ENVIRONMENTAL PROTECTION DIVISION
WATER STEWARDSHIP DIVISION
MINISTRY OF ENVIRONMENT

Water Quality Assessment and Objectives for Newcastle Creek Community Watershed

OVERVIEW REPORT

Prepared pursuant to Section 5(e) of the *Environmental Management Act* (2003),

Section 150 (1)(a)(ii) of the *Forest and Range Practices Act* (2002) and

Section 8 (1) of the Government Actions Regulation (2004)

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SUMMARY

This document is one in a series that presents water quality objectives for British Columbia. This overview report summarizes the findings of the technical report, which is available as a separate document. The overview report provides general information about the water quality of Newcastle Creek, a community watershed supplying drinking water to the community of Sayward, B.C. on the north-east coast of Vancouver Island in British Columbia. It is intended for both technical readers and for readers who may not be familiar with the process for setting water quality objectives. Separate tables listing water quality objectives and monitoring recommendations are included. The technical report presents the details of the water quality assessment for Newcastle Creek, and forms the basis of the recommendations and objectives presented here.

The primary activities occurring within the watershed that could potentially impact water quality are recreation and possible future forestry activities.

Water quality objectives are recommended to protect source water (raw drinking water supply), wildlife and aquatic life.

PREFACE

Purpose of Water Quality Objectives

Water quality objectives are prepared for specific bodies of fresh, estuarine and coastal marine surface waters of British Columbia as part of the Ministry of Environment's (MoE) mandate to manage water quality. Objectives are prepared only for those waterbodies and water quality characteristics that may be affected by human activity now or in the future.

Authority to set Water Quality Objectives

The MoE has the authority to set water quality objectives under Section 5(e) of the *Environmental Management Act*. In addition, Section 150 of the *Forest and Range Practices Act* (FRPA) contains provisions for the MoE to establish objectives to protect water quality in designated community watersheds. This legislation is intended to protect consumptive uses of water in designated community watersheds within working Crown forests. For this reason water quality objectives developed for community watersheds generally focus on potential impacts from logging, range activities and forestry-related road construction.

The definition of a community watershed can be interpreted from Section 8 of the Government Actions Regulation (2004) under FRPA, which states that the minister responsible for the *Land Act* may designate all or part of the drainage area upslope from an intake for a licensed waterworks as a community watershed to protect the water, if the area requires special management that is not provided for elsewhere. The purpose of this designation is to conserve the quality,

quantity and timing of water flow or prevent cumulative hydrological effects.

How Objectives Are Determined

Water quality objectives are the safe limits for the physical, chemical or biological characteristics of water, biota (plant and animal life) or sediment that protect all designated water uses in a given waterbody or a watershed. The water uses considered in this exercise are the following:

- source water for public water supply and food processing
- aquatic life and wildlife
- agriculture (livestock watering and irrigation)
- recreation and aesthetics
- industrial (e.g., food processing) water supplies.

Objectives are established in British Columbia for waterbodies on a site-specific basis taking into consideration provincial water quality guidelines, local water quality, water uses, water movement, waste discharges and socio-economic factors. Each objective for a location may be based on the protection of a different water use, depending on the uses that are most sensitive to the physical, chemical or biological characteristics affecting that waterbody.

How Objectives Are Used

Historically, water quality objectives have not been legally enforceable. However, since 2004, objectives for water quality, quantity and timing of flow established under the Government Actions Regulation (B.C. Reg. 582/2004) may be enforced by the Conservation Officer Service.

Objectives are most commonly used to guide the evaluation of the state of water quality in a watershed, the issuance of permits, licenses and legal orders, and the management of fisheries and the province's land base. Water quality objectives are also a standard for assessing the ministry's performance in protecting water uses.

Monitoring Requirement

Monitoring of water quality objectives is undertaken to determine if the designated water uses are being protected. Monitoring usually takes place at a critical time when a water quality specialist has determined that the water quality objectives may not be met. In the case of forestry-related impacts, these critical times may be associated with periods of peak flows when the majority of suspended and dissolved particulates and other contaminants, such as bacteria, are introduced into a waterbody. Late summer periods of low flow could also be sensitive to impacts due to human disturbances. It is assumed that if all designated water uses are protected at the critical times, then they also will be protected at other times when the threat to water quality is less.

The monitoring usually takes place during a five-week period, twice during the calendar year which allows the specialists to measure the worst, as well as the average condition in the water. For some water bodies, the monitoring period and frequency may vary, depending upon the nature of the problem, severity of threats to designated water uses and the way objectives are expressed (e.g. mean value, maximum value, 95^{th} percentile etc.).

Vancouver Island Eco-Region Approach

There are over 60 community watersheds within the Vancouver Island Region of the Ministry of Environment. Rather than develop water quality objectives for each of these watersheds on an individual basis, an ecoregion approach has been implemented, whereby Vancouver Island Region has been split into eleven ecoregions based on similar climate, geology, soils and hydrology. Representative lake and stream watersheds within each ecoregion are selected and a three year monitoring program is implemented to collect water quality and quantity data, as well as biological data. Watershed objectives will be developed for each of the representative lake and stream watersheds based on this data, and these objectives will also be applied on an interim basis to the remaining lake and stream watersheds within that ecoregion. Over time, other priority watersheds within each ecoregion will be monitored for one year to verify the validity of the objectives developed for each ecoregion and to determine whether the objectives are being met for individual watersheds.

INTRODUCTION

This report examines the existing water quality of Newcastle Creek and recommends water quality objectives for this watershed based on potential impacts of certain key water quality parameters of concern. Newcastle Creek is of the primary source of drinking water for the Village of Sayward, BC, located on the northeast coast of Vancouver Island, 60 km north of Campbell River.

Anthropogenic land uses within the watershed are currently limited but include possible future timber harvesting and recreation. These activities, as well as natural erosion and the presence of wildlife, all potentially affect water quality in Newcastle Creek. The purpose of this report is to develop water quality objectives for this watershed to help ensure long-term sustainability of the water resource.

BASIN PROFILE

Watershed Description

The community watershed portion of Newcastle Creek (Figure 1) is approximately 912 ha in area and ranges from approximately 700 m elevation at the Sayward water intake to about 1,200 m in the upper watershed. The creek is approximately 6.5 km long in total, and about 5 km long from the its headwaters near Newcastle Ridge to the Sayward intake. There are a few small, unnamed lakes in the upper reaches of the watershed.

The majority of the watershed falls within the Coastal Western Hemlock (submontane very wet maritime, CWHvm1) biogeoclimatic zone, with higher elevations (above about 950 m) falling within the Mountain Hemlock (windward moist montane, MHmm1) biogeoclimatic zone. Newcastle Creek falls within the Northern Island Mountains (NIM) eco-region established for Vancouver Island by MOE staff.

Figure 1. Map of watershed, with sampling location

Hydrology

Hydrometric data is not available for Newcastle Creek, however the hydrology is typical of coastal streams with peak flows occurring between October and January, and low flow occurring between August and September.

Climate

The nearest climate station to the watershed for which climate normal data is available is at Campbell River. Weather patterns are likely quite similar between the two locations as they are both located on the east coast of Vancouver Island and near sea level. Average daily temperatures in Campbell River ranged from 1.3^{o}C in January to 16.9^{o}C in July and August for the 30-year period between 1971 and 2000. Average total annual precipitation is 1450 mm, with only 110 mm (water equivalent) (8%) of this falling as snow. A larger portion of the annual total precipitation occurs as snowfall in the higher-elevation terrain of the watershed. Most precipitation (1,100 mm, or 75%) falls between October and March.

Water Uses

Water Licenses

Two water licenses have been issued for Newcastle Creek, both to the Village of Sayward under a Waterworks – Local Authority license, with a total allocation volume of 845 dam^3/year. The domestic intake is located approximately 1.5 km upstream from its confluence with Salmon Bay.

Recreation

There are no BC Forest Service recreation sites located in the Newcastle Creek watershed. No specific studies have been conducted to determine the recreational use of the Newcastle Creek watershed, but the presence of logging roads throughout the watershed provides recreational access.

Fisheries

No fisheries data are available for Newcastle Creek. Because of the relatively steep stream gradient and lack of lakes, it is likely there is limited fish habitat within the watershed.

Wildlife

The Newcastle Creek watershed provides habitat to a variety of species typical of west coast Vancouver Island, including blacktail deer, black bear, cougar, and numerous other small mammals and birds. The BC Conservation Data Centre (CDC) lists one Species of Special Concern, the *anguinae* subspecies of ermine (*Mustela erminea anguina*), that has been observed within the watershed boundaries (CDC, 2005).

Designated Uses

The water uses to be protected in the Newcastle Creek community watershed should include drinking water, aquatic life and wildlife.

Influences on Water Quality

Forest Harvesting and Forest Roads

Forestry activities can impact water quality both directly and indirectly in several ways. The removal of trees can decrease water retention times within the watershed and result in a more rapid response to precipitation events and earlier and higher spring freshets. The improper construction of roads can change drainage patterns, destabilize slopes and introduce high concentrations of sediment to streams.

The Newcastle Creek community watershed is located on Crown Lands and is included in TFL 39, managed by Island Timberlands. The forest is primarily old growth, and there has been little historical logging within the community watershed boundaries. The current five-year plan does not include any proposed logging activities.

Recreation

Recreational activities can affect water quality in a number of ways. Erosion associated with 4-wheel drive and ATV vehicles, direct contamination of water from vehicle fuel, and fecal contamination from human and domestic animal wastes (*e.g.*, dogs or horses) are typical examples of potential effects. As no specific studies have been conducted on recreation within the Newcastle Creek watershed, the relative impacts of recreational activities cannot be discussed, but they are likely to be minimal.

Wildlife

Warm-blooded animals can carry microorganisms such as *Giardia lamblia* and *Cryptosporidium*, which are harmful to humans, causing

gastrointestinal disease. Newcastle Creek provides habitat for a wide variety of wildlife which can potentially impact water quality.

Water Licenses

Water licenses can impact aquatic habitat downstream from the withdrawal, especially during low-flow periods. The two licensed water withdrawals from Newcastle Creek allow an overall maximum withdrawal of 845 dam^3/year. Assuming water was withdrawn from Newcastle Creek at a constant rate throughout the year (an unlikely scenario), this would result in an average withdrawal rate of 0.027 m^3/s. As no flow data is available for Newcastle Creek, it is uncertain whether this volume of water is likely to impact flows downstream from the intake. Given the location of the watershed, and the amount of rain this area receives, low flows are likely not of great concern.

WATER QUALITY ASSESSMENT AND OBJECTIVES

Water Quality Assessment

Water quality monitoring was conducted in the Newcastle Creek watershed on a monthly basis between June 2002 and May 2005. The sampling frequency was increased to weekly during summer low-flows and during fall peak-flows. The results from this assessment indicate that water quality is generally very good in Newcastle Creek. Parameters of concern include microbiological indicators, as well as temperature, true colour, turbidity, total suspended solids and total organic carbon.

Concentrations of microbiological indicators were slightly elevated on occasion, generally during the fall freshet. The drinking water guideline for water receiving disinfection only was exceeded in one of the four sample sets (five weekly samples in 30 days) for fecal coliforms and in one of five

sample sets (five weekly samples in 30 days) for *E. coli*. The source of these micro-contaminants is likely endemic wildlife, but these occasional exceedances demonstrate the need to treat water for human consumption to prevent potential health risks.

Turbidity and total suspended solid levels in Newcastle Creek were consistently very low. To ensure that future activities do not impact the exceptional water clarity in Newcastle Creek, a water quality objective is proposed for both parameters.

Water temperatures remained consistently below the aesthetic guideline over the course of the monitoring program. However, it is possible that activities such future forest harvesting could cause increases in water temperature. For this reason a water temperature objective is recommended.

Typical of most watersheds on northern Vancouver Island, true colour levels tended to be naturally high, and generally exceeded the aesthetic drinking water guideline. As well, total organic carbon levels (which often correlate well with true colour) exceeded drinking water guidelines on occasion.

Water Quality Objectives

Water quality objectives have been set for key characteristics for the Newcastle Creek watershed (Table 1). The objectives are required to ensure that inputs from forestry, agriculture, recreation, and rural and urban development do not impair water uses. The objectives apply to the watershed above the community water supply intake.

Table 1. Water Quality Objectives for the Newcastle Creek community watershed.

Variable	Objective Value
Fecal Coliform Bacteria	≤10 CFU/100 mL (90th percentile based on a minimum of five weekly samples collected over a 30-day period)
Escherichia coli	≤10 CFU/100 mL (90th percentile based on a minimum of five weekly samples collected over a 30-day period)
Turbidity	2 NTU average (based on a minimum 5 weekly samples collected over a 30-day period) 5 NTU maximum
True Colour	≤ 27 TCU average (based on a minimum of five weekly samples collected over a 30-day period)
Total Suspended Solids	26 mg/L maximum in a 24-hour period 6 mg/L average (based on a minimum of five weekly samples collected over a 30-day period)
Total Organic Carbon	≤ 6.5 mg/L average (based on a minimum of five weekly samples collected over a 30-day period)
Temperature	≤15^{o}C (long-term) with hourly rate of change not exceeding 1^{o}C

Designated water uses: drinking water, aquatic life, and wildlife

Monitoring Recommendations

The recommended minimum monitoring program for the Newcastle Creek watershed is summarized in Table 2. To reflect "worst case" conditions a monitoring program should be established during winter rain events and summer low-flows. This should consist of the traditional sampling method of five grab samples in a 30-day period. Benthic invertebrate monitoring is proposed to provide a better understanding of the overall ecosystem health.

Table 2. Recommended Water Quality Monitoring for the Newcastle Creek Watershed

Frequency and timing	Parameters to be measured
August – September (low-flow season): five weekly samples in a 30-day period	TSS, turbidity, DOC/TOC, true colour, fecal coliforms and *E. coli*
November – February (high-flow season): five weekly samples in a 30-day period	TSS, turbidity, DOC/TOC, true colour, fecal coliforms and *E. coli*
Once each during low-flow and high-flow season	Total and dissolved metals, nutrients (total phosphorus, nitrate, nitrite) and pH
Once every five years	Benthic invertebrate sampling

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