



Water Quality

Ambient Water Quality Assessment And Objectives Charlie Lake Sub-Basin Peace River Area

Overview Report

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

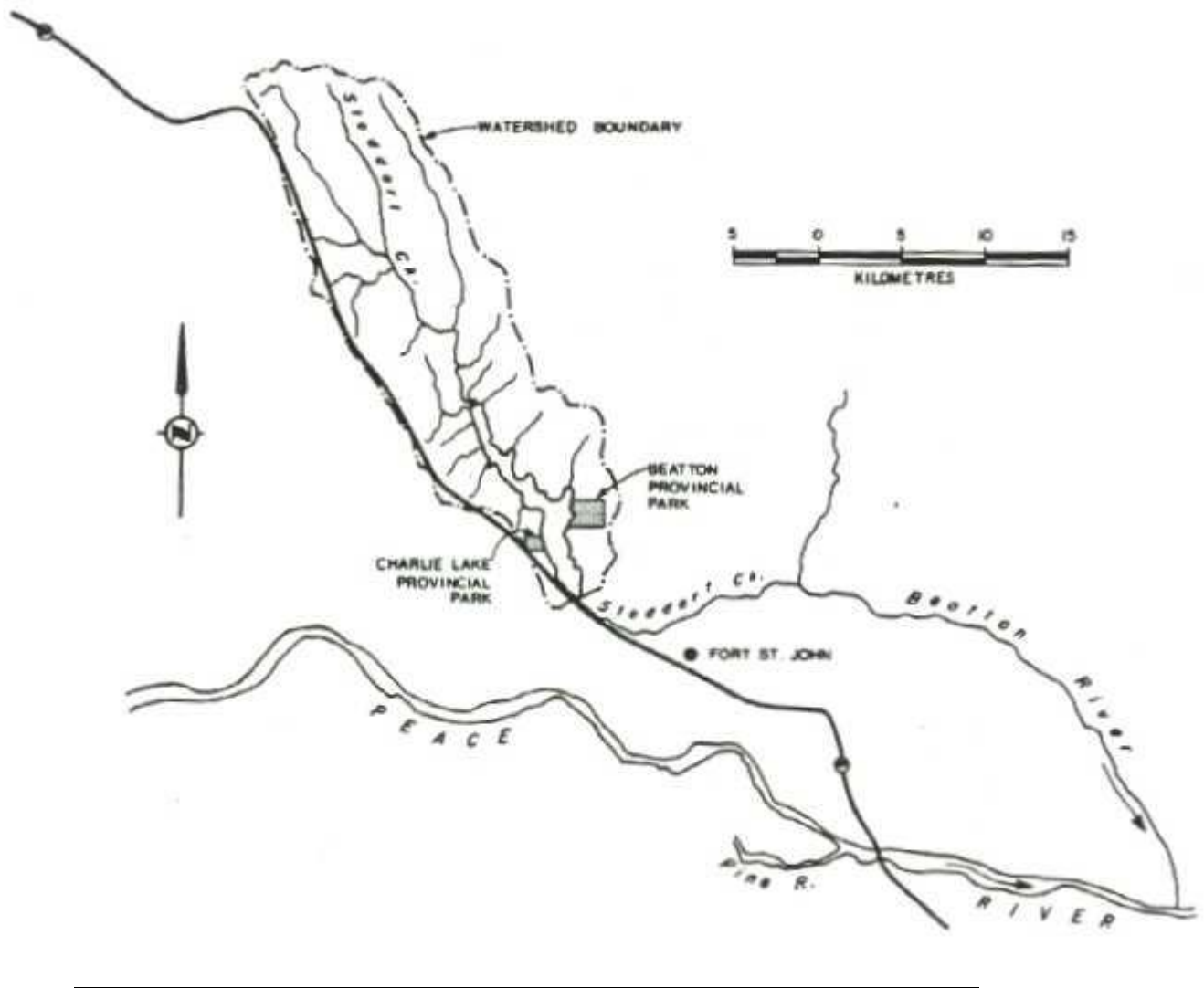
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Original Signed By Ben Marr
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INTRODUCTION

This report contains an assessment of water quality in the Charlie Lake sub-basin located in the Peace River area. The conclusions presented in the report are supplemented by a detailed technical appendix. The watershed is considered a priority sub-basin because of the importance of Charlie Lake as a water resource. The lake serves as the water supply for the City of Fort St. John, is the focus of heavy recreational use and has an important sport fishery.

Figure 1. Charlie Lake Watershed Map



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, 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 on 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).

HYDROLOGY

The lake is relatively large and shallow, and shows little, if any, temperature stratification. Average water residence time in the lake is six years, indicating that the lake is poorly flushed.

Outlet water is controlled by a dam and flows via Stoddart Creek into the Beatton River then into the Peace River, as shown on the attached [map](#).

WATER USES

Lake water is licenced for domestic use, irrigation, bulk water supply (waterworks) and industrial use. The total licenced withdrawal is 7221 dam³/year, the largest licence being for the City of Fort St. John.

WASTE DISCHARGES

There are no point-source discharges of waste within the watershed, but significant amounts of nutrients, coliform bacteria and possibly agricultural chemicals may originate from non-point sources such as sewage disposal and agricultural activity.

WATER QUALITY

The overall water quality is very poor because of excessively high algal production. The water has poor water clarity, high colour and high nutrient values. The high algal production is due to high phosphorus levels in the lake (mean 0.096 mg/L total phosphorus), but the sources of the phosphorus have not been

specifically identified or quantified. No systematic sampling has been conducted for fecal coliform bacteria, but available information shows sufficiently high concentrations to be a cause of concern.

PROVISIONAL WATER QUALITY OBJECTIVES

Provisional water quality objectives for two variables have been proposed for Charlie Lake and Stoddart Creek below the lake, and are summarized in [table 1](#). Insufficient data are available to set objectives in Stoddart Creek above the lake, although the water uses are identified.

The objectives are based on preliminary working criteria for water quality and on available data on ambient water quality, waste discharges, water uses and limnological characteristics.

The objectives will remain provisional until receiving water monitoring programs provide adequate data, and the Ministry has established approved water quality criteria for the characteristics of concern.

The objectives can be considered as policy guidelines for resource managers to protect water uses in the specified water bodies. For example, they can be used to draw up waste management permits and plans, regulate water use or plan fisheries management. They can also provide a reference against which the state of water quality in a particular water body can be checked.

Water quality objectives have no legal standing and their direct enforcement would not be practical. This would be due to the difficulty of accurately measuring contaminants in receiving water and attributing the contamination exceeding the objective to particular sources for legal purposes, and thus of proving violations and their causes. Hence, although water quality objectives should be used when determining effluent permit limits, they should not be incorporated as part of the conditions in a waste management permit.

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 water quality characteristics which may be affected by man's activity, now and in the foreseeable future.

The designated water uses for Stoddart Creek upstream from Charlie Lake are fisheries and irrigation; for Charlie Lake itself they are drinking water supply, recreation, fisheries and industrial use; and for Stoddart Creek downstream from the lake they are drinking water supply, fisheries, irrigation and recreation

A reduction in phosphorus has been recommended to improve the water quality of the lake. Long-term provisional objectives of less than or equal to 0.050 mg/L (total phosphorus) for spring overturn and 0.075 mg/L for all other times of the year are recommended for Charlie Lake. For fecal coliform bacteria, the provisional objective recommended to protect drinking water is for the 90th percentile not to exceed 10 MPN per 100 mL in any 30-day period for Charlie Lake and Stoddart Creek downstream from Charlie Lake. At bathing beaches a 30-day geometric mean of 200 MPN/100 mL and a 90th percentile of 400 MPN/100 mL are recommended during the recreation season.

The phosphorus objectives are not being met and studies to ascertain the main source of phosphorus will be needed before corrective measures can be taken. The drinking water objective for fecal coliforms is probably close to being met, but more monitoring is needed to confirm this situation and thus ensure protection of water supplies.

MONITORING RECOMMENDATIONS

Three areas are identified for future monitoring. Specific studies are being recommended rather than a program of ongoing monitoring. A survey of fecal coliform bacteria in the lake is required. The study could be done in conjunction with the phosphorus study outlined below.

A nutrient input study is required to determine the sources and relative contributions of phosphorus to the lake. The project would require evaluation of septic tank disposal sites and agricultural practices around the lake, examination of inlet streams and ground water inputs and estimates of dustfall and precipitation contributions.

The third study is for a survey of insecticides and herbicides in lake sediments. A preliminary inquiry would be needed into the types of chemicals used, the areas in which they were used and time of year.

The monitoring recommendations above are made from a technical perspective and the extent to which recommended monitoring is carried out will depend on the overall priorities and monitoring resources available. Details of the proposed monitoring are given in table 2.

TABLES

Table 1

Provisional Water Quality Objectives for Charlie Lake

Water Bodies	Charlie Lake	Stoddart Creek d/s from Charlie Lake
Designated Water Uses	drinking water, aquatic life, recreation, industrial	
fecal coliforms near water intakes	less than or equal to 10 MPN/100 mL 90th percentile	

fecal coliforms at bathing beaches	less than or equal to 200 MPN/100 mL geometric mean less than or equal to 400 MPN/100 mL 90th percentile	
total phosphorus	less than or equal to 0.050 mg/L mean at spring overturn less than or equal to 0.075 mg/L mean at all other times	not applicable

1. the geometric mean and 90th percentiles are calculated from at least 5 weekly samples taken in a period of 30 days. The drinking water objective (10/100 mL) applies year-round and the recreation objective (200 to 400/100 mL) applies during the recreation season.

2. these are long-term objectives to be met in the future. Each average is calculated from a set of at least 3 samples, including near the surface, at mid-depth and near the bottom, all 3 at mid-lake.

Table 2

Recommended Water Quality Monitoring for Charlie Lake

Site	Frequency and Time	Characteristics
Bacterial study		
10 lake sites	minimum of 5 times per month at each site for at least 1 month	fecal coliforms
Insecticide and Herbicide study		
lake sediments	once or twice in freshet or runoff periods	insecticides and herbicides in use locally

Nutrient input study		
sewage disposal sites	once	number of dwellings, distance to lake, soil type, terrain, slope, etc.
agricultural land around the lake	once	area in use, number of livestock, fertilizer applied, soil type, distance to lake, etc.
inlet streams	weekly for 1 to 2 months	total P, total dissolved-P, ortho-P, total solids, suspended solids, colour, fecal coliforms, flow
5 ground water sites	monthly for 6 months	total P, total dissolved-P, ortho-P, total N, NH₃-N, NO₂-N
ambient air at 1 site	monthly for 1 year	total P, total-N in dustfall and in precipitation
2 lake sites at surface, mid-depth and bottom	every 3 to 4 weeks for 1 year	total P, ortho-P, total dissolved-P, temperature profile, DO profile

Note: This table is for specific studies to be done once and not for routine monitoring.

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