



## Water Quality

### Ambient Water Quality Objectives For Quatse Lake

#### Overview Report

*Water Management Branch  
Environment And Resource Division  
Ministry Of Environment, Lands And Parks*

Prepared pursuant to Section 2(e) of the  
Environment Management Act, 1981

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## SUMMARY

This document is one in a series that presents ambient water quality objectives for British Columbia. It has two parts: an overview-which is available as a separate document-and the report. The overview provides general information about water quality in Quatse Lake. It is intended for both technical readers and for readers who may not be familiar with the process of setting water quality objectives. It includes tables listing water quality objectives and required monitoring. The main report presents the details of the water quality assessment for the lake and forms the basis of the recommendations and objectives presented in the overview.

Quatse Lake has low fisheries productivity, resulting in limited appeal for this type of recreational activity. The lake and its outlet stream (Quatse River) are used as drinking water supplies for the Mount Waddington Regional District. The water is currently treated with large amounts of chlorine to disinfect the water and reduce the concentration of colour present.

Most water contamination seems to come from past forestry activities, with about 25% of the watershed having been logged. However, it is difficult to completely isolate impacts which may have arisen due to logging activities.

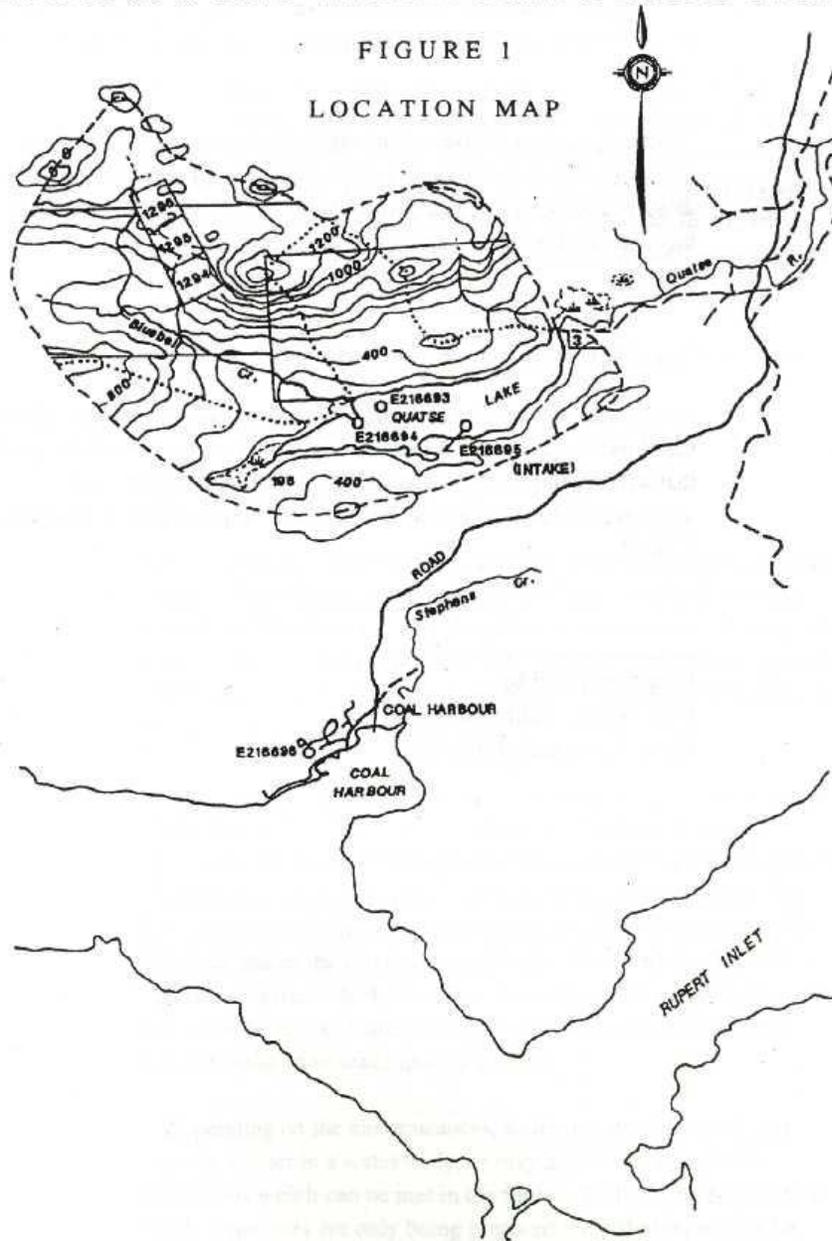
Water quality objectives are recommended to protect aquatic life, wildlife and drinking water supplies with disinfection only. The objectives have been prepared for Environmental Managers for use in determining compliance with the Forest Practices Code of BC.

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Figure 1. Quatse Lake Location Map

# LOCATION AND MONITORING SITES MAPS

FIGURE 1  
LOCATION MAP



## **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, Lands and Parks' 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 near future.

## **How Objectives Are Determined**

Water quality objectives are based the BC approved and working criteria as well as national water quality guidelines. Water quality criteria and guidelines are safe limits of the physical, chemical, or biological characteristics of water, biota (plant and animal life) or sediment which protect water use. Objectives are established in British Columbia for waterbodies on a site-specific basis. They are derived from the criteria by considering local water quality, water uses, water movement, waste discharges, and socio-economic factors.

Water quality objectives are set to protect the most sensitive designated water use at a specific location. A designated water use is one that is protected in a given location and is one of the following:

- raw drinking water, public water supply, and food processing
- aquatic life and wildlife
- agriculture (livestock watering and irrigation)
- recreation and aesthetics
- industrial water supplies.

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**

Water quality objectives routinely provide policy direction for resource managers for the protection of water uses in specific waterbodies. Objectives guide the evaluation of water quality, the issuing of permits, licences and orders, and the management of fisheries and the province's land base. They also provide a reference against which the state of water quality in a particular waterbody can be checked, and help to determine whether basin-wide water quality studies should be initiated.

Water quality objectives are also a standard for assessing the Ministry's performance in protecting water uses. While water quality objectives have no legal standing and are not directly enforced, these objectives become legally enforceable when included as a requirement of a permit, licence, order, or regulation, such as the Forest Practices Code Act, Water Act regulations or Waste Management Act regulations.

## **Objectives and Monitoring**

Water quality objectives are established to protect all uses which may take place in a waterbody. Monitoring (sometimes called sampling) is undertaken to determine if all the designated water uses are being protected. The monitoring usually takes place at a critical time when a water quality specialist has determined that the water quality objectives may not be met. It is assumed that if all designated water uses are protected at the critical time, then they also will be protected at other times when the threat is less.

The monitoring usually takes place during a five week period, which allows the specialists to measure the worst, as well as the average condition in the water.

For some waterbodies, the monitoring period and frequency may vary, depending upon the nature of the problem, severity of threats to designated water uses, and the way the objectives are expressed (*i.e.*, mean value, maximum value).

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## INTRODUCTION

Quatse Lake is located on the north-eastern end of Vancouver Island, approximately three kilometers north from Coal harbour (see [Figure 1.](#)), and is the primary source of drinking water for the town. Currently, the water is treated with large amounts of chlorine prior to drinking to disinfect the water and reduce the concentration of colour. Recent logging activity in the lake watershed has raised concerns that the water quality might be affected.

The purpose of this report was to provide Environment Managers water quality objectives for Quatse Lake for use in determining compliance with the Forest Practices Code of BC.

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## QUATSE LAKE-PROFILE

### HYDROLOGY

Quatse Lake watershed has a contributory area of 15 km<sup>2</sup>. The lake has a surface area of 1,500,000 m<sup>2</sup> and a volume of 11,760,000 m<sup>3</sup>, resulting in an exchange rate of about one and one-half times per year.

Flows into Quatse Lake come from Bluebell Creek to the west, with estimated flows from 0.037 to 0.124 m<sup>3</sup>/s in the April to September period and to as high as 1.03 m<sup>3</sup>/s in January. Return periods could not be calculated since these flows were estimates based upon precipitation measurements.

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## **WATER USES**

Water uses in Quatse lake are for aquatic life, wildlife and drinking water supplies. Mt. Waddington Regional District is allowed a withdrawal of 10,642 m<sup>3</sup> per year from the lake, with an additional licence for water from the Quatse River, the outflow from the lake.

Aquatic biological productivity in the lake is low, resulting in a small amount of recreational fishing.

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## **WASTE DISCHARGES**

There are no permitted refuse sites or waste discharges into the Quatse Lake watershed. Approximately 25% of the watershed was logged in the 1970's and 1980's, including a large area of about 300 ha north from the lake.

There are also several mining claims in the watershed; however, none are currently mined actively.

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## **WATER QUALITY ASSESSMENT AND OBJECTIVES**

### **WATER QUALITY ASSESSMENT**

Quatse Lake is a coastal lake and is typical in being poorly buffered to acidic inputs, having low alkalinity and therefore low hardness. The mean pH (6.3) is below the criteria range for drinking water (6.5-8.5). An objective of pH 6.0 is set in light of the naturally low pH.

Metal concentrations in Quatse Lake were usually below the BC approved or working water quality criteria except for occasional higher concentrations of iron or aluminum. This is typical in coastal lakes and no objectives were set.

Phosphorus concentrations were low enough to not cause excessive algal growth but watershed disturbance may cause an increase in phosphorus. For this reason, an objective is set in order to monitor this aspect of water quality.

Dissolved oxygen concentrations were usually satisfactory, but late summer concentrations in the deep water were low enough to be of some concern. Since these levels should not decrease (potentially by future anthropogenic activities, including logging) further, an objective is set to protect aquatic life.

The natural colour of the lake is very high, typically in the range of 50 to 100 true colour units, as a consequence of input of organic acids from watershed vegetation. The mean colour value (82 true colour units) exceeds the criteria for drinking water (75 units). A long-term objective of 75 units is set for raw drinking water recognizing that some management efforts may be needed to achieve this.

Turbidity values are typically low (less than 1 NTU) but there are times during high runoff and summer algal blooms when this may be exceeded. The objective is set for 1 NTU.

Fecal coliform concentrations are generally very low, below criteria and the objective set (10/cL). Fecal coliforms are very important indicators that need to be included in an objectives monitoring program.

Trihalomethanes (THM's) were found to be in relatively high concentrations for samples taken of treated water (after chlorination) at the tap. The high THM's are due to high amounts of natural organic material in the water (which are measured as total organic carbon and colour). Monitoring of THM's at the tap should be undertaken by the appropriate health authority as they may represent a significant human health risk.

The remainder of the general ion chemistry values are low and of little concern.

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## **WATER QUALITY OBJECTIVES**

Water quality objectives proposed for Quatse Lake are summarized in Table 1. The objectives are based on BC approved and working criteria and the Canadian Drinking Water Guidelines for water quality and on available data on ambient water quality, waste discharges and water uses. The objectives will be modified as necessary by new data from receiving water monitoring programs.

Water quality objectives have no legal standing and would not be directly enforced. The objectives can be considered as policy guidelines for resource managers to protect water uses in the specified waterbodies. They will guide the evaluation of water quality, the issuing of permits, licences and orders and the management of the fisheries and of the Province's land base. They will also provide a reference against which the state of water quality in a particular water body can be checked and serve to make decisions on whether to initiate basin-wide water quality studies.

Depending on the circumstances, water quality objectives may already be met in a water body, or may describe water quality conditions which can be met in the future. To limit the scope of the work, objectives are only being prepared for waterbodies and for water quality characteristics which may be affected by human activity now and in the foreseeable future.

Designated water uses for all three waterbodies (Quatse lake, Quatse River and Bluebell Creek) are for the protection of aquatic life, wildlife and drinking water supplies with disinfection only. Objectives are set and monitoring is proposed only for Quatse Lake.

Water quality objectives which are based on approved BC water quality criteria are proposed for microbiological indicators, turbidity, dissolved oxygen, pH and phosphorus. The objective for colour is based on the Canadian Drinking Water Guidelines.

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## **MONITORING RECOMMENDATIONS**

At least three years of monitoring is recommended to check whether the objectives are being achieved. The extent of the monitoring after that will depend on results, as well as on regional priorities and available funding. A recommended monitoring design is included as [Table 2](#).

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### **WATER QUALITY OBJECTIVES AND MONITORING TABLES**

The following tables provide a summary of the objectives data and monitoring recommendations.

To protect water uses in a water body, objectives specify a range of values for characteristics (variables) that may affect these uses. These values are maximum and/or minimum values that are not to be exceeded.

Some readers may be unfamiliar with terms such as: maximum concentration, 30-day average concentration, 90th percentile and not applicable (NA). Maximum concentration means that a value for a specific variable should not be exceeded; 30-day average concentration means that a value should not be exceeded during a period of 30 days, when five or more samples are collected at approximately equal time intervals. The term 90th percentile indicates that 9 out of 10 values should be less than a particular value. Not applicable (NA) means that water uses are not threatened for that particular variable.

**Table 1. Water Quality Objectives for Quatse Lake**

<b>Characteristics</b>	<b>Values</b>
<b>designated water uses</b>	<b>aquatic life, wildlife, drinking water (disinfection only)</b>
<b>fecal coliforms</b>	<b>10/cL geometric mean</b>
<b>turbidity</b>	<b>1 NTU maximum</b>
<b>phosphorus</b>	<b>0.015 mg/L maximum</b>
<b>colour-true</b>	<b>75 units maximum</b>
<b>dissolved oxygen</b>	<b>greater than 5 mg/L</b>
<b>pH</b>	<b>greater than 6.0</b>

*For fecal coliforms the geometric mean is calculated from at least five weekly samples in a period of thirty days. For values recorded as less than the detection limit, the detection limit itself should be used in calculating the statistic.*

**Table 2. Recommended Water Quality Monitoring for Quatse Lake**

Site	Location	Frequency and Date	Samples	Variables
E216693	at deepest point	spring overturn (surface, mid-water and bottom)	3	total phosphorus
		August	1	dissolved oxygen at 1 m above the sediments
E216695	at water intake	once in each of January, April, July and October	4	pH, true colour, turbidity
		5 samples in 30-days in July or August	5	fecal coliforms

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