ENVIRONMENTAL PROTECTION DIVISION

WATER STEWARDSHIP DIVISION

MINISTRY OF ENVIRONMENT

Water Quality Assessment and Objectives for the Tsulquate River 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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Fern Schultz, Director, Science and Information

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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 the Tsulquate River, a community watershed supplying drinking water to the community of Port Hardy, located on the north-east end 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 the Tsulquate River, 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 the Tsulquate River and recommends water quality objectives for this watershed based on potential impacts of certain key water quality parameters of concern. The Tsulquate River is a fourth-order stream 20 km in length, draining into Johnstone Straight near the community of Port Hardy, BC. The portion of the watershed designated as a community watershed is 4,475 ha in area, and includes the upper reaches of the Tsulquate River above the Port Hardy water intake (**Figure 1**). The intake is located approximately 2.5 km upstream from its confluence with Hardy Bay.

Anthropogenic land uses within the watershed include timber harvesting, and recreation. These activities, as well as natural erosion and the presence of wildlife, all potentially affect water quality in the Tsulquate River. 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 the Tsulquate River is approximately 4,475 ha in area and ranges from approximately 100m elevation at the Port Hardy water intake to about 610 m in the upper watershed. The river is approximately 19.77 km long in total, and about 18 km long from the its headwaters to the Port Hardy intake. There is one large lake in the watershed, Kains Lake, located at an elevation of 307 metres, with a maximum depth of 25 m and a surface area of 218 ha. This lake is manmade, with water levels controlled with a dam. The upper portion of the watershed, above Kains Lake, has large areas of organic terrain that likely contribute significant amounts of organics to the water and increases overall retention times.

The watershed falls completely within the Coastal Western Hemlock (southern very wet hypermaritime, CWHvh1) biogeoclimatic zone. The Tsulquate River falls within the Nahwitti Lowland (NWM) eco-region established for Vancouver Island by MoE staff.

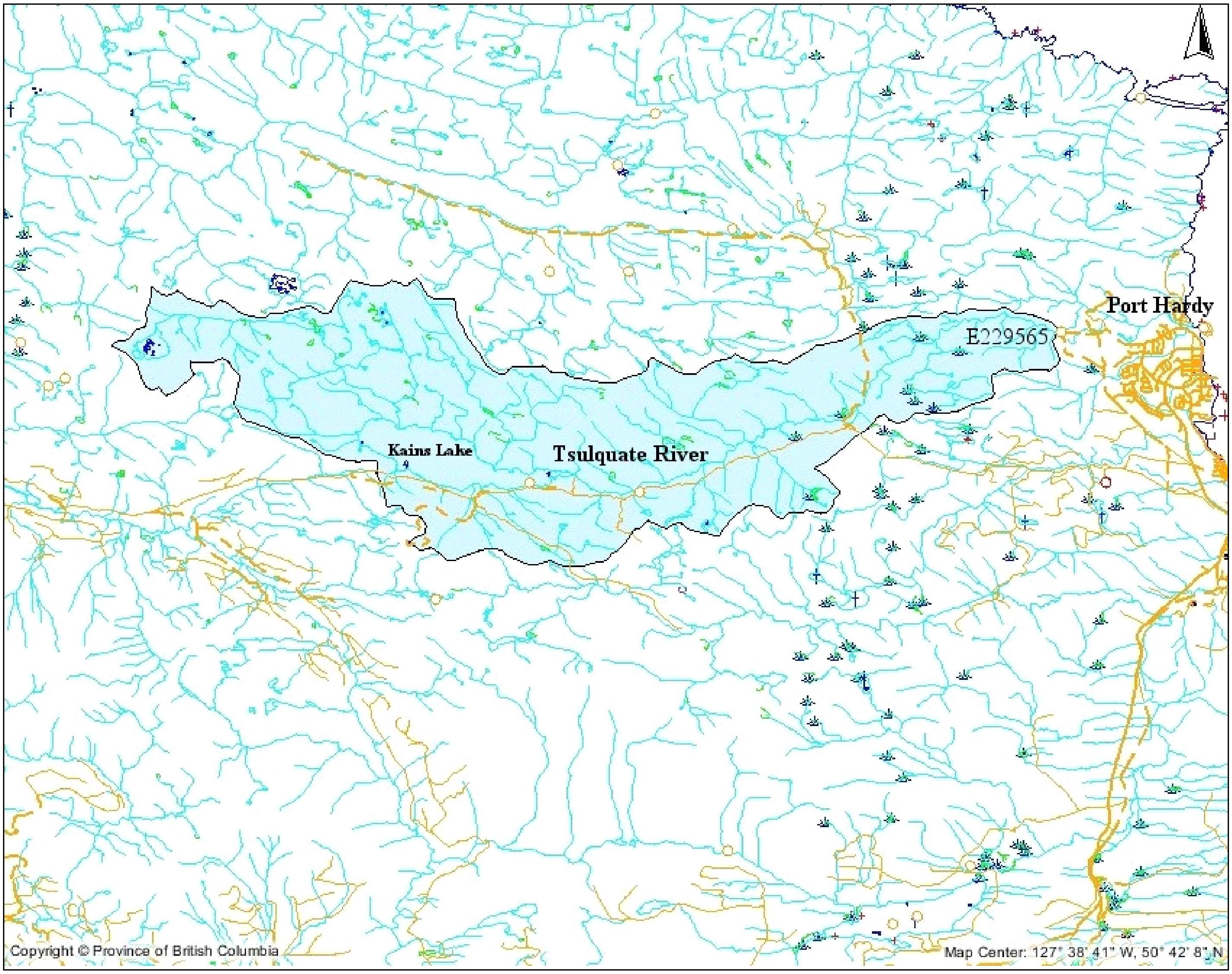

Figure 1. Map of watershed, with sampling location

Hydrology

Water Survey Canada (WSC) has not operated a hydrometric station on the Tsulquate River. However, hydrometric data was collected as part of the automated monitoring program between 2003 and 2005, and shows peak water levels occurring between September and January.

Climate

The nearest climate station to the watershed for which climate normal data is available is at Port Hardy (elevation 21.6 m, Environment Canada Climate Station 1026270). Average daily temperatures in Port Hardy ranged from 3.3^{o}C in January to 14.1^{o}C in July and August for the 30-year period between 1971 and 2000. Average total annual precipitation is 1,869 mm, with only 56 mm (water equivalent) (3%) of this falling as snow.

Water Uses

Water Licenses

Two water licenses have been issued for the Tsulquate River, both to the District of Port Hardy under a Waterworks – Local Authority license, with a total volume of 2,323.1 dam^3/annum. As well, an additional licence has been issued which permits the storage of 1,233.5 dam^3/annum in Kains Lake.

Recreation

There are no BC Forest Service recreation sites located in the Tsulquate River watershed. No specific studies have been conducted to determine the recreational use of the Tsulquate River watershed. However, the presence of historical logging roads in the Kains Lake portion of the watershed allows limited recreational access. The main road is gated and the remaining roads are overgrown.

Fisheries

The Tsulquate River has high fisheries values and is utilized by pink (*Oncorhynchus gorbuscha*), coho (*O. kisutch*) and chum (*O. keta*) salmon, as well as cutthroat trout (*O. clarkii*), Dolly Varden (*Salvelinus malma*), rainbow trout (*O. mykiss*), and steelhead (*O. mykiss*). The river was also stocked with 4,298 Steelhead fry in 2001. Kains Lake has cutthroat trout, Dolly Varden, and rainbow trout.

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 Tsulquate River watershed consists primarily of Crown lands located within TSA 3 and is designated a community watershed under the *Forest and Range Practices Act*. In the 1980's a small portion of the Kains Lake sub-basin was logged, however, as of 1999, all cutblocks on public land were well regenerated. At that time, the Equivalent Clearcut Area (ECA) above 300 metres was 6% in the Kains Lake sub-basin and 2% in the Lower Tsulquate sub-basin. This was forecast to increase slightly to between 6-8% by 2005. The total road density in the Kains Lake sub-basin was 0.7 km/km^2, while the density in the Lower Tsulquate sub-basin was 0.4 km/km^2. One short section of road (50-100 m in length) was given a high hazard rating as a sediment source in the Kains Lake sub-basin.

There were no landslides in either the upper or lower portion of the watershed, and none of the stream channel in either the upper or lower portion of the watershed was considered to be unstable. There were 13 stream crossings in the Kains Lake sub-basin and three crossings in the Lower Tsulquate sub-basin.

Overall, the rate of harvesting within the Tsulquate River watershed has been low, and it appears that there is relatively low risk of landslides or sedimentation from roadways due to past logging and/or road-building activities within the watershed.

Range Tenures and Agriculture

In areas where logging has occurred, range tenures are often issued to allow cattle grazing in new cut-blocks. Cattle have the potential to impact water quality in a number of ways including the introduction of bacteria and pathogens through their wastes, increased levels of nutrients such as nitrogen and phosphorus, and increased stream-bank erosion through vegetation removal and walking in and out of streams. The physical impacts on the stream can result in alterations of the stream channel. Other agricultural activities can contribute nutrients from fertilizers, as well as pesticides.

There are no agricultural activities or range tenures within the Tsulquate River watershed.

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 Tsulquate River watershed, the relative impacts of recreational activities cannot be discussed, but they are likely to be minimal due to the lack of camping areas within the watershed.

Wildlife

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

The Tsulquate River provides habitat for a wide variety of warm-blooded species including black-tail deer, black bear, wolf, cougar, red squirrels, eagles, hawks, owls, grouse and numerous other species of small birds.

Water Licenses

Water licenses can impact aquatic habitat downstream from the withdrawal, especially during low-flow periods. There are two licensed water withdrawals from the Tsulquate River community watershed, with an overall maximum volume of 2,323.1 dam^3/annum. Assuming water was withdrawn from the Tsulquate River at a constant rate throughout the year (an unlikely scenario), this would result in an average withdrawal rate of 0.074 m^3/s. As no flow data is available for the Tsulquate River, it is uncertain whether this volume of water is likely to impact flows downstream from the intake.

Mining and Permitted Discharges

Mining activities can impact water quality by introducing high concentrations of metals to the watershed, depending on the location, and can also contribute to acidification of the water.

MINFILE reports that the local geology consists of Karmutsen Formation andesites and minor limestone in contact to the southwest with Quatsino Formation limestone, both of the Upper Triassic Vancouver Group. A number of mineral showings (copper and zinc) are reported within the watershed. As such, there is a possibility of future mining activities that might impact water quality. However, before such explorations were allowed to occur environmental impact assessments would be required to ensure that impacts to water quality did not occur.

Discharges from commercial operations can affect water quality and timing of flow. However, there are no licensed discharges within the Tsulquate River watershed.

Highways and Transportation

Highways and transportation corridors can influence water quality through run-off of pollutants such as oil and gasoline, as well as alter flow patterns. However, there are no highways or transportation corridors within the Tsulquate River watershed.

Urban Development

Urban development can impact water quality in a number of ways, including increased contaminant concentrations in run-off, direct discharges to the river from businesses, changes in water flow patterns, etc. Industrial development, especially in the lower watershed, may impact water quality due to run-off from these properties. However, there is no urban development within the Tsulquate River watershed.

WATER QUALITY ASSESSMENT AND OBJECTIVES

Water Quality Assessment

Water quality monitoring was conducted in the Tsulquate River 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 good in the Tsulquate River. Parameters of occasional concern include microbiological indicators, turbidity, pH, temperature, true colour, total suspended solids and total organic carbon.

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 (10 CFU/100mL) was exceeded in two of the four sample sets (five samples in 30 days) for fecal coliforms and in two of the three 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.

Turbidity levels in the Tsulquate River were generally low. However, the maximum recorded value approached the upper drinking water guideline. As there has been relatively little activity within the Tsulquate River watershed in recent years, these occasional elevated values likely represent natural variability within the system. A guideline is proposed to ensure that future activities do not impact turbidity levels.

Water temperatures exceeded the aesthetic drinking water guideline in the one summer when temperatures were monitored. It is likely that increased retention times caused by the dam on Kains Lake contribute somewhat to warmer summer water temperatures.

Typical of most watersheds in northern Vancouver Island, true colour levels tended to be naturally high, and consistently exceeded the aesthetic drinking water guideline. As well, total organic carbon levels (which often correlate well with true colour) also consistently exceeded drinking water guidelines. The pH of Tsulquate River water was generally low, again likely reflecting the chemistry of the watershed.

Water Quality Objectives

Water quality objectives have been set for key drinking water characteristics for the Tsulquate River watershed (Table 1). These objectives will also protect wildlife and aquatic life for these characteristics. As there has been little activity in the Tsulquate River watershed these water quality objectives were developed using the background concentration approach, whereby the data collected from this assessment reflects the natural or background conditions in the watershed. 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 Tsulquate River community watershed.

Parameter	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 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
pH	6.0 – 8.5 pH units
Temperature	≤15^{o}C (long-term) with hourly rate of change not exceeding 1^{o}C
True Colour	≤ 108 TCU (90th percentile 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	≤ 12 mg/L (90th percentile based on a minimum of five weekly samples collected over a 30-day period)

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

Monitoring Recommendations

The recommended minimum monitoring program for the Tsulquate River 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 Tsulquate River Watershed

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