ENVIRONMENTAL PROTECTION DIVISION
WATER STEWARDSHIP DIVISION
MINISTRY OF ENVIRONMENT

Water Quality Assessment and Objectives for the McKelvie 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 McKelvie Creek, a community watershed supplying drinking water to the Village of Tahsis, located on the north-west side of Vancouver Island. 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 McKelvie Creek, and forms the basis of the recommendations and objectives presented here.

The primary activity occurring within the watershed that could potentially impact water quality is forestry. No harvesting has occurred in the upper watershed to date, but it is likely that harvesting will occur in the near future. As well, the construction of a hydroelectric project has the potential to significantly impact water quality.

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 McKelvie Creek and recommends water quality objectives for this watershed based on potential impacts of certain key water quality parameters of concern. McKelvie Creek is located on the northwest coast of Vancouver Island and is the primary source of domestic water for the Village of Tahsis.

McKelvie Creek has significant fisheries values, with steelhead present in the creek, and likely a number of other species as well. The McKelvie Creek watershed consists of Crown Land located within TFL 19, which is managed by Pacific Forest Products. The land use within the watershed has the potential to support timber harvesting in the future and a hydroelectric producing dam. These activities, as well as natural erosion and the presence of wildlife, all potentially affect water quality in McKelvie 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 McKelvie Creek (Figure 1) is approximately 2,111 ha in area and ranges in elevation from approximately 120 m at the Village of Tahsis water intake to about 1,600 m elevation in the upper watershed. The creek is approximately 10.2 km long in total, and about 9 km long from the its headwaters near Mount McKelvie to the Village of Tahsis intake. There are no named lakes within 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 800 m) falling within the Mountain Hemlock (windward moist montane, MHmm1) biogeoclimatic zone and small areas above 1,200 m composed of Alpine Tundra undifferentiated and parkland (ATunp). McKelvie Creek falls within the Windward Island Mountains (WIM) ecoregion established for Vancouver Island by MoE staff.

Figure 1. Map of watershed, with sampling location.

Hydrology

Water Survey Canada (WSC) operated a hydrometric station on McKelvie Creek above the Village of Tahsis intake between 1998 and 2004. Peak flows measured between 1998 and 2004 were approximately 33.1 m^3/s, while minimum flows were approximately 0.008 m^3/s.

Climate

The nearest climate station to the watershed is the Tahsis Village North station (elevation 9.0 m) (Environment Canada Climate Station 1037899). The following averages are based on average monthly values measured between 1994 and 2003. Average daily temperatures ranged from 3.5°C in December to 17.0°C in August. Average total annual precipitation between 1994 and 2003 was 4,279 mm, with only 55 mm (water equivalent) (1%) 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 (3,182 mm, or 74%) falls between October and March.

Water Uses

Water Licenses

Two water licenses have been issued for McKelvie Creek within the community watershed boundaries. The Village of Tahsis has a licence to remove 166 dam^3/year for domestic use under a Waterworks – Local Authority license. This water is chlorinated prior to consumption.

In addition, a power generating company has a license to utilize 11,823 dam^3/year from the mainstem, approximately 500 m upstream from the Village of Tahsis intake, for the purposes of generating power. Currently this hydroelectric project is just in its preliminary stages. Over the next two years a dam will be constructed upstream of the village intake, which will allow the diversion of 60% - 70% of the flow from McKelvie Creek to a generating plant down at the Village center. The plant will operate seasonally, allowing for low flow

conditions during the summer period and the community water supply withdrawal requirement.

Recreation

The community watershed designation has resulted in restricted access to the McKelvie Creek watershed. The local community is very supportive of this restriction and there is little or no access to the watershed.

Fisheries

McKelvie Creek has significant fisheries values, and is utilized by steelhead (*Oncorhynchus mykiss*), and likely other species as well.

Wildlife

The McKelvie Creek watershed provides habitat to a variety of wildlife species typical of west coast Vancouver Island, including blacktail deer, black bear, cougar, and numerous other small mammals and birds.

Designated Uses

Based on the information presented here, the water uses to be protected 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.

Forestry is likely to be the dominant land use in the McKelvie Creek watershed, although no logging has occurred to date in the upper watershed. Road access to the upper watershed is limited. Harvesting activities may occur in the future, but a watershed assessment procedure (WAP) should be conducted prior to road-building or harvesting activities to ensure that significant impacts to water quality do not occur.

Recreation

As the community supports restricted recreational access and use within the McKelvie Creek watershed, the impacts of recreational activities are expected to be minimal.

Wildlife

Warm-blooded animals, such as native wildlife, can carry microorganisms, such as *Giardia* and *Cryptosporidium,* which may be harmful to humans causing gastrointestinal disease.

Water Licenses

Water licenses can impact aquatic habitat downstream from the withdrawal, especially during low-flow periods. Licensed water withdrawals by both the Village of Tahsis and the power generating company are unlikely to significantly impact downstream water flows, as the Village removes relatively little water and the power generating station will operate seasonally (withdrawing little or no water during summer low-flow periods).

The biggest potential impact to the water quality may be during the construction of the hydroelectric dam and associated works. If properly managed, this may not be an issue. Once in operation, the new dam may help to settle suspended matter in the water column and improve water quality during peak flow events.

WATER QUALITY ASSESSMENT AND OBJECTIVES

Water Quality Assessment

The monitoring results for McKelvie Creek show that water quality has been consistently good over the period of study. There are a few exceedances (fecal coliforms, *E. coli*, turbidity and total suspended solids) above the recommended provincial guidelines which have been associated with rainfall events. With little or no human activity currently underway within the watershed, the data set collected here are likely to reflect background or natural conditions.

One area of concern is the exceedance of microbiological indicators during the low flow and high flow sampling periods. The drinking water guideline for water receiving disinfection only was exceeded in six of the seven sample sets (five samples in 30 days) for fecal coliforms and in four of the six sample sets (five samples in 30 days) for *E. coli*. The source of these micro-contaminants is likely endemic wildlife as there is limited access to the upper watershed. These exceedances demonstrate the need to treat water for human consumption to prevent potential health risks.

Background levels for turbidity in McKelvie Creek generally are low throughout the year. Elevated levels generally occurred between October and April, and were usually associated with rainfall.

Generally, both true color and total organic carbon (TOC) values remain well below the B.C. drinking water guidelines. However there are a few elevated values for each parameter during rainstorm events that reach near the acceptable values. In light of future activities in the watershed, such as the hydroelectric project and forest harvesting, these parameters may be subject to increases in value.

Concentrations of total suspended solids (TSS, also referred to as non-filterable residue or NFR) were generally below detectable limits with only one sample higher than the water quality guideline for aquatic life. This occurred on November 12, 2002 after a winter rain event.

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

The concentrations of most metals were below detectable limits and well below guidelines for drinking water and aquatic life. The one exception to this was for dissolved aluminum which exceeded the aquatic life guideline of 0.10 mg/L on one occasion. This is likely a result of the natural geology of the area and continued monitoring is recommended to determine if site-specific objectives are warranted.

Water Quality Objectives

Water quality objectives have been set for key characteristics for the McKelvie watershed (Table 1) to protect the water quality for the designated uses: drinking water, aquatic life and wildlife. The objectives are required to ensure that inputs from forestry activities and hydroelectric power generation do not impair water uses in McKelvie creek. The objectives apply to the watershed above the community water supply intakes.

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

Variable	Objective Value
Fecal Coliform Bacteria	≤60 CFU/100 mL (90th percentile based on a minimum of five weekly samples collected over a 30-day period)
Escherichia coli	≤60 CFU/100 mL (90th percentile based on a minimum 5 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
Temperature	≤15^{o}C (long-term) with hourly rate of change not exceeding 1^{o}C
True Colour	15 TCU maximum
Total Organic Carbon	4.0 mg/L maximum
Total Suspended Solids	25 mg/L maximum in a 24-hour period 5 mg/L average (based on a minimum of five weekly samples collected over a 30-day period)

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

The proposed water quality objectives are for the protection of drinking water.

Monitoring Recommendations

The recommended minimum monitoring program for the McKelvie 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. If and when timber harvesting activities commence in the watershed, water temperature monitoring should be conducted. Benthic invertebrate monitoring is proposed to provide a better understanding of the overall ecosystem health.

Table 2. Recommended Water Quality Monitoring for McKelvie Creek Watershed.

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

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