#### **2.2.1.2 Stocking Creek**

The outlet channel from the Stocking Lake reservoir cascades down a steep rocky slope over a distance of approximately 2.0 km. This section of the creek is not considered as viable fish habitat due to high channel gradient (MELP 1996). Under the present water management regime, no water is released from the reservoir into Stocking Creek between May and November. There are several major tributaries that flow into Stocking Creek downstream of the power line crossing. Stream channel gradients and instream habitat conditions are suitable for spawning, rearing and over-wintering fish.



throughout the lower section of Stocking Creek downstream of the power line crossing. There is an impassable water fall located on the mainstem of Stocking Creek downstream of the Island Highway crossing. An assessment of fish habitat conditions in lower Stocking Creek and tributary streams has been prepared for the Town of Ladysmith by Terrestrial Logic Consultants (2001 and 2002).

Low summer flows limit fish habitat capabilities in many of the smaller tributary streams to Stocking Creek. Early summer flow in the lower reaches of the mainstem of Stocking Creek were suitable for rearing fish in late June (Harder, P.A. in: Terrestrial Logic 2002).

### **2.2.2 Fish Resources**

The lower 0.5 km of Stocking Creek located downstream of the Island Highway supports anadromous populations of chum salmon, coho salmon and cutthroat trout (Taylor, 2000). MELP (1996) reported that the 10 year mean annual escapement of chum and coho salmon to lower Stocking Creek was 3700 and 14 fish respectively. Fish species found in stocking creek upstream of the fish migration barrier include native cutthroat trout and introduced rainbow trout that have been released into the Stocking Lake reservoir. Taylor reported that there is a population of hybrid cutthroat /rainbow trout in lower Stocking Creek. Hatchery raised rainbow trout were released into Stocking Creek between 1982 and 1986 (Webber and Young 1992). Reservoir stocking was stopped when the watershed was closed to public access by the Town of Ladysmith in the late 1980's. Local residents report that the reservoir still supports recreational fishing (unauthorized) and that rainbow trout are present in the reservoir. The size of the existing population and species composition is not known.

### **2.3 Holland Creek**

Holland Creek flows north east from the headwaters into Ladysmith Harbour south of the Town of Ladysmith. The drainage has two main channels in the upper watershed; the North and South Forks. The South Fork of Holland Creek flows out of the Holland Lake reservoir and joins the mainstem channel approximately 7.1 km upstream from the mouth of Holland Creek. There are a series of impassable waterfalls in lower Holland Creek located between Chicken Ladder and the confluence of Heart Creek.

## **2.2.1 Habitat Conditions**

### **2.2.1.1 Holland Lake Reservoir**

The Holland Lake reservoir is situated at elevation 631 m ASL and is contained by two separate earth filled dams. The face of the dams are armoured with shot rock. The reservoir has a total surface area of 43 ha and a mean water depth of 3.2 m at full supply level. Approximately 20% of the shoreline length is characterized by shallow waters with some aquatic vegetation growth. The lake shore vegetation is predominantly deciduous growth including mature alder with and coniferous trees growing further back from the shoreline. The surrounding terrain has a gentle relief.

There are no well defined inlet stream channels flowing into the Holland Lake reservoir. The outlet stream is controlled by a gate valve that regulates flow into the South Holland Creek.

### **2.2.1.2 Holland Creek**

The total mainstem channel length of Holland Creek channel is approximately 9.1 km. South Holland Creek flows north from Holland Lake and enters the mainstem creek approximately 2.9 km upstream from the Chicken Ladder Dam and existing creek diversion.

Instream habitat diversity is high throughout most of the middle reaches (upstream and downstream of the South Holland Creek confluence) of Holland Creek. The channel is characterized by moderate gradients (2 to 3%), a bed material of gravel and cobble and a high proportion of pool and riffle habitats. The banks are stable and there is an abundance instream organic debris. The South Holland Creek channel has a higher channel gradient than the mainstem channel. Instream cover is diverse with cobble, pool, log debris and undercut banks. Low stream flow is a significant limitation to fish habitat capabilities in sections of Holland Creek throughout the summer and early fall periods. The mainstem channel immediately upstream of the south Holland Creek confluence was dry during the August 2002 site inspection. Flowing water was present further upstream at the logging road crossing. Ephemeral flow conditions in the lower section of the channel upstream of the South Holland Creek confluence restrict the upstream distribution of resident fish in the system.

Habitat conditions in lower Holland Creek downstream of the Chicken Ladder dam are strongly influenced by residual flow volumes after water has been diverted into the water supply system for Ladysmith. MELP (1996) estimated that the net effect from flow regulation through the Banon Creek diversion and Holland Lake reservoir storage has significantly increased natural creek flow levels in Holland Creek during the low flow months (July, August and September). It is estimated that mean monthly flows upstream of the Chicken Ladder diversion have been increased by a factor of 2 to 4 times and between 1.5 to 3 times natural flow in lower Holland Creek downstream of Chicken Ladder (MELP 1996). In general, these flow conditions have likely resulted in a significant improvement to fish habitat conditions for resident and anadromous fish in Holland Creek from pre-diversion conditions. The estimated mean monthly residual flow in Holland Creek downstream of the Chicken Ladder diversion for the low flow period is summarized from Earth Tech (2001) below:

Month	Holland Creek Regulated Flow (m <sup>3</sup> /sec) <sub>1</sub>	Holland Creek Residual Flow (m <sup>3</sup> /sec) <sub>2</sub>
June	0.339	0.281
July	0.217	0.155
August	0.231	0.169
September	0.245	0.194
October	0.560	0.521

1/ Estimated stream discharge upstream of Chicken Ladder diversion

2/ Estimated stream discharge at mouth of Holland Creek.

Examining daily flow data for Holland Creek collected at Chicken Ladder during 2000 (Earth Tech 2001) indicates that on some occasions, there is no residual stream flow over the spillway into lower Holland Creek. This occurred on nine days between June and September 2000. Residual flow over the Chicken Ladder spillway was less than 0.01 m<sup>3</sup>/sec (10 L/sec) on three days and was between 0.01 and 0.02 m<sup>3</sup>/sec (10 and 20 L/sec) on three other days during this period.

The relationship between stream flow levels and optimal fish habitat availability in lower Holland Creek is not known. Detailed channel cross section and flow measurement data would be required to

establish this relationship. This information could be used to manage minimum spillway flow requirements for fish habitat protection needs in lower Holland Creek.

### **2.2.1.3 Heart Lake**

Heart Lake is part of the Holland Creek drainage and is located approximately 410 m north from the west end of Stocking Lake/Reservoir. Heart Lake is approximately 350m long with a maximum width of 150 m. Limnological characteristics for the lake are not known. There are two small unnamed inlet streams to the lake. The outlet channel is located at the north west corner of the lake and flows north into Holland Creek, entering the creek approximately 600 m downstream of the Chicken Ladder water diversion. There are no fish resource data available for Heart Lake. The outlet channel flows down steep mountainous terrain with an elevation drop of over 180 m over a channel distance of 800 m. The high gradient of the outlet channel would preclude any fish access from the mainstem of Holland Creek.

### **2.2.2 Fish Resources**

The lower 2.3 km of Holland Creek is accessible to anadromous fish including chum and coho salmon, steelhead trout and cutthroat trout. MELP (1996) reported that in excess of 15,000 chum salmon have been observed in lower Holland Creek with a 10 year mean escapement of 3,800 spawners. The maximum reported escapement of coho salmon and steelhead trout has been 60 and 25 fish respectively (MELP 1996). There are no data for the number of anadromous cutthroat trout that use the lower system. Resident cutthroat trout are found throughout the Holland Creek drainage (MELP 1996, Webber and Young 1992). Holland Lake reservoir was stocked with rainbow trout between 1983 and 1991. Rainbow trout have been found in the upper reaches of the south fork of Holland Creek downstream of the reservoir outlet indicating that the reservoir population of rainbow trout have moved into Holland Creek. Adult rainbow trout were captured and observed in the Holland Lake reservoir during our August 2002 site inspection.

It is not know if fish are present in Heart Lake.

### **3.0 POTENTIAL IMPACTS**

#### **3.1 Description of Water Supply Development Plans**

Four options are currently being considered to improve the water supply system for the Town of Ladysmith and nearby community of Saltair. Options A and B would entail construction of a new balancing reservoir at the Arbutus site and upgrades of existing water treatment facilities. The main difference between Option A and B is that water treatment would be consolidated into one treatment facility at the Arbutus Reservoir with Option A and two separate water treatment facilities would be used for Option B (Arbutus and Saltair sites). Facility construction for both Options A and B would involve work in upland areas and there would be no effect on stream habitats. In the short term there would be no change to existing flow regimes from the Stocking Lake/Reservoir or the Holland Creek diversion from Chicken Ladder under Options A and B. Longer term plans (post 2022) may require additional water diversion from the existing Banon Creek diversion into Holland lake with a subsequent increase in Holland Creek diversion volumes from the Chicken Ladder site.

Option C would entail a new diversion of Holland Creek water from the South Fork of Holland Creek into the Stocking Lake/Reservoir. There would be no change to the existing Stocking Lake reservoir dam. A new balancing reservoir at the Arbutus site would be constructed as described for Options A and B. The existing Chicken Ladder diversion facility would be decommissioned under Option C. Similar to Options A and B, longer term plans (post 2022) may require additional water diversion from the existing Banon Creek diversion into Holland Lake with a subsequent increase in Holland Creek diversion volumes from the Chicken Ladder site.

Option D would require the existing dam on the Stocking Lake reservoir to be raised by up to 6 m with an expansion of the existing reservoir area. The proposed Stocking Lake reservoir expansion would flood into Heart Lake (part of the Holland Creek drainage) and a new dam may be required on the outlet channel of Heart Lake. A new pipe line would be constructed from Heart Lake down slope to the existing pipeline from Chicken Ladder to Arbutus Reservoir. The existing Chicken ladder diversion facility on Holland Creek would be maintained in its present state.

Preliminary assessments of potential environmental impacts and a discussion of the regulatory

requirements associated with each of the four options are presented in the following sections.

### **3.2 Options A and B: Water Treatment Facility Upgrades**

#### **3.2.1 Preliminary Impact Assessment**

There are no stream or lake habitats that would be directly affected by the proposed construction associated with facility upgrades as described for Options A and B. Standard construction mitigation techniques (ie. slope grading, slope armouring and seeding) should be used to stabilize all disturbed sites with the construction zone. These measure would ensure that there is no potential for sediment generation that could affect downslope water quality.

#### **3.2.2 Additional Environmental Study Requirements**

No additional environmental study requirements have been identified for the proposed construction work associated with facility upgrades as described for Options A and B. Detailed habitat assessment work and investigations of habitat availability in relation to stream flow discharge would be required in lower Holland Creek if longer term plans required additional flow diversions beyond currently licensed amounts from Banon and Holland Creeks.

#### **3.2.3 Environmental Regulatory Requirements**

There would be no requirements for obtaining approvals under Section 9 of the BC Water Act for the proposed facility upgrades associated with Options A and B. Since the proposed work does not affect fish habitat, Approvals from the Department of Fisheries and Oceans (DFO) would not be required. DFO Approvals would be required if the Town planned to divert additional water from the existing Banon Creek diversion into Holland Lake reservoir. Approvals under Section 9 of the BC Water Act would be required for any potential construction work that affected an existing steam channel of lake body.

### **3.3 Option C: Diversion of Holland Creek to Stocking Lake Reservoir**

#### **3.3.1 Preliminary Impact Assessment**

Under this option water from South Holland Creek would be diverted into Stocking Lake/reservoir.

The diversion point would be located approximately 2.6 km downstream from the Holland Lake Reservoir outlet control structure and 1.1 km upstream of the confluence of South Holland Creek and Holland Creek. Diverted water from South Holland Creek would be conveyed into Stocking Lake/Reservoir via a 4000 m long pipeline (300 mm diam) constructed adjacent to the existing logging road that extends west from the north end of the Stocking Lake Reservoir.

#### **3.3.1.1 Stream Habitat Impacts**

The potential diversion of water out of South Holland Creek could have a major impact on wetted habitat area in the lower reach of South Holland Creek (1.1 km long) and the lower reach of mainstem Holland Creek downstream from the confluence with South Holland Creek (7.1 km long). During the summer period the South Fork of Holland Creek contributes the majority of stream flow to lower Holland Creek due to flow releases from Holland Reservoir for drinking water supply purposes. Resident cutthroat trout in this section of the creek could be adversely affected by reduced flow levels after the Stocking Lake/reservoir diversion is constructed. Potential flow related impacts would be greatest during the low flow summer period.

#### **3.3.1.2 Fish and Fish Parasite Transfers**

Other potential environmental impacts associated with a diversion of Holland Creek water to the Stocking Creek watershed include the transfer of fish and associated fish parasite assemblages from the Holland Creek watershed to the Stocking Creek watershed. There is some potential that existing fish stocks in Stocking Lake could be adversely affected if it was found that Holland Creek fish stocks are host to a fish parasite assemblage that is not already found in the Stocking Lake reservoir. This potential concern would also apply to lower Stocking Creek watershed downstream of the Stocking reservoir dam and could affect fish population in the lower system. The significance of this potential concern is likely low since both fish stocks have been established from the same hatchery source.

#### **3.3.1.3 Changes in Water Temperature**

The proposed diversion of Holland Creek water into Stocking Lake may affect water temperatures in

Stocking Lake reservoir and could influence fish production if any changes to existing water temperature were pronounced. It is suspected that water temperatures in the higher elevation Holland Lake reservoir may be cooler than in Stocking Lake. However, any changes to water temperature in Stocking Lake would likely be minor due to relatively low volume of water that would be diverted into Stocking Reservoir.

### **3.3.2 Information Deficiencies**

The following information would be required to fully assess environmental impacts associated with the proposed work described for Option C.

- Fish and parasite sampling data for Holland Lake and Stocking Lake reservoirs.
- Seasonal water temperature data comparisons from Holland and Stocking Lake reservoirs.
- An assessment of existing habitat capabilities and quantify potential habitat losses in lower Holland Creek downstream of the proposed diversion point.
- Criteria for an operational flow regime in lower Holland Creek that adequately protects existing fish habitat capabilities.

### **3.3.3 Environmental Regulatory Requirements**

The construction plan outlined for Option C would require a new Water Licence for the proposed flow diversion from Holland Creek to Stocking Lake reservoir. In addition, the project would have to be reviewed by DFO to determine if the project complies with the Canadian Environmental Assessment Act (CEAA). DFO would need to approve the project before construction work could proceed. DFO would require a comprehensive habitat compensation plan if the project resulted in the loss or destruction of fish habitat. A comprehensive impact assessment of the proposed project would be required in support of an application for approval through DFO. It is possible that the scope of the proposed work would trigger a "Comprehensive Review" under CEAA.

## **3.4 Option D: Diversion of Stocking Lake to Holland Creek**



### **3.4.1 Preliminary Impact Assessment**

#### **3.4.1.1 Stocking Lake Reservoir**

Under this option the storage capacity of the existing Stocking Lake/Reservoir would be increased by raising the height of the existing dam to provide an additional 6 m of water storage. This would affect existing littoral (shallow water) habitat. A net loss of littoral habitat would have an adverse effect on fish productivity in Stocking Lake. Existing littoral habitats would need to be delineated and mapped and then compared to projected reservoir contours in order to determine if there would be net loss or gain to existing littoral habitats. Increased reservoir level would affect existing lake shore vegetation and flood additional upland vegetated area between the northwest end of Stocking Reservoir and Heart Lake.

#### **3.4.1.2 Heart Lake**

Existing lake shore vegetation and littoral habitat in Heart Lake may also be affected depending on the design elevation of the new reservoir in relation to the existing elevation of the Heart Lake shoreline. This could affect existing or potential fish habitat production capabilities in Heart Lake. Additional elevation survey data is required to assess this concern.

#### **3.4.1.3 Fish and Fish Parasite Transfers**

Water from the Stocking Creek watershed would be diverted into the Holland Creek watershed and there is the potential for fish and fish parasite transfers between the Stocking and Holland Creek watersheds. There is some potential that existing fish stocks in lower Holland Creek could be adversely affected if it was found that Stocking Lake fish stocks are host to a fish parasite assemblage that is not already found in lower Holland Creek.

### **3.4.2 Information Deficiencies**

The following information would be required to fully assess environmental impacts associated with the proposed work described for Option D.

- Fish and parasite sampling data for Stocking Lake reservoir and lower Holland Creek.

- Fish sampling data for Heart Lake.
- Delineation and quantification of existing littoral habitat areas and limnological characteristics in Stocking Lake reservoir and Heart Lake.
- Contour mapping of new reservoir profile and delineation of post-construction littoral areas and shoreline.

### **3.4.3 Environmental Regulatory Requirements**

The construction plan outlined for Option D would require a new Water Licence for the proposed additional storage in Stocking Lake reservoir. In addition, the project would have to be reviewed by DFO to determine if the project complies with the Canadian Environmental Assessment Act (CEAA) would be required. DFO would need to approve the project before construction work could proceed. DFO would require a comprehensive habitat compensation plan if the project resulted in the loss or destruction of fish habitat. A comprehensive impact assessment of the proposed project would be required in support of an application for approval through DFO. It is possible that the scope of the proposed work would trigger a "Comprehensive Review" under CEAA.

## **4.0 CONCLUSIONS AND RECOMMENDATIONS**

Of the four options evaluated in this preliminary environmental assessment, Option A and B are the preferred options with the least potential for environmental impact. The proposed construction work required under these options would not affect fish habitat and there would be no need to obtain regulatory approval under the Federal Fisheries Act or Section 7 of the BC Water Act.

Potential environmental impacts associated with either Options C or D are considerably higher than with Option A and B.

The most severe potential environmental impact would likely be associated with Option C, entailing the diversion of South Holland Creek flow into Stocking Lake. Reduced water levels in the lower reach of South Holland Creek and the mid reach of the mainstem Holland Creek (downstream of the South Holland Creek confluence) throughout the year could have a major impact on salmonid rearing and over-wintering habitat capabilities. The severity of these potential impacts would be influenced by the proportion of water maintained in South Holland and Holland creeks downstream of the proposed new diversion point.

Option D would result in a major change to the existing landscape surrounding the Stocking Lake/Reservoir and previously undisturbed habitat in Heart Lake would be flooded and combined with an extended reservoir area altered into a reservoir regime. It is suspected that winter time flow retention in the headwater reach of the Stocking Creek watershed would have minor impact on downstream over-wintering fish habitat capabilities in lower Stocking Creek due to the influence of other tributary water sources in this system. Under present conditions there is no flow release from Stocking Lake/Reservoir to the upper reach of Stocking Creek during the summer period. Previous fish habitat assessment work in lower Stocking Creek suggest that fish rearing habitat capabilities during the early summer are not limited by low flow constraints under the present flow regime.

New transboundary flow diversions would occur between the Holland and Stocking creek watersheds under Options C and D. There is some potential impact associated with the mixing of resident fish stocks and any associated parasite communities from the two watersheds. However, the severity of these potential impacts is likely low since existing headwater fish stocks in both watersheds have been established from the same hatchery stock. It is not known if there are indigenous resident fish stocks in the headwater reach of Banon Creek that may have been transferred into the Holland Creek watershed and in turn could be transferred to the Stocking Creek watershed if Option C was pursued.

From an environmental perspective is recommended that Option A or B be selected in favour of

either Options C or D. Additional data and comprehensive impact assessment would be required if Option C or D was pursued in order to address regulatory concerns. The regulatory approval process for either Option C or D could be lengthy and involved. There is some potential that the proposed design plan outlined for Options C and D could trigger a Comprehensive Review under CEAA. Existing fish habitat conditions in lower Holland Creek downstream of the Chicken Ladder diversion dam could be improved by ensuring that a minimum base flow is maintained over the spillway. Additional studies would be required to determine what flow levels would be adequate for protecting existing fish habitat capabilities. Modifications to the existing flow diversion structures and control systems would be required to eliminate existing channel de-watering events in lower Holland Creek.

## **5.0 REFERENCES**

- Chudyk, B., and Erickson. 1971. Lake Survey Data form for Stocking Lake in BC Ministry of Water, Land and Air Protection files, Nanaimo, BC.
- Earth Tech (Canada) Inc. 2001. Town of Ladysmith water quality monitoring project. Report prepared by Earth The (Canada Inc) for the Town of Ladysmith.
- Elaisen, R. 1992. The fisheries resource of Holland and Stocking creeks; file notes with Department of Fisheries and Oceans, Nanaimo, BC.

- Palmer, M. F. 1990. Management report on the Holland Creek and Stocking Lake watersheds. BC WLAP, Nanaimo, BC.
- Soroksoki, R. 1964. Water resources in Holland Creek, Banon Creek, Stocking Lake and Silver Lake Watersheds: Existing water supply systems, water supply for Department of Public Works 25 pp.
- Taylor, G. D. 2000. Coho restoration and enhancement potential in Stocking Creek, Vancouver Island, BC. Prepared for Chemainus Road and Gun Club.
- Terrestrial Logic Consulting Ltd. 2002. Environmental assessment of the southern extension of Peerless Road Planning Area, CVRD. Report prepared for the Town of Ladysmith.
- Terrestrial Logic Consulting Ltd., Talisman Land Resource Consultants and Triton Environmental Consultants Ltd. 2001. Environmental assessment of the Peerless Road Site, Cowichan Valley Regional District. Report prepared for the Town of Ladysmith.
- Webber, G. and E. Yonge. 1992. Fish and Wildlife Objectives for the Stocking Lake/Holland Creek Integrated Watershed Management Plan. Memorandum on file with BC WLAP, Nanaimo, BC.