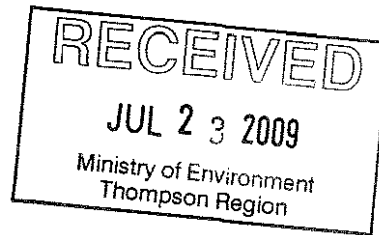


Gabi
~~Lab~~
Brian
File

RSG - letter sent

Teck



July 20, 2009

Ministry of Environment
1259 Dalhousie Drive,
Kamloops, BC

Attention: Mr. R. Adams, Regional Manager

Dear Sir:

Re: Afton Operating Corporation 2008 Water Monitoring Program - PE 3904

Please find enclosed the results of the 2008 water monitoring program for Afton Operating Corporation site located near Kamloops, BC. This report was prepared by Kala Groundwater Consulting Ltd. of Kamloops, as part of the reporting requirement of Permit PE-3904.

If, you have any questions, please contact Mr. Mark Edwards, Director Environment, at Teck Resources Limited's Vancouver office (604 699 4000)

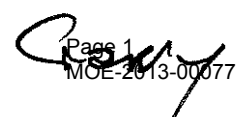
Thank you.

Sincerely


Garry Davies
Manager

s.22

if, you need more info
Please, contact me as well
250 319 6360

Page 1
MOE-2013-00077


1314 McGill Road
Kamloops, BC
V2C 6N6

Tel (250) 372-9194
Fax (250) 372-9398
info@kalagroundwater.com

RECEIVED**JUL 23 2009**

Ministry of Environment
Thompson Region

Date: November 7, 2008
Kala Ref.: R97183-300

Afton Operating Corporation
4000 Trans Canada Highway,
Kamloops, BC
V1S 2A9

Attn: Garry W. Davies
Senior Environmental Coordinator

Re: **AFTON MINESITE
2008 SURFACE WATER MONITORING PROGRAM - KAMLOOPS, BC
REPORT OF FINDINGS TO DATE**

1.0 INTRODUCTION

The following report summarizes the findings to date for the 2008 routine surface water monitoring program undertaken by Kala Groundwater Consulting Ltd. (Kala) at the former Afton Mine site west of Kamloops, BC.

This monitoring program involved bi-annual water quality monitoring of seven groundwater locations situated around the Afton Mine tailing pond. The monitoring program was initiated in December, 2007. A site location and layout diagram is shown in Figure 1 and Figure 2, respectively. Detailed certificates of analytical chemistry are provided in Appendix A.

2.0 DESCRIPTION OF MONITORING PROGRAM

Kala was onsite December 11, 2007 and June 11, 2008 to collect water quality monitoring samples. Three surface samples were taken southeast of the tailing pond, two from Peterson Creek and one from Alkali Creek. Two samples were taken northwest at Cherry Creek and two samples were taken from the surface of the tailing pond. The comparative criteria used for this site is the, "*British Columbia Approved Water Quality Guidelines 2006 Edition*". The site will be visited again in December, 2008. Sampling locations outlined in Table 1 and water quality analysis parameters are outlined in Table 2. Chemistry data and exceeded parameters are outlined in Table 3.

3.0 FINDINGS

The December, 2007 and June, 2008 surface samples either exceeded the applicable criteria or indicated elevated concentrations for the following parameters: pH, sodium, sulphate, hardness (CaCO_3), phosphate, iron and selenium, as shown in Table 3.

4.0 RECOMMENDATIONS FOR 2009 GROUNDWATER MONITORING

Based on the findings to date, Kala recommends that the monitoring program be continued in 2009 unless altered by mutual consent by client and regulator. The program would include surface water monitoring of seven existing sites conducted bi-annually in June and December. The water quality parameters would be the same as for the 2007 - 2008 monitoring period.

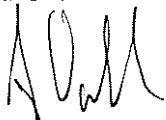
5.0 CLOSURE

Please find attached a detailed description of the terms, limitations and constraints applicable to Kala involvement within this project and the uses of this report.

We trust this meets your present requirements and if there are any questions, please do not hesitate to contact the undersigned.

Sincerely,

Kala Groundwater Consulting Ltd.



Arlen Valade, B.Sc.
Technical Services Manager

Distribution 3 Copies – Afton Operating Corporation
 2 Copies – Kala Groundwater Consulting Ltd.

P: 1997 97183-300 Afton Sampling Current Report R97183-300 Afton Monitoring Report Summary 1107K.C.doc

LIMITATIONS AND CONSTRAINTS

Standard of Care

This report has been prepared in accordance with generally accepted hydrogeological and environmental practices. Where possible and applicable Kala has referenced and undertaken authorized commissions in accordance with governing regulatory guidelines. No other warranty, expressed or implied, is made.

Reporting

This report has been prepared for the specific site, design objective, development and purpose that was described to Kala Groundwater Consulting Ltd. (Kala) by the client and summarized in this document. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the report are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Kala, unless Kala was specifically requested by the Client to review and revise the report in light of such alteration or variation.

Preliminary Site Investigations

This report authorizes the use of this Kala Groundwater Consulting Ltd. (Kala) report by the client as named here within, its solicitors, lenders, engineers and consultants to the same extent as the client, and confirms that the client can rely on this report for financial purposes. This report may be relied upon by supporting financial institutions and related solicitors, lenders, engineers and consultants to the same extent as the original client. Reporting is confidential intended to provide the client with a baseline assessment of environmental conditions within and adjacent to the subject property. Reporting is based on data, information and materials collected during the performance of a PSI. A PSI is based solely on site conditions of the subject property during the time of the site visits as described in this report. In evaluating a site Kala relies in good faith on historical information provided by individuals and agencies noted within the report. Kala does not warranty any property, explicitly or implicitly. Although every effort is made to verify the authenticity of pertinent information, Kala assumes no responsibility for any deficiency, mis-statement or inaccuracy contained within a report as a result of omissions, misrepresentation or fraudulent acts of the individuals or parties interviewed.

Groundwater Potential Evaluations and Proof of Sufficient Water Investigations

Groundwater potential evaluations are based on a thorough review of maps, databases and published documents available at the time of the assessment, and a site reconnaissance. The conclusions provided by Kala do not preclude the existence of other aquifers from those identified. A groundwater supply investigation involving testwells and evaluation techniques is required to verify the presence or absence of suspected aquifers. If additional information or assessment findings arise which may alter the conclusions and/or recommendations of this report Kala would be pleased to review and append our report where required.

Proof of water assessments are based on pumping test information provided by others and interpreted by Kala unless otherwise noted. Groundwater sourced from fractured bedrock aquifers is dependant on the density and aperture of randomly and structurally oriented fractures and joints. Kala can not warranty the long term viability of domestic water wells completed within fractured bedrock. Water well maintenance is required on a regular basis to ensure long term yields.

LIMITATIONS AND CONSTRAINTS

Kala proof of water evaluations are valid for the time of year and site conditions as noted. The impacts of neighboring water wells on the pumping well or the later alteration of site conditions to include additional water wells has not been determined. While every effort is made to establish a recommended pumping rate for a subject water well based on the data provided, the client or well owner is responsible for monitoring long term well water to verify an aquifers response to pumping and maintain the well such that well bore deterioration does not impact well performance.

Kala recommends the construction, development and use of drilled wells over and above excavated wells where ever possible. Dug wells generally comprise shallow culvert style excavations which are directly under the influence of surface water owing to depth and proximity to surface water recharge. Dug wells unlike deeper drilled wells are more sensitive to fluctuations in total available drawdown which impacts the quantity of water available. Seasonal fluctuations in water level especially during drought periods can have pronounced impact on dug wells. Dug wells are not developed to a silt and sand free condition as deeper drilled wells completed in unconsolidated formations are; rather dug wells rely on the filtering capacity of the surrounding envelope of drain rock to improve water quality. Both the quality and quantity of water sourced from dug wells is more sensitive to surface and local watershed changes.

Report Use

Kala will consent to any reasonable request by the client to approve the use of this report by other parties as approved users. This report may be relied upon by financial institutions, solicitors, lenders, engineers and consultants to the same extent as the original client. Kala authorizes only the client and those client identified agents to make copies of the report, and only in such quantities as are reasonably necessary for the use of the report by those parties. The client and approved users or agents may not give, lend, sell or otherwise make available the report or any portion thereof, or any copy of the report or portion thereof, to any other party without the permission of Kala.

Third Party Report Use

The information provided within this report is for the exclusive use of the client/owner and their authorized users and agents. Third party use of this report or any reliance or decisions made on the subject information herein, is at the sole risk of the third party. Kala has no obligation, contractual or otherwise to any third persons or parties, using or relying on this information for any reason and therefore accepts no responsibility for damages incurred by a third party as a result of actions taken or decisions made on the basis of the subject information.

Complete Report

The report is not intended to stand alone without reference to the instructions given to Kala by the Client, communications between Kala and the Client, and to any other reports prepared by Kala for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations, and opinions expressed in the report, reference must be made to the whole of the report. Kala cannot be responsible for use by any party of portions of the report without reference to the whole report.

LIMITATIONS AND CONSTRAINTS

Interpretation of the Report

(a) *Nature and Exactness of Soil Description:* Classification and identification of soils, rocks and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from these systems have been used they are specifically mentioned. Classification and identification of the type and condition of soils, rocks and geologic units are judgmental in nature. Accordingly, Kala cannot warrant or guarantee the exactness of the description of insitu ground conditions set forth in the Report.

(b) *Logs of Test Holes, Pits, Trenches etc.:* The test hole logs are a record of information obtained from field observations and laboratory testing of selected samples as well as an interpretation of the likely subsurface stratigraphy at the test hole sites. In some instances normal sampling procedures do not recover a complete sample. Soil, rock or geologic zones have been interpreted from the available data. The change from one zone to another, indicated on the logs as a distinct line, may be transitional. The same limitations apply to test pit and other logs.

(c) *Stratigraphic and Geologic Sections:* The stratigraphic and geologic sections indicated on drawings contained in this report are interpreted from logs of test holes, test pits or other available information. Stratigraphy is inferred only at the locations of the test holes or pits to the extent indicated by items (a) and (b) above. The actual geology and stratigraphy, particularly between these locations, may vary considerably from that shown on the drawings. Since natural variations in geologic conditions are inherent and a function of the historic site environment, Kala does not represent or warrant that the conditions illustrated are exact and the user of the report should recognize that variations may exist.

(d) *Groundwater Conditions:* Groundwater conditions shown on logs of test holes and test pits, and/or given within the text of this report, record the observed conditions at the time of their measurement. Groundwater conditions may vary between test hole and test pit locations and can be affected by annual, seasonal and special meteorological conditions, or by tidal conditions for sites near the seas. Groundwater conditions can also be altered by construction activity. These types of variations need to be considered in design and construction.

Samples

Kala normally disposes of all unused soil, rock, and sediment or water samples after 90 days of completing the testing program for which the samples were obtained. Further storage or transfer of samples can be made at the owner's expense upon written request.

LIST OF TABLES

Table 1:	Sampling Locations
Table 2:	Analysis Parameters
Table 3:	Analytical Parameters Exceeding BCWQC - 2006

LIST OF FIGURES

Figure 1:	Site Location Diagram
Figure 2:	Sampling Location Diagram

LIST OF APPENDICES

Appendix A:	Certificates of Analytical Chemistry
	Summary of BC Approved Water Quality Guidelines - 2006

TABLES

LIST OF TABLES

Table 1:	Sampling Locations
Table 2:	Analysis Parameters
Table 3:	Analytical Parameters Exceeding BCWQC - 2006

Table 1 - Sampling Locations		
Site ID	Latitude, Longitude and Elevation	Location Description
601013	N50 39.055 W120 31.385 697 m	Tailing Pond
601005	N50 39.310 W120 32.539 641 m	NW seepage pond
600178	N50 40.062 W120 33.838 597 m	Cherry Creek at TC Highway and Greenstone road turn off, creek runs under Greenstone road.
600177	N50 37.702 W120 32.228 800 m	Past 6 km marker on Greenstone Road, side road turns off to left.
600210	N50 38.592 W120 32.105 719 m	Akliali Creek south of tailing pond
600301	N50 36.343 W120 24.644 894 m	Peterson Creek at toe of Jacko Lake dam.
600303	N50 36.382 W120 22.530 880 m	Peterson Creek where it runs under Goose Lake Road.

Table 2 - Analysis Parameters		
pH	Conductivity ($\mu\text{S}/\text{cm}$)	Sodium – Total (mg/L)
Sulphate (mg/L)	Hardness (CaCO_3 – mg/L)	Nitrate, Nitrite, Nitrate+Nitrite (mg/L)
Nitrogen - Kjeldahl (mg/L)	Ammonium-N (mg/L)	Phosphate (mg/L)
Iron – Total (mg/L)	Copper – Total (mg/L)	Calcium – Total & Dissolved (mg/L)
Molybdenum- Total (mg/L)	Selenium – Total (mg/L)	Magnesium – Total & Dissolved (mg/L)
Zinc – Total (mg/L)		

Table 3 – Analytical Parameters Exceeding BCWQG - 2006

Site ID	pH	Conductivity (µS/cm)	Sodium Total (mg/L)	Sulphate (mg/L)	Hardness (CaCO ₃ – mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Nitrate+ Nitrite (mg/L)	Nitrogen - Kjeldahl (mg/L)	Ammonium- N (mg/L)	Phosphate (mg/L)	Iron Total (mg/L)	Copper Total (mg/L)	Calcium Total (mg/L)	Calcium Dissolved (mg/L)	Molybdenum Total (mg/L)	Selenium Total (mg/L)	Magnesium Total (mg/L)	Magnesium Dissolved (mg/L)	Zinc Total (mg/L)
BCEWQC Drinking Water	6.5-8.5 AO	-	-	<500 AO	>500 mg/L	45 mg/L	3.2 mg/L	10	-	-	0.01 mg/L MAC (Lakes)	<0.3 mg/L AO	<1 mg/L AO	-	-	-	0.01 mg/L MAC	-	100 mg/L	<5 mg/L AO
BCEWQC Freshwater	6.5-9.0	-	-	100 mg/L MAC	-	-	-	200	-	-	0.005 to 0.015 (Lakes)	-	(0.094 (hardness)+2)/1000 mg/L	-	-	-	0.01 mg/L MAC	-	-	0.1mg/L
11-Dec-07																				
TP 601013	9.15	3230	546	942	439	<	0.004	<	2.4	0.54	0.16	0.38	0.018	17	19.5	0.162	<	83.5	94.6	<
SP 601005	8.07	4560	497	1630	736	3.36	0.004	3.36	0.3	0.03	0.03	0.41	0.021	89.2	82.4	0.19	0.038	134	129	<
DS 600178	7.96	681	29.3	95	295	0.32	0.004	0.32	0.6	0.03	0.03	0.15	0.002	76.2	74.5	0.0082	<	26.7	26.3	<
NS 600177	7.87	361	5.91	12.2	190	0.02	<	0.02	0.3	<	0.04	0.13	0.002	65.1	55.5	0.0099	<	14.8	12.4	<
NS 600210	7.77	1950	130	493	603	0.08	0.008	0.09	3.6	0.51	0.24	0.17	0.003	82.1	79.5	0.0047	<	105	98.2	<
NS 600301	7.34	830	45.1	62.9	338	<	<	<	1.4	0.39	0.09	2.01	0.002	75.4	67.1	0.0029	<	46	41.3	<
NS 600303	7.61	1790	98.1	469	995	<	<	<	1.5	<	0.12	0.32	0.003	149	158	0.007	<	136	146	<
11-Jun-08																				
601013	8.95	2120	384	568	357	<0.01	<0.01	<0.01	1.3	0.04	0.04	<0.05	0.017	27.1	27.1	0.096	<	69.5	70.2	<
601005	8.81	4830	702	2290	1120	0.04	<0.01	0.04	0.8	0.04	<	<0.05	0.008	66	63.5	0.17	0.029	233	234	<
600178	8.09	303	9.13	27.2	150	0.03	<0.01	0.03	1.7	0.04	0.05	0.2	0.005	38.9	38.5	0.01	<	13	13	<
600177	8.04	208	3.54	10.1	103	0.01	<0.01	0.01	1.4	0.02	0.02	0.1	0.004	32	29.9	0.01	<	7.24	6.86	<
600210	8.18	582	33.7	62.2	271	0.01	<0.01	0.01	1.3	0.04	0.2	0.05	0.004	51.1	50.3	0.0026	<	34.5	35.3	<
600301	7.79	781	43	71	310	0.02	<0.01	0.02	2	0.22	0.05	1.18	0.003	64.9	58.5	0.0027	<	43.9	39.8	<
600303	8.11	821	50.1	112	354	0.01	<0.01	0.01	0.9	0.06	0.04	0.06	0.003	63	59	0.014	<	55.1	50.2	<

BCWQC = BC Approved Water Quality Guidelines (criteria) - 2006

AO = Aesthetic Objective

MAC = Maximum Acceptable Concentration

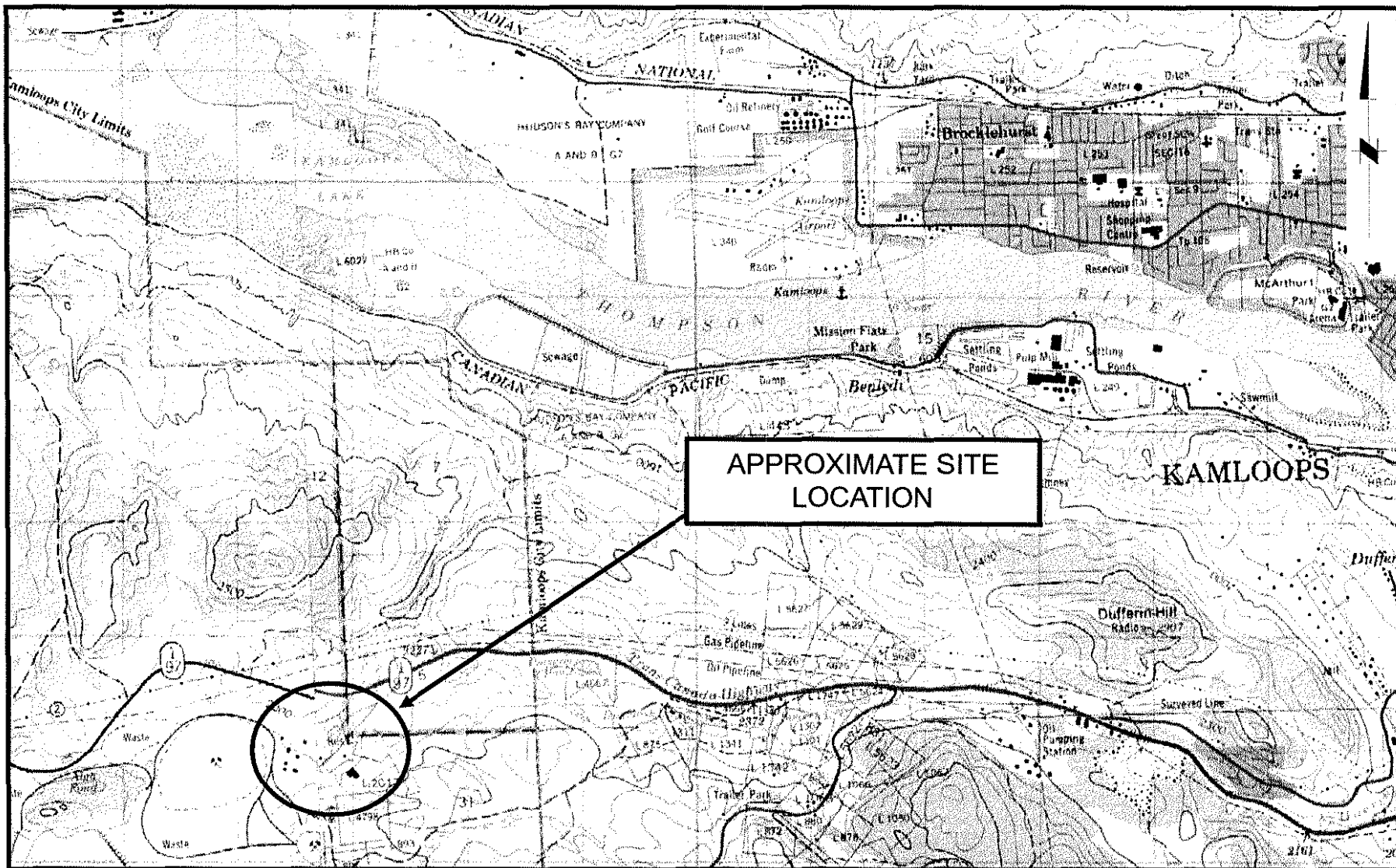
Bold = Exceeds BCWQC for Drinking Water

Italic = Exceeds BCWQC for fresh water aquatic

FIGURES

LIST OF FIGURES

- Figure 1: Site Location Diagram
Figure 2: Sampling Location Diagram



Scale in Meters 1: 50,000
 -500 0 500 1,000 2,000

Scale: 1:50,000
 Date: October 2007
 Approval:
 Design By:
 Drawn By: JB
 Checked By:

SEAL



KALA GROUNDWATER CONSULTING LTD.
 VERNON KAMLOOPS

1314 MCGILL ROAD
 TEL (250) 372-9194

KAMLOOPS, BC, V2C 6N6
 FAX (250) 372-9398

AFTON OPERATING CORPORATION

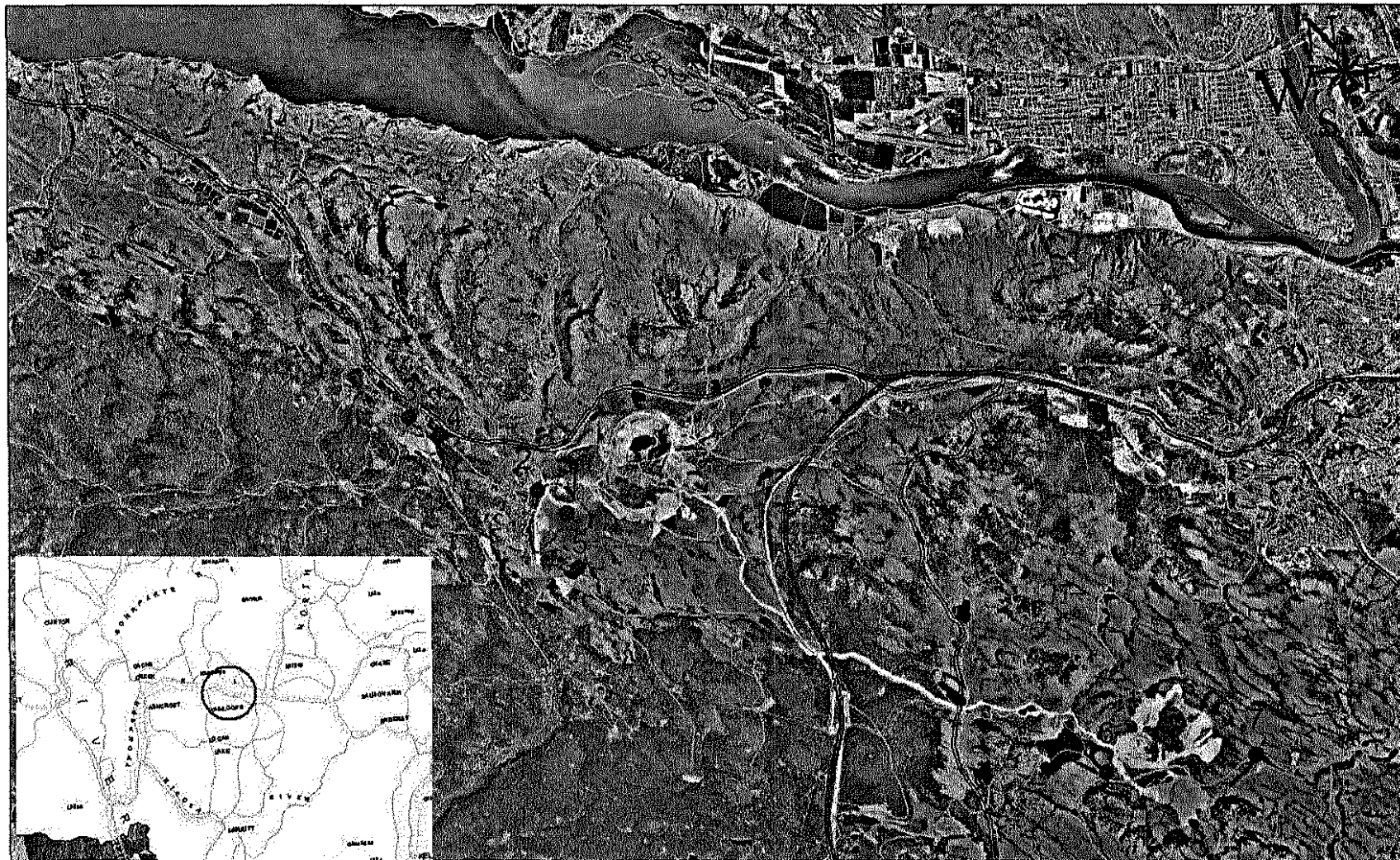
Surface Water Monitoring Program, Kamloops, BC

Site Location Diagram

Ref: 97183-300

File Ref:
 97183-300Fig1.ppt

Fig: 1



Sampling Locations

● 1

Scale: NS

Date: October 2008

Approval:

Design By:

Drawn By: JB

Checked By:

SEAL



KALA GROUNDWATER CONSULTING LTD.
VERNON KAMLOOPS

1314 MCGILL ROAD
TEL. (250) 372-9194

KAMLOOPS, BC, V2C 6N6
FAX (250) 372-9398

AFTON OPERATING CORPORATION

Surface Water Monitoring Program, Kamloops, BC

Sampling Location Diagram

Ref: 97183-300

File Ref:

97183-300Fig2.ppt

Fig: 2

Page 45

MOE-2013-00077

APPENDIX A

Certificates of Analytical Chemistry
Summary of BC Approved Water Quality Guidelines - 2006

Analysis Report



REPORT ON: Amended Analysis of Water Samples

REPORTED TO: Kala Groundwater Consulting Ltd
1314 McGill Rd
Kamloops, BC
V2C 6N6

Att'n: Kendra Brown

CHAIN OF CUSTODY: 2029362
PROJECT NAME: Afton
PROJECT NUMBER: 97183-300

NUMBER OF SAMPLES: 7

REPORT DATE: October 31, 2008

DATE SUBMITTED: June 12, 2008

GROUP NUMBER: 90612028

SAMPLE TYPE: Water

NOTE: Results contained in this report refer only to the testing of samples as submitted. Other information is available on request.

TEST METHODS:

Anions in Water by Ion Chromatography - was determined based on Method 4110 in Standard Methods (21st Edition) and EPA Method 300.0 (Revision 2.1).

Conductivity in Water - was performed based on Method 2510 in Standard Methods (21st Edition) and Method X322 in the BC Laboratory Manual (2005 Edition).

Nitrate and Nitrite in Water - was performed using Flow Injection Analysis where Nitrate is reduced to nitrite by passing the sample through a cadmium reduction column. The nitrite produced is then determined by diazotizing sulphanilamide and N-(1-naphthyl)-ethylenediamine dihydrochloride to form a reddish azo dye which is then measured colorimetrically at 540 nm.

Ammonia in Water - was performed using Flow Injection Analysis where the aqueous sample is injected into a carrier stream, which merges a sodium hydroxide stream. Gaseous ammonia is formed, which diffuses through a gas permeable membrane into an indicator stream. This indicator stream is comprised of a mixture of acid-base indicators, which will react with the ammonia gas; resulting in a colour shift which is measured photometrically @ 590 nm.

Nitrite in Water - was determined based on Method 4500-NO₃ B in Standard Methods for the examination of Water and Wastewater (21st Edition) and from the BC Laboratory Methods Manual (2005).

pH in Water - was determined based on Method 4500-H in Standard Methods (21st Edition) and Method X330 in

(Continued)

CANTEST LTD.

Anna Becalska, PhD
Coordinator, Trace Metals

Page 1 of 12

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



pH in Water

the BC Laboratory Manual (2005).

Total Kjeldahl Nitrogen in Water - was determined based on Method 4500-N in Standard Methods (21st Edition) and Method X325 in the BC Laboratory Manual (2005).

Total Phosphate in Water - was determined based on Method 4500-P in Standard Methods (21st Edition) and Method X185 in the BC Laboratory Manual (2005).

Conventional Parameters - analyses were performed using procedures based on those described in the most current editions of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials", (2005 edition) Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" (21st Edition), published by the American Public Health Association.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 245.7, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

Dissolved Metals in Water - Samples were filtered in the laboratory and quantitatively determined using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP) and/or Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

COMMENTS:

Amended: Client ID of 806120053 changed per client request. This report supersedes the report dated 25-June-2008. LC 31-Oct-2008.

TEST RESULTS:

(See following pages)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	601013	601005	600210	600177	DETECTION LIMIT	UNITS
	TP	SP	AICK	Chery W/S		
DATE SAMPLED:	Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:	806120053	806120054	806120055	806120056		
pH, Laboratory	8.95	8.81	8.18	8.04	-	pH units
Conductivity	2120	4830	582	208	1	μ S/cm
Hardness CaCO ₃	357	1120	271	103	1	mg/L
Hardness (Total) CaCO ₃	354	1130	270	110	1	mg/L
Nitrate and Nitrite N	<	0.04	0.01	0.01	0.01	mg/L
Nitrate N	<	0.04	0.01	0.01	0.01	mg/L
Nitrite N	<	<	<	<	0.002	mg/L
Dissolved Sulphate SO ₄	568	2290	62.2	10.1	0.5	mg/L
Ammonia Nitrogen N	0.04	0.04	0.04	0.02	0.01	mg/L
Total Kjeldahl Nitrogen N	1.3	0.8	1.3	1.4	0.2	mg/L
Total Phosphorus P	0.04	<	0.20	0.02	0.02	mg/L as P

μ S/cm = microsiemens per centimeter

mg/L = milligrams per liter

mg/L as P = milligrams per liter as P

< = Less than detection limit

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:		600178 <i>Cherry D/S</i>	600301 <i>Peterson W/S</i>	600303 <i>Peterson D/S</i>	DETECTION LIMIT	UNITS
DATE SAMPLED:		Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:		806120057	806120058	806120059		
pH, Laboratory		8.09	7.79	8.11	-	pH units
Conductivity		303	781	821	1	µS/cm
Hardness	CaCO3	150	310	354	1	mg/L
Hardness (Total)	CaCO3	151	343	384	1	mg/L
Nitrate and Nitrite	N	0.03	0.02	0.01	0.01	mg/L
Nitrate	N	0.03	0.02	0.01	0.01	mg/L
Nitrite	N	<	<	<	0.002	mg/L
Dissolved Sulphate	SO4	27.2	71.0	112	0.5	mg/L
Ammonia Nitrogen	N	0.04	0.22	0.06	0.01	mg/L
Total Kjeldahl Nitrogen	N	1.7	2.0	0.9	0.2	mg/L
Total Phosphorus	P	0.05	0.05	0.04	0.02	mg/L as P

µS/cm = microsiemens per centimeter

mg/L as P = milligrams per liter as P

< = Less than detection limit

mg/L = milligrams per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		601013	601013	601005	601005		
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:		806120053	806120053	806120054	806120054	DETECTION LIMIT	UNITS
Aluminum	Al	0.055	0.022	0.032	0.009	0.005	mg/L
Antimony	Sb	0.006	0.006	0.001	<	0.001	mg/L
Arsenic	As	0.014	0.015	0.004	0.003	0.001	mg/L
Barium	Ba	0.066	0.066	0.006	0.007	0.001	mg/L
Beryllium	Be	<	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	<	0.001	mg/L
Boron	B	0.23	0.23	0.74	0.7	0.05	mg/L
Cadmium	Cd	<	<	<	<	0.0002	mg/L
Calcium	Ca	27.1	27.1	66	63.5	0.05	mg/L
Chromium	Cr	<	<	<	<	0.001	mg/L
Cobalt	Co	<	<	<	<	0.001	mg/L
Copper	Cu	0.017	0.016	0.008	0.007	0.001	mg/L
Iron	Fe	<	<	<	<	0.05	mg/L
Lead	Pb	<	<	<	<	0.001	mg/L
Lithium	Li	0.007	0.006	0.014	0.013	0.001	mg/L
Magnesium	Mg	69.5	70.2	233	234	0.05	mg/L
Manganese	Mn	0.002	0.002	0.005	<	0.001	mg/L
Mercury	Hg	<	<	<	<	0.02	µg/L
Molybdenum	Mo	0.096	0.098	0.17	0.151	0.0005	mg/L
Nickel	Ni	0.003	0.003	0.001	0.001	0.001	mg/L
Phosphorus	P	<	<	<	<	0.15	mg/L
Potassium	K	27.6	27.5	16.1	16.2	0.1	mg/L
Selenium	Se	<	<	0.029	0.026	0.001	mg/L
Silicon	Si	2	1.9	<	<	0.25	mg/L
Silver	Ag	<	<	<	<	0.00025	mg/L
Sodium	Na	384	361	702	651	0.05	mg/L
Strontium	Sr	0.77	0.79	1.17	1.07	0.001	mg/L
Tellurium	Te	<	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	<	0.0005	mg/L
Tin	Sn	<	<	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	601013	601013	601005	601005		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:	Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:	806120053	806120053	806120054	806120054	DETECTION LIMIT	UNITS
Titanium Ti	0.001	<	0.001	<	0.001	mg/L
Uranium U	0.0017	0.0016	0.0037	0.0033	0.0005	mg/L
Vanadium V	0.007	0.007	0.003	0.003	0.001	mg/L
Zinc Zn	<	<	<	<	0.005	mg/L
Zirconium Zr	<	<	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600210	600210	600177	600177		
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:		806120055	806120055	806120056	806120056	DETECTION LIMIT	UNITS
Aluminum	Al	0.022	0.020	0.081	0.009	0.005	mg/L
Antimony	Sb	<	<	<	<	0.001	mg/L
Arsenic	As	0.003	0.002	<	<	0.001	mg/L
Barium	Ba	0.041	0.038	0.035	0.031	0.001	mg/L
Beryllium	Be	<	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	<	0.001	mg/L
Boron	B	0.07	0.07	<	<	0.05	mg/L
Cadmium	Cd	<	<	<	<	0.0002	mg/L
Calcium	Ca	51.1	50.3	32	29.9	0.05	mg/L
Chromium	Cr	<	<	<	<	0.001	mg/L
Cobalt	Co	<	<	<	<	0.001	mg/L
Copper	Cu	0.004	0.003	0.004	0.003	0.001	mg/L
Iron	Fe	0.05	<	0.1	<	0.05	mg/L
Lead	Pb	<	<	<	<	0.001	mg/L
Lithium	Li	0.005	0.005	<	<	0.001	mg/L
Magnesium	Mg	34.5	35.3	7.24	6.86	0.05	mg/L
Manganese	Mn	0.022	0.016	0.003	<	0.001	mg/L
Mercury	Hg	<	<	<	<	0.02	µg/L
Molybdenum	Mo	0.0026	0.0036	0.01	0.0094	0.0005	mg/L
Nickel	Ni	0.002	0.002	<	<	0.001	mg/L
Phosphorus	P	0.2	0.2	<	<	0.15	mg/L
Potassium	K	8.8	8.4	1.2	1.1	0.1	mg/L
Selenium	Se	<	<	<	<	0.001	mg/L
Silicon	Si	8.6	8.6	7.5	6.7	0.25	mg/L
Silver	Ag	<	<	<	<	0.00025	mg/L
Sodium	Na	33.7	34.9	3.54	3.23	0.05	mg/L
Strontium	Sr	0.41	0.39	0.089	0.083	0.001	mg/L
Tellurium	Te	<	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	<	0.0005	mg/L
Tin	Sn	<	<	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	600210	600210	600177	600177		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:	Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:	806120055	806120055	806120056	806120056	DETECTION LIMIT	UNITS
Titanium Ti	<	<	0.002	<	0.001	mg/L
Uranium U	0.0005	0.0005	<	<	0.0005	mg/L
Vanadium V	0.004	0.004	<	<	0.001	mg/L
Zinc Zn	<	<	<	<	0.005	mg/L
Zirconium Zr	<	<	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600178	600178	600301	600301		
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:		806120057	806120057	806120058	806120058	DETECTION LIMIT	UNITS
Aluminum	Al	0.13	0.013	0.031	<	0.005	mg/L
Antimony	Sb	<	<	<	<	0.001	mg/L
Arsenic	As	<	<	0.001	<	0.001	mg/L
Barium	Ba	0.047	0.044	0.067	0.058	0.001	mg/L
Beryllium	Be	<	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	<	0.001	mg/L
Boron	B	<	<	<	<	0.05	mg/L
Cadmium	Cd	<	<	<	<	0.0002	mg/L
Calcium	Ca	38.9	38.5	64.9	58.5	0.05	mg/L
Chromium	Cr	<	<	<	<	0.001	mg/L
Cobalt	Co	<	<	<	<	0.001	mg/L
Copper	Cu	0.005	0.004	0.003	0.002	0.001	mg/L
Iron	Fe	0.2	<	1.18	<	0.05	mg/L
Lead	Pb	<	<	<	<	0.001	mg/L
Lithium	Li	0.001	<	0.006	0.005	0.001	mg/L
Magnesium	Mg	13	13	43.9	39.8	0.05	mg/L
Manganese	Mn	0.013	0.004	0.18	0.14	0.001	mg/L
Mercury	Hg	<	<	<	<	0.02	µg/L
Molybdenum	Mo	0.01	0.01	0.0027	0.0026	0.0005	mg/L
Nickel	Ni	<	<	0.003	0.003	0.001	mg/L
Phosphorus	P	<	<	<	<	0.15	mg/L
Potassium	K	2	1.8	10.7	9.5	0.1	mg/L
Selenium	Se	<	<	<	<	0.001	mg/L
Silicon	Si	7.5	7.3	8.5	7.5	0.25	mg/L
Silver	Ag	<	<	<	<	0.00025	mg/L
Sodium	Na	9.13	9.29	43	39	0.05	mg/L
Strontium	Sr	0.15	0.14	0.47	0.39	0.001	mg/L
Tellurium	Te	<	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	<	0.0005	mg/L
Tin	Sn	<	<	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	600178	600178	600301	600301		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:	Jun 11/08	Jun 11/08	Jun 11/08	Jun 11/08		
CANTEST ID:	806120057	806120057	806120058	806120058	DETECTION LIMIT	UNITS
Titanium	Ti	0.004	<	0.001	<	0.001 mg/L
Uranium	U	<	<	0.0006	0.0005	0.0005 mg/L
Vanadium	V	0.002	0.001	0.002	<	0.001 mg/L
Zinc	Zn	<	<	<	<	0.005 mg/L
Zirconium	Zr	<	<	<	<	0.01 mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600303	600303		
SAMPLE PREPARATION:		TOTAL	DISSOLVED		
DATE SAMPLED:		Jun 11/08	Jun 11/08	DETECTION LIMIT	UNITS
CANTEST ID:		806120059	806120059		
Aluminum	Al	0.027	0.015	0.005	mg/L
Antimony	Sb	<	<	0.001	mg/L
Arsenic	As	0.001	0.001	0.001	mg/L
Barium	Ba	0.059	0.051	0.001	mg/L
Beryllium	Be	<	<	0.001	mg/L
Bismuth	Bi	<	<	0.001	mg/L
Boron	B	<	<	0.05	mg/L
Cadmium	Cd	<	<	0.0002	mg/L
Calcium	Ca	63	59	0.05	mg/L
Chromium	Cr	<	<	0.001	mg/L
Cobalt	Co	<	<	0.001	mg/L
Copper	Cu	0.003	0.003	0.001	mg/L
Iron	Fe	0.06	0.09	0.05	mg/L
Lead	Pb	<	<	0.001	mg/L
Lithium	Li	0.007	0.006	0.001	mg/L
Magnesium	Mg	55.1	50.2	0.05	mg/L
Manganese	Mn	0.033	0.018	0.001	mg/L
Mercury	Hg	<	<	0.02	µg/L
Molybdenum	Mo	0.014	0.013	0.0005	mg/L
Nickel	Ni	0.002	0.002	0.001	mg/L
Phosphorus	P	<	<	0.15	mg/L
Potassium	K	13.8	13.1	0.1	mg/L
Selenium	Se	<	<	0.001	mg/L
Silicon	Si	1.8	1.5	0.25	mg/L
Silver	Ag	<	<	0.00025	mg/L
Sodium	Na	50.1	44.4	0.05	mg/L
Strontium	Sr	0.52	0.48	0.001	mg/L
Tellurium	Te	<	<	0.001	mg/L
Thallium	Tl	<	<	0.0001	mg/L
Thorium	Th	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 90612028



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600303	600303		
SAMPLE PREPARATION:		TOTAL	DISSOLVED		
DATE SAMPLED:		Jun 11/08	Jun 11/08		
CANTEST ID:		806120059	806120059	DETECTION LIMIT	UNITS
Titanium	Ti	<	<	0.001	mg/L
Uranium	U	0.0011	0.001	0.0005	mg/L
Vanadium	V	0.002	0.002	0.001	mg/L
Zinc	Zn	<	<	0.005	mg/L
Zirconium	Zr	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

Analysis Report



REPORT ON: Amended Analysis of Water Samples

REPORTED TO: Kala Groundwater Consulting Ltd
1314 McGill Rd
Kamloops, BC
V2C 6N6

Att'n: Kendra Brown

CHAIN OF CUSTODY: 198736
PROJECT NAME: Afton
PROJECT NUMBER: 97183-300

NUMBER OF SAMPLES: 7

REPORT DATE: October 31, 2008

DATE SUBMITTED: December 12, 2007

GROUP NUMBER: 81212127

SAMPLE TYPE: Water

NOTE: Results contained in this report refer only to the testing of samples as submitted. Other information is available on request.

TEST METHODS:

Anions in Water by Ion Chromatography - was determined based on Method 4110 in Standard Methods (21st Edition) and EPA Method 300.0 (Revision 2.1).

Conductivity in Water - was performed based on Method 2510 in Standard Methods (21st Edition) and Method X322 in the BC Laboratory Manual (2005 Edition).

Nitrate and Nitrite in Water - was performed using Flow Injection Analysis where Nitrate is reduced to nitrite by passing the sample through a cadmium reduction column. The nitrite produced is then determined by diazotizing sulphanilamide and N-(1-naphthyl)-ethylenediamine dihydrochloride to form a reddish azo dye which is then measured colorimetrically at 540 nm.

Ammonia in Water - was performed using Flow Injection Analysis where the aqueous sample is injected into a carrier stream, which merges a sodium hydroxide stream. Gaseous ammonia is formed, which diffuses through a gas permeable membrane into an indicator stream. This indicator stream is comprised of a mixture of acid-base indicators, which will react with the ammonia gas; resulting in a colour shift which is measured photometrically @ 590 nm.

Nitrite in Water - was determined based on Method 4500-NO3 B in Standard Methods for the examination of Water and Wastewater (21st Edition) and from the BC Laboratory Methods Manual (2005).

pH in Water - was determined based on Method 4500-H in Standard Methods (21st Edition) and Method X330 in

(Continued)

CANTEST LTD.

Anna Becalska, PhD
Coordinator, Trace Metals

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



pH in Water

the BC Laboratory Manual (2005).

Total Kjeldahl Nitrogen in Water - was determined based on Method 4500-N in Standard Methods (21st Edition) and Method X325 in the BC Laboratory Manual (2005).

Total Phosphate in Water - was determined based on Method 4500-P in Standard Methods (21st Edition) and Method X185 in the BC Laboratory Manual (2005).

Conventional Parameters - analyses were performed using procedures based on those described in the most current editions of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials", (2005 edition) Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" (21st Edition), published by the American Public Health Association.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 245.7, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

Dissolved Metals in Water - Samples were filtered in the laboratory and quantitatively determined using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP) and/or Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

COMMENTS:

Amended: Client sample ID of 712120703 changed per client request. This report supersedes the report dated 20-Dec-2007. LC 31-Oct-2008.

TEST RESULTS:

(See following pages)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	601005	600210	601013	600301	DETECTION LIMIT	UNITS
DATE SAMPLED:	Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07		
CANTEST ID:	712120690	712120701	712120703	712120708		
pH, Laboratory	8.07	7.77	9.15	7.34	-	pH units
Conductivity	4560	1950	3230	830	1	µS/cm
Hardness CaCO3	736	603	439	338	1	mg/L
Hardness (Total) CaCO3	776	636	386	378	1	mg/L
Nitrate and Nitrite N	3.36	0.09	<	<	0.01	mg/L
Nitrate N	3.36	0.08	<	<	0.01	mg/L
Nitrite N	0.004	0.008	0.004	<	0.002	mg/L
Dissolved Sulphate SO4	1630	493	942	62.9	1	mg/L
Ammonia Nitrogen N	0.03	0.51	0.54	0.39	0.01	mg/L
Total Kjeldahl Nitrogen N	0.3	3.6	2.4	1.4	0.2	mg/L
Total Phosphorus P	0.03	0.24	0.16	0.09	0.02	mg/L as P

µS/cm = microsiemens per centimeter

mg/L as P = milligrams per liter as P

< = Less than detection limit

mg/L = milligrams per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	600303	600177	600178		
DATE SAMPLED:	Dec 11/07	Dec 11/07	Dec 11/07		
CANTEST ID:	712120710	712120717	712120720	DETECTION LIMIT	UNITS
pH, Laboratory	7.61	7.87	7.96	-	pH units
Conductivity	1790	361	681	1	µS/cm
Hardness CaCO3	995	190	295	1	mg/L
Hardness (Total) CaCO3	935	224	301	1	mg/L
Nitrate and Nitrite N	<	0.02	0.32	0.01	mg/L
Nitrate N	<	0.02	0.32	0.01	mg/L
Nitrite N	<	<	0.004	0.002	mg/L
Dissolved Sulphate SO4	469	12.2	95.0	0.5	mg/L
Ammonia Nitrogen N	<	<	0.03	0.01	mg/L
Total Kjeldahl Nitrogen N	1.5	0.3	0.6	0.2	mg/L
Total Phosphorus P	0.12	0.04	0.03	0.02	mg/L as P

µS/cm = microsiemens per centimeter

mg/L as P = milligrams per liter as P

< = Less than detection limit

mg/L = milligrams per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		601005	601005	600210	600210		
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07		
CANTEST ID:		712120690	712120690	712120701	712120701	DETECTION LIMIT	UNITS
Aluminum	Al	0.25	0.01	0.006	0.006	0.005	mg/L
Antimony	Sb	0.001	0.001	<	<	0.001	mg/L
Arsenic	As	0.007	0.007	0.003	0.003	0.001	mg/L
Barium	Ba	0.016	0.013	0.051	0.05	0.001	mg/L
Beryllium	Be	<	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	<	0.001	mg/L
Boron	B	0.41	0.4	0.2	0.19	0.05	mg/L
Cadmium	Cd	<	<	<	<	0.0002	mg/L
Calcium	Ca	89.2	82.4	82.1	79.5	0.05	mg/L
Chromium	Cr	<	<	<	<	0.001	mg/L
Cobalt	Co	<	<	<	<	0.001	mg/L
Copper	Cu	0.021	0.008	0.003	0.003	0.001	mg/L
Iron	Fe	0.41	0.07	0.17	0.1	0.05	mg/L
Lead	Pb	<	<	<	<	0.001	mg/L
Lithium	Li	0.008	0.008	0.011	0.01	0.001	mg/L
Magnesium	Mg	134	129	105	98.2	0.05	mg/L
Manganese	Mn	0.016	0.006	0.44	0.42	0.001	mg/L
Mercury	Hg	<	<	<	<	0.02	µg/L
Molybdenum	Mo	0.19	0.184	0.0047	0.0047	0.0005	mg/L
Nickel	Ni	0.002	0.002	0.001	0.001	0.001	mg/L
Phosphorus	P	<	<	0.2	0.2	0.15	mg/L
Potassium	K	11.6	10.9	20.5	19.5	0.1	mg/L
Selenium	Se	0.038	0.034	<	<	0.001	mg/L
Silicon	Si	5.7	4.2	7.2	6.7	0.25	mg/L
Silver	Ag	<	<	<	<	0.00025	mg/L
Sodium	Na	497	488	130	121	0.05	mg/L
Strontium	Sr	2.59	2.47	1.43	1.34	0.001	mg/L
Tellurium	Te	<	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	<	0.0005	mg/L
Tin	Sn	<	<	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	601005	601005	600210	600210		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:	Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07		
CANTEST ID:	712120690	712120690	712120701	712120701	DETECTION LIMIT	UNITS
Titanium	Ti	0.008	<	<	0.001	mg/L
Uranium	U	0.0031	0.0028	0.0021	0.0005	mg/L
Vanadium	V	0.004	0.003	0.003	0.001	mg/L
Zinc	Zn	<	<	<	0.005	mg/L
Zirconium	Zr	<	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		601013 <i>Tailings Pond</i>	601013 <i>TP</i>	600301	600301	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07	DETECTION LIMIT	UNITS
CANTEST ID:		712120703	712120703	712120708	712120708		
Aluminum	Al	0.38	0.013	0.083	0.008	0.005	mg/L
Antimony	Sb	0.009	0.01	<	<	0.001	mg/L
Arsenic	As	0.037	0.042	0.002	<	0.001	mg/L
Barium	Ba	0.091	0.1	0.072	0.056	0.001	mg/L
Beryllium	Be	<	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	<	0.001	mg/L
Boron	B	0.27	0.3	<	<	0.05	mg/L
Cadmium	Cd	<	<	<	<	0.0002	mg/L
Calcium	Ca	17	19.5	75.4	67.1	0.05	mg/L
Chromium	Cr	0.002	<	0.001	<	0.001	mg/L
Cobalt	Co	0.001	<	<	<	0.001	mg/L
Copper	Cu	0.018	0.012	0.002	<	0.001	mg/L
Iron	Fe	0.38	<	2.01	0.12	0.05	mg/L
Lead	Pb	<	<	<	<	0.001	mg/L
Lithium	Li	0.008	0.009	0.006	0.005	0.001	mg/L
Magnesium	Mg	83.5	94.6	46	41.3	0.05	mg/L
Manganese	Mn	0.006	0.001	0.28	0.25	0.001	mg/L
Mercury	Hg	<	<	<	<	0.02	µg/L
Molybdenum	Mo	0.162	0.185	0.0029	0.0026	0.0005	mg/L
Nickel	Ni	0.004	0.004	0.003	0.002	0.001	mg/L
Phosphorus	P	<	<	<	<	0.15	mg/L
Potassium	K	38.3	43.9	11.6	10.6	0.1	mg/L
Selenium	Se	<	<	<	<	0.001	mg/L
Silicon	Si	2.4	2	11.6	10.2	0.25	mg/L
Silver	Ag	<	<	<	<	0.00025	mg/L
Sodium	Na	546	438	45.1	42.1	0.05	mg/L
Strontium	Sr	0.97	1.09	0.5	0.45	0.001	mg/L
Tellurium	Te	<	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	<	0.0005	mg/L
Tin	Sn	<	<	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	601013	601013	600301	600301		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:	Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07		
CANTEST ID:	712120703	712120703	712120708	712120708	DETECTION LIMIT	UNITS
Titanium Ti	0.01	<	0.003	<	0.001	mg/L
Uranium U	0.0022	0.0024	<	<	0.0005	mg/L
Vanadium V	0.022	0.025	0.004	0.001	0.001	mg/L
Zinc Zn	<	<	<	<	0.005	mg/L
Zirconium Zr	<	<	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600303	600303	600177	600177	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07	DETECTION LIMIT	UNITS
CANTEST ID:		712120710	712120710	712120717	712120717		
Aluminum	Al	0.013	<	0.04	<	0.005	mg/L
Antimony	Sb	<	<	<	<	0.001	mg/L
Arsenic	As	0.001	0.001	<	<	0.001	mg/L
Barium	Ba	0.13	0.14	0.064	0.054	0.001	mg/L
Beryllium	Be	<	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	<	0.001	mg/L
Boron	B	<	<	<	<	0.05	mg/L
Cadmium	Cd	<	<	<	<	0.0002	mg/L
Calcium	Ca	149	158	65.1	55.5	0.05	mg/L
Chromium	Cr	<	<	<	<	0.001	mg/L
Cobalt	Co	<	<	<	<	0.001	mg/L
Copper	Cu	0.003	0.005	0.002	0.002	0.001	mg/L
Iron	Fe	0.32	0.18	0.13	0.07	0.05	mg/L
Lead	Pb	<	<	<	<	0.001	mg/L
Lithium	Li	0.009	0.009	0.001	<	0.001	mg/L
Magnesium	Mg	136	146	14.8	12.4	0.05	mg/L
Manganese	Mn	1.52	1.62	0.005	0.003	0.001	mg/L
Mercury	Hg	<	<	<	<	0.02	µg/L
Molybdenum	Mo	0.007	0.0074	0.0099	0.0083	0.0005	mg/L
Nickel	Ni	0.003	0.003	<	<	0.001	mg/L
Phosphorus	P	0.2	<	<	<	0.15	mg/L
Potassium	K	22	23.5	2.6	2.2	0.1	mg/L
Selenium	Se	<	<	<	<	0.001	mg/L
Silicon	Si	14.8	15.6	9.7	8	0.25	mg/L
Silver	Ag	<	<	<	<	0.00025	mg/L
Sodium	Na	98.1	105	5.91	5.1	0.05	mg/L
Strontium	Sr	1.34	1.44	0.21	0.17	0.001	mg/L
Tellurium	Te	<	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	600303	600303	600177	600177		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:	Dec 11/07	Dec 11/07	Dec 11/07	Dec 11/07		
CANTEST ID:	712120710	712120710	712120717	712120717	DETECTION LIMIT	UNITS
Titanium Ti	0.001	<	0.002	<	0.001	mg/L
Uranium U	0.0011	0.0012	<	<	0.0005	mg/L
Vanadium V	0.002	0.002	0.001	<	0.001	mg/L
Zinc Zn	<	<	<	<	0.005	mg/L
Zirconium Zr	<	<	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600178	600178		
SAMPLE PREPARATION:		TOTAL	DISSOLVED		
DATE SAMPLED:		Dec 11/07	Dec 11/07		
CANTEST ID:		712120720	712120720	DETECTION LIMIT	UNITS
Aluminum	Al	0.043	<	0.005	mg/L
Antimony	Sb	<	<	0.001	mg/L
Arsenic	As	<	<	0.001	mg/L
Barium	Ba	0.083	0.079	0.001	mg/L
Beryllium	Be	<	<	0.001	mg/L
Bismuth	Bi	<	<	0.001	mg/L
Boron	B	<	<	0.05	mg/L
Cadmium	Cd	<	<	0.0002	mg/L
Calcium	Ca	76.2	74.5	0.05	mg/L
Chromium	Cr	<	<	0.001	mg/L
Cobalt	Co	<	<	0.001	mg/L
Copper	Cu	0.002	0.001	0.001	mg/L
Iron	Fe	0.15	0.07	0.05	mg/L
Lead	Pb	<	<	0.001	mg/L
Lithium	Li	0.002	0.002	0.001	mg/L
Magnesium	Mg	26.7	26.3	0.05	mg/L
Manganese	Mn	0.052	0.042	0.001	mg/L
Mercury	Hg	<	<	0.02	µg/L
Molybdenum	Mo	0.0082	0.0078	0.0005	mg/L
Nickel	Ni	<	<	0.001	mg/L
Phosphorus	P	<	<	0.15	mg/L
Potassium	K	3.7	3.4	0.1	mg/L
Selenium	Se	<	<	0.001	mg/L
Silicon	Si	8.2	7.9	0.25	mg/L
Silver	Ag	<	<	0.00025	mg/L
Sodium	Na	29.3	28.7	0.05	mg/L
Strontium	Sr	0.33	0.32	0.001	mg/L
Tellurium	Te	<	<	0.001	mg/L
Thallium	Tl	0.0001	<	0.0001	mg/L
Thorium	Th	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Kala Groundwater Consulting Ltd

REPORT DATE: October 31, 2008

GROUP NUMBER: 81212127



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		600178	600178		
SAMPLE PREPARATION:		TOTAL	DISSOLVED		
DATE SAMPLED:		Dec 11/07	Dec 11/07		
CANTEST ID:		712120720	712120720	DETECTION LIMIT	UNITS
Titanium	Ti	0.002	<	0.001	mg/L
Uranium	U	0.0008	0.0006	0.0005	mg/L
Vanadium	V	0.002	0.001	0.001	mg/L
Zinc	Zn	<	<	0.005	mg/L
Zirconium	Zr	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

Science and Information Branch

Water Quality

British Columbia Approved Water Quality Guidelines 2006 Edition

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

Original signed by Don Fast
Assistant Deputy Minister
Environment and Lands HQ Division
September 11, 1998

Updated: August 2006

Table of Contents

Introduction

Tables of Recommended Guidelines

- - Table 1 Water Quality Guidelines for Drinking and Recreational Water Uses
 - Table 2 Summary of Water Quality Guidelines for Turbidity, Suspended and Benthic Sediments
 - Table 3 Summary of Water Quality Guidelines for Nutrients and Algae
 - Table 4 Average 30-day Concentrations of Total Ammonia Nitrogen for Protection of Aquatic Life (mg/L of Nitrogen)
 - Table 5 Maximum Concentrations of Total Ammonia Nitrogen for Protection of Aquatic Life
 - Table 6 Summary of Water Quality Guidelines for Aluminum
 - Table 7 Examples of Freshwater Aluminum Guidelines Specified by the Regression Equations
 - Table 7a. Maximum Dissolved Aluminum Concentration (mg/L) at pH less than 6.5
 - Table 7b. 30-day Average Dissolved Aluminum Concentration (mg/L) at pH less than 6.5
 - Table 8 Summary of Water Quality Guidelines for Microbiological Indicators
 - Table 9 Summary of Water Quality Guidelines for Copper
 - Table 10 Summary of Water Quality Guidelines for Cyanide
 - Table 11 Summary of Water Quality Guidelines for Lead
 - Table 12 Details of Freshwater Aquatic Life Guidelines for Lead
 - Table 13 Summary of Water Quality Guidelines for Mercury
 - Table 13a Relationship between Methyl Mercury (MeHg) Concentration in the Environment and the Total Hg Guideline
 - Table 13b Tissue Residue Guideline to Protect Wildlife from Hg Toxicity
 - Table 14 Variations in Aquatic Life Guidelines for Fish/Shellfish When the Diet is Based Primarily on Fish
 - Table 15 Summary of Water Quality Guidelines for Molybdenum
 - Table 16 Summary of Water Quality Guidelines for Nitrogen
 - Table 17 Guidelines for Nitrite for Protection of Freshwater Aquatic Life
 - Table 18 Summary of Water Quality Guidelines for Dissolved Oxygen for the Protection of

Fresh, Marine and Estuarine Life

- Table 19 Summary of Water Quality Guidelines for Chlorine
- Table 20 Summary Table of Recommended Guidelines for Fluoride
- Table 21 Maximum Concentration of Total Ammonia Nitrogen for Protection of Saltwater Aquatic Life (mg/L of Nitrogen)
- Table 22 Average 5 to 30-day Concentration of Total Ammonia Nitrogen for Protection of Saltwater Aquatic Life (mg/L of Nitrogen)
- Table 23 Summary of Guidelines for Polychlorinated Biphenyls (PCBs)
- Table 24 Summary of Guidelines for Polycyclic Aromatic Hydrocarbons (PAHs)
- Table 25 Summary of Aquatic Life and Sediment Guidelines for Polycyclic Aromatic Hydrocarbons (PAHs)
- Table 26 Summary of Water Quality Guidelines for Chlorophenols
- Table 27 Summary of Interim Aquatic Life and Tissue Residue Guidelines for Chlorophenols
 - Table 27a Aquatic Life Toxicity Guidelines
 - Table 27b Interim Fish Muscle Tissue Flavour Impairment Guidelines
- Table 28 Summary of the pH Guidelines
- Table 29 Recommended Guidelines for the Protection of Marine and Freshwater Life for Silver
- Table 30 Summary of Guidelines for Total Gas Pressure (TGP)
- Table 31 Summary of Water Quality Guidelines for Colour
- Table 32 Summary of Water Quality Guidelines for Organic Carbon
- Table 33 Recommended Guidelines for Zinc
- Table 34 Recommended Guidelines for Ethylbenzene
- Table 35 Summary of Water Quality Guidelines for Toluene
- Table 36 Summary of Water Quality Guidelines for Sulphate
- Table 37 Examples of the Recommended Acute Guidelines to Protect Freshwater Aquatic Life from the Toxic Effects of Manganese
- Table 38 Examples of the Recommended Chronic Guidelines to Protect Freshwater Aquatic Life from the Toxic Effects of Manganese
- Table 39 Recommended Guidelines for Methyl Tertiary-Butyl Ether (MTBE)
- Table 40 Recommended Guideline for Selenium
- Table 41 Recommended Guidelines for Temperature
- Table 42 Optimum Temperature Ranges of Specific Life History Stages of Salmonids and Other Cold water Species for Guideline Application.
- Table 43 Summary of Water Quality Guidelines for Arsenic
- Table 44 Summary of Chlorate Guidelines
- Table 45 Summary of Recommended Water Quality Guidelines for Diisopropanolamine (DIPA)
- Table 46 Summary of Recommended Guidelines for Sulpholane
- Table 47 Recommended Guidelines for Chloride
- Table 48 Recommended Guidelines for Cobalt
- Table 49 Recommended Guidelines for Boron
- Table 50 Recommended Irrigation Water Guidelines for Boron

Introduction

Welcome to British Columbia's Approved Guidelines Report for 2006.

The following questions and answers will introduce you to the British Columbia Water Quality Guidelines Report — 2006. They will explain what the report is and guide you through its use. This report is revised periodically to incorporate new information. The authors invite your comments and suggestion on any errors and omissions in the guidelines cited here.

Why do we have an *Approved Water Quality Guidelines Report — 2006?*

Water quality guidelines are developed in order that water quality data can be assessed and site-specific water quality objectives can be prepared. They provide the benchmarks for the assessment of water quality and setting water quality objectives. In general, water quality problems are non-existent if the substance concentration is lower than the guideline(s). However, if the substance concentration exceeds its guideline, an assessment of the water quality is desirable.

Why are some values for drinking water and recreation different between the Ministry publications and the approved guidelines listed in Table 1?

When the Ministry prepares guideline reports, it does so for the six potential designated water uses. For drinking water and recreation uses, there are also parallel processes for guideline development under Health Canada mandate. Sometimes, the approved B.C. guidelines have not been accepted by Health Canada or there are time lags between the different processes. In such cases, the policy of the Ministry is that the Health Canada guidelines will be the official Ministry guidelines for drinking water and recreation, even if other values were approved independently by the Ministry.

Why are some tables listed as 'Criteria' and how are they related to 'Guidelines'?

The term 'Criterion' was originally used for the 'Guideline' in B.C. but this nomenclature was changed in the late 1980s.

Who can use this report?

Traditionally, water quality professionals such as consultants have used this report. We are hoping that members of the public, especially those associated with local stewardship groups, will use this new "user-friendly" edition of the report to evaluate water quality data that they collect.

What are the *Approved Water Quality Guidelines* and what do they protect?

Tables 2 through 50 list guidelines that have been developed by the Ministry of Environment. They have been approved by the province and, as noted above, will be used to assess water quality in B.C.. Approved guidelines are given to protect up to seven major water uses: Drinking Water, Aquatic Life (freshwater and marine), Wildlife, Recreation and Aesthetics, Agriculture (Irrigation and Livestock Watering), and Industrial (e.g., Food Processing Industry).

Why does Table 1 look different from the other tables in the report?

Table 1 lists guidelines for drinking water (at the point of consumption) and recreational waters. These guidelines, designed to protect human health, are the responsibility of Health and Welfare Canada. The list of substances considered by Health Canada is broader than that considered by the Province (Tables 2 through 50) and reflects a Canadian perspective.

Drinking water guidelines as stated in Tables 2 through 50 are, in some cases, for raw waters before treatment and should not be confused with those in Table 1.

How do you define water quality guidelines?

Water quality guidelines apply province-wide and are safe levels of substances for the protection of a given water use, including drinking water, aquatic life, recreation and agricultural uses. In aquatic environments, water quality includes the physical, chemical and biological quality of the water, sediment and biota. These guidelines are being developed by the province substance by substance, starting with those most urgently needed for water quality assessments and objectives.

Are there other (than water column) guidelines recommended by the province?

The province has recommended a limited number of sediment quality and tissue guidelines to protect aquatic environments. These guidelines are specified for contaminants such as mercury, PCBs, and PAHs.

What are site-specific water quality guidelines or objectives?

Water quality objectives or site-specific guidelines are a refinement of the province-wide guidelines that are adapted to protect the most sensitive water use at a specific location, taking local circumstances into account. As suggested above, they have their basis in the water quality guidelines plus the site characteristics that may influence the toxic action of the substance of concern. The Ministry recognizes that site-specific factors may necessitate modification of the **Approved** or the **Working** guidelines and suggests means to do this in a 1997 publication: **Methods for Deriving Site-specific Water Quality Objectives in British Columbia and Yukon.**

I have seen other references to similar reports issued by the Ministry in the past. Are those reports still valid?

As indicated above, this report is revised periodically to incorporate new information. Sections from the earlier versions that are still useful have been included in this 2006 report. The 2006 version supersedes the following documents:

1. ***Preliminary Working Criteria for Water Quality***, October 1982.
2. ***Working Criteria for Water Quality***, April 1985.
3. ***Approved and Working Criteria for Water Quality***, April 1987, March 1989, May 1991, February 1994, and April 1995.
4. ***British Columbia Approved Water Quality Guidelines (Criteria) 1998 Edition***, September 11, 1998 and updated August 24, 2001.

A second report, ***A Compendium of Working Water Quality Guidelines for British Columbia***, which contains guidelines from other jurisdictions, has been published separately.

Which water quality guidelines have been developed by the Ministry?

Water quality guidelines for the following substances have been approved*.

Substance	Table Number	Substance	Table Number
Algae	3	Nitrate	16
Aluminum	6, 7	Nitrite	16, 17
Arsenic	43	Nitrogen (nitrate, nitrite and ammonia)	4, 5, 16, 21, 22
Benthic sedimentation	2	Nutrients (phosphorus) and algae	3
Boron	49, 50	Organic carbon	33
Chlorate	44	Oxygen (dissolved)	18
Chloride	47	PAHs (polycyclic aromatic hydrocarbons)	24, 25
Chlorine	19	Particulate matter (suspended solids and turbidity)	2
Chlorophenols	26, 27	PCBs (polychlorinated biphenyls)	23
Cobalt	48	pH	28
Coliforms	8	Phosphorus	3
Colour	32	Polychlorinated biphenyls (PCBs)	23
Copper	9	Polycyclic aromatic hydrocarbons (PAHs)	24, 25
Cyanide	10	Selenium	41
Diisopropanolamine (DIPA)	45	Silver	29
Ethylbenzene	35	Sulphate	37
Fluoride	20	Sulpholane	46
Lead	11, 12	Suspended Solids	2
Manganese	38	Temperature	42, 43
Mercury	13, 14	Toluene	36
Methyl tertiary-butyl ether (MTBE)	40	Total gas pressure	30
Microbiological indicators	8	Turbidity	2
Molybdenum	15	Zinc	34

when using the guidelines to ensure accuracy and a full understanding of the guidelines.

What guidelines have changed since the 1998 (updated in 2001) editions?

Approved guidelines have been added for:

- Arsenic (Table 43)
- Boron (Tables 49 and 50)
- Chlorate (Table 44)
- Chloride (Table 47)
- Cobalt (Table 48)
- Diisopropanolamine - DIPA (Table 45)
- Sulpholane (Table 46)

Approved guidelines have been revised for:

- Total gas pressure (Table 30)
- Mercury (aquatic life; Tables 13 and 13a)

Which water quality guidelines are currently being developed by the Ministry?

Guidelines for the following substances are being reviewed:

Substance
<ul style="list-style-type: none">• Barium• Benzene• Beryllium• Chromium• Dioxins and furans• Iron• Toluene• Xylene

Which other tools does the Ministry have to help one assess water quality?

In addition to this report and the *Compendium* report, the Ministry has developed several tools that can be used to assess water quality. For instance, the *Principles* document, the *User's Guide*, and the *Deriving Site-Specific Objectives* reports (see below) outline the process that can be used to develop site-specific water quality objectives. The *Status Report* indicates the state of water quality

for waterbodies in B.C. based on available data. The Ministry has also developed manuals that will help in designing and implementing monitoring programs, and interpreting water quality data. Titles of the completed reports are listed below:

- *Principles for Preparing Water Quality Objectives in British Columbia. 1986*
- *Developing Water Quality Objectives in British Columbia-A User's Guide. 1996*
- *British Columbia Water Quality Status Report. 1996*
- *Lake and Stream Bottom Sediment Sampling Manual. 1997*
- *Freshwater Biological Sampling Manual. 1997*
- *Ambient Fresh Water and Effluent Sampling Manual. 1997*
- *Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia. 1998*
- *Guidelines for Interpreting Water Quality Data. 1998*
- *Methods for Deriving Site-Specific Objectives in British Columbia and Yukon, 1997*

Tables of Recommended Guidelines

Table 1. Water Quality Guidelines for Drinking and Recreational Water Uses

(For more up-to-date information for these guidelines use the web link:
http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index_e.html)

Substance	Water Use	Guidelines
Aldicarb (total) -aldicarb, aldicarb sulfoxide, aldicarb sulfone	Drinking	9 µg/L (maximum)
Aldrin + Dieldrin (total)	Drinking	0.7 µg/L (maximum)
Aluminum	Drinking	0.1 (conventional treatment) 0.2 (other treatment) also see Tables 6 and 7 for approved guidelines
Aluminum	Recreation	see Tables 6 and 7 for approved guidelines
Antimony	Drinking	6 µg/L (proposed interim maximum)
Arsenic	Drinking	25 µg/L (interim maximum) 5 µg/L (proposed maximum)
Atrazine and its metabolites	Drinking	5 µg/L (interim maximum)
Azinphos-methyl	Drinking	20 µg/L (maximum)
Barium	Drinking	1 mg/L (maximum)
Bendiocarp	Drinking	40 µg/L (maximum)
Benzene	Drinking	5 µg/L (maximum)
Benzo[a]pyrene	Drinking	0.01 µg/L (maximum)
Boron	Drinking	5 mg/L (maximum)
Bromate	Drinking	10 µg/L (maximum)

Bromodichloromethane (BDCM)	Drinking	16 µg/L (maximum)
Bromoxnyl	Drinking	5 µg/L (interim maximum)
Cadmium (total)	Drinking	5 µg/L (maximum)
Carbaryl	Drinking	90 µg/L (maximum)
Carbofuran	Drinking	90 µg/L (maximum)
Carbon tetrachloride	Drinking	5 µg/L (maximum)
Chloramines	Drinking	3 mg/L (maximum)
Chlorate	Drinking	1 mg/L (proposed maximum) also see Table 44 for approved guidelines
Chloride (dissolved)	Drinking	less than or equal to 250 mg/L (aesthetic objective)
Chlorite	Drinking	1 mg/L (proposed maximum)
Chlorophyll a (approved B.C. guideline)	Drinking	2 to 2.5 µg/L (lakes, summer average)
Chlorpyrifos	Drinking	90 µg/L (maximum)
Chromium (total)	Drinking	50 µg/L (maximum)
Clarity (as Secchi disc visibility)	Recreation	1.2 m (minimum)
Colour (true)	Drinking	less than or equal to 15 TCU (aesthetic objective)
Colour (true)	Recreation	should not impede visibility in swimming areas
Conductivity (specific)	Drinking	700 µS/cm(maximum) approximate equivalent of 500 mg/L total dissolved solids
Copper	Drinking	less than or equal to 1 mg/L (aesthetic objective)
Cyanazine	Drinking	10 µg/L (interim maximum)
Cyanide	Drinking	200 µg/L (maximum)
Cyanobacterial toxins (as Microcystin-LR)	Drinking	1.5 µg/L (maximum)
1,2-Dichlorobenzene	Drinking	200 µg/L (maximum) less than or equal to 3 µg/L (aesthetics objective)
1,2-Dichlorobenzene	Drinking	less than or equal to 3 µg/L (aesthetics objective)
Dichlorodiphenyltrichloroethane (DDT+ metabolites)	Drinking	30 µg/L (interim maximum)
2,4-Dichlorophenoxy acetic acid (2,4-D)	Drinking	100 µg/L (interim maximum)
Diazinon	Drinking	20 µg/L (maximum)
Dicamba	Drinking	120 µg/L (interim maximum)
1,4-Dichlorobenzene	Drinking	5 µg/L (maximum) less than or equal to 1µg/L (aesthetics objective)

1,2-Dichloroethane	Drinking	5 µg/L (interim maximum)
1,1-Dichloroethylene	Drinking	14 µg/L (maximum)
Dichloromethane (methylene chloride)	Drinking	50 µg/L (maximum)
2,4-Dichlorophenol	Drinking	900 µg/L (maximum) 0.3 µg/L (aesthetic objective)
Diclofop-methyl	Drinking	9 µg/L (maximum)
Dimethoate	Drinking	20 µg/L (maximum)
Dinoseb	Drinking	10 µg/L (maximum)
Diquat	Drinking	70 µg/L (maximum)
Diuron	Drinking	150 µg/L (maximum)
Ethylbenzene	Drinking	2.4 µg/L (aesthetic objective)
Ethylbenzene	Recreation	2.4 µg/L (aesthetic objective)
Fluoride (total)	Drinking	1.5 mg/L (maximum)
Glyphosate	Drinking	280 µg/L (maximum)
Hardness (total dissolved)	Drinking	80 to 100 mg/L as CaCO ₃ is acceptable over 200 mg/L as CaCO ₃ is poor but can be tolerated over 500 mg/L as CaCO ₃ is normally unacceptable
Iron	Drinking	less than or equal to 0.3 mg/L (aesthetic objective)
Lead	Drinking	10 µg/L (maximum)
Magnesium (dissolved)	Drinking	100 mg/L, taste threshold for sensitive people 500 mg/L, taste threshold for average people over 700 mg/L, laxative effects for everyone
Malathion	Drinking	190 µg/L (maximum)
Manganese	Drinking	less than or equal to 50 µg/L (aesthetic objective)
Mercury	Drinking	1 µg/L (maximum)
Methoxychlor	Drinking	900 µg/L (maximum)
Methyl tertiary-butyl ether (MTBE)	Drinking	0.02 mg/L (maximum) 0.015 mg/L (proposed maximum)
Methyl tertiary-butyl ether (MTBE)	Recreation	0.02 mg/L (maximum)
Metolachlor	Drinking	50 µg/L (maximum)
Metribuzin	Drinking	80 µg/L (maximum)
Microbiological indicators	Drinking	0 total coliforms/100 mL 0 <i>E. coli</i> per 100 mL

Microbiological indicators	Recreation	2000 E. coli/L (geometric mean, fresh water) 350 enterococci/L (geometric mean, marine water) (resample at 4000 E. coli or 700 enterococci)
Monochlorobenzene	Drinking	80 µg/L (maximum) less than or equal to 30 µg/L (aesthetic objective)
MTBE (Methyl tertiary-butyl ether)	Drinking	0.02 mg/L (maximum) 0.015 mg/L (proposed maximum)
MTBE (Methyl tertiary-butyl ether)	Recreation	0.02 mg/L (maximum)
Nitrate	Drinking	45 mg/L as NO ₃ (maximum) 10 mg/L as N
Nitrite	Drinking	3.2 mg/L as NO ₃ 1.0 mg/L as N
Nitrilotriacetic acid (NTA)	Drinking	400 µg/L (maximum)
Odour	Drinking	inoffensive (aesthetic objective)
Oil and grease	Recreation	not detectable by sight or smell
Paraquat dichloride	Drinking	10 µg/L (maximum) (7 µg/L for the paraquat ion)
Parathon	Drinking	50 µg/L (maximum)
Pentachlorophenol	Drinking	60 µg/L (maximum) 30 µg/L (aesthetic objective)
pH	Drinking	6.5 to 8.5 (aesthetic objective)
pH	Recreation	6.5 to 8.5 (aesthetic objective)
pH	Recreation	5.0 to 9.0 (buffering capacity)
Phorate	Drinking	2 µg/L (maximum)
Picloram	Drinking	190 µg/L (interim maximum)
Selenium	Drinking	10 µg/L (maximum)
Simazine	Drinking	10 µg/L (interim maximum)
Sodium	Drinking	less than or equal to 200 mg/L (aesthetic objective) 20 mg/L alert level for people on sodium restricted diets
Solids (floatable or settleable)	Recreation	none
Sulphate	Drinking	less than or equal to 500 mg/L (aesthetic objective)
Sulphide (as H ₂ S)	Drinking	50 µg/L (aesthetic objective)
Taste	Drinking	inoffensive (aesthetic objective)
Temperature	Drinking	15 degrees Celsius maximum (aesthetic objective)
Temperature	Recreation	30 degrees Celsius maximum
Terbufos	Drinking	1 µg/L (maximum)

Tetrachoroethylene	Drinking	30 µg/L (maximum)
2,3,4,6-Tetrachlorophenol	Drinking	100 µg/L (maximum) less than or equal to 1 µg/L (aesthetic objective)
Toluene	Drinking	less than or equal to 24 µg/L (aesthetic objective)
Total dissolved solids	Drinking	less than or equal to 500 mg/L (aesthetic objective)
Trichloroethylene	Drinking	5 µg/L (maximum)
2,4,6-Trichlorophenol	Drinking	5 µg/L (maximum) less than or equal to 2 µg/L (aesthetic objective)
Trifluralin	Drinking	45 µg/L (maximum)
Triralomethanes	Drinking	100 µg/L (annual average) 100 µg/L (proposed maximum)
Turbidity	Drinking	<0.1 NTU (target at all times) 0.3 NTU 95th percentile, 1.0 NTU maximum for chemically assisted filtration 1.0 NTU 95th percentile, 3.0 NTU maximum for slow sand or diatomaceous earth filtration 0.1 NTU 99th percentile, 0.3 NTU maximum for membrane filtration
Turbidity	Recreation	50 NTU (maximum)
Uranium	Drinking	20µg/L (maximum)
Vinyl chloride	Drinking	2 µg/L (maximum)
Xylenes (total)	Drinking	less than or equal to 300 µg/L (aesthetic objective)
Zinc	Drinking	less than or equal to 5 mg/L (aesthetic objective)

**1. From Health and Welfare Canada,
References 21, 22, 23, 24 and 25.**

Updated to 5-May-2006 from www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/

Table 2: Summary of Water Quality Guidelines for Turbidity, Suspended and Benthic Sediments

Water Use	Maximum Induced Turbidity - NTU or % of background	Maximum Induced Suspended Sediments - mg/L or % of background	Streambed Substrate Composition
Drinking Water - raw untreated	1 NTU when background is less than or equal to 5	No Guideline	No Guideline
Drinking Water - raw treated	5 NTU when background is less than or equal to 50 10% when background is greater than 50	No Guideline	No Guideline
Recreation and Aesthetics	Maximum 50 NTU Secchi disc visible at 1.2m	No Guideline	No Guideline
Aquatic Life - fresh - marine - estuarine	8 NTU in 24 hours when background is less than or equal to 8 mean of 2 NTU in 30 days when background is less than or equal to 8	25 mg/L in 24 hours when background is less than or equal to 25 mean of 5 mg/L in 30 days when background is less than or equal to 25	finer not to exceed -10% as less than 2 mm -19% as less than 3 mm -25% as less than 6.35 mm at salmonid spawning sites
Aquatic Life - fresh - marine - estuarine	8 NTU when background is between 8 and 80 10% when background is greater than or equal to 80	25 mg/L when background is between 25 and 250 10% when background is greater than or equal to 250	Geometric mean diameter not less than 12 mm Fredle number not less than 5 mm
Terrestrial Life - wildlife - livestock water Irrigation Industrial	10 NTU when background is less than or equal to 50 20% when background is greater than or equal to 50	20 mg/L when background is less than or equal to 100 20% when background is greater than or equal to 100	No Guideline

References 1, 32

Table 3. Summary of Water Quality Guidelines for Nutrients and Algae

Water Use	Phosphorus µg/L (total)	Chlorophyll a mg/m²
Drinking Water - lakes	10 µg/L (maximum)	None proposed
Aquatic Life - streams	None proposed	100 mg/m ² (maximum)
Aquatic Life - lakes (salmonids are the predominant fish species)	5 to 15 µg/L (inclusive)	None proposed
Recreation - streams	None proposed	50 mg/m ²
Recreation - lakes	10 µg/L (maximum)	None proposed

1. Total phosphorus in lakes is either the spring overturn concentration, if the residence time of the epilimnetic water is greater than 6 months, or the mean epilimnetic growing season concentration, if the residence time of the epilimnetic water is less than 6 months

2. Chlorophyll a guidelines in streams apply to naturally growing periphytic algae.

Reference 2

Table 4. Average 30-day Concentration of Total Ammonia Nitrogen for Protection of Aquatic Life (mg/L of Nitrogen)

Temperature (T) in degrees Celsius

pH	T=0.0	T=1.0	T=2.0	T=3.0	T=4.0	T=5.0	T=6.0
6.5	2.08	2.05	2.02	1.99	1.97	1.94	1.92
6.6	2.08	2.05	2.02	1.99	1.97	1.94	1.92
6.7	2.08	2.05	2.02	1.99	1.97	1.94	1.92
6.8	2.08	2.05	2.02	1.99	1.97	1.94	1.92
6.9	2.08	2.05	2.02	1.99	1.97	1.94	1.92
7.0	2.08	2.05	2.02	1.99	1.97	1.94	1.92
7.1	2.08	2.05	2.02	1.99	1.97	1.94	1.92
7.2	2.08	2.05	2.02	1.99	1.97	1.95	1.92
7.3	2.08	2.05	2.02	1.99	1.97	1.95	1.92
7.4	2.08	2.05	2.02	2.00	1.97	1.95	1.92
7.5	2.08	2.05	2.02	2.00	1.97	1.95	1.93
7.6	2.09	2.05	2.03	2.00	1.97	1.95	1.93
7.7	2.09	2.05	2.03	2.00	1.98	1.95	1.93
7.8	1.78	1.75	1.73	1.71	1.69	1.67	1.65
7.9	1.50	1.48	1.46	1.44	1.43	1.41	1.39
8.0	1.26	1.24	1.23	1.21	1.20	1.18	1.17
8.1	1.00	0.989	0.976	0.963	0.952	0.942	0.932
8.2	0.799	0.788	0.777	0.768	0.759	0.751	0.743
8.3	0.636	0.628	0.620	0.613	0.606	0.599	0.594
8.4	0.508	0.501	0.495	0.489	0.484	0.479	0.475
8.5	0.405	0.400	0.396	0.381	0.387	0.384	0.380
8.6	0.324	0.320	0.317	0.313	0.310	0.308	0.305
8.7	0.260	0.257	0.254	0.251	0.249	0.247	0.246
8.8	0.208	0.206	0.204	0.202	0.201	0.200	0.198
8.9	0.168	0.166	0.165	0.163	0.162	0.161	0.161
9.0	0.135	0.134	0.133	0.132	0.132	0.131	0.131

Temperature (T) in degrees Celsius

pH	T=7.0	T=8.0	T=9.0	T=10.0	T=11.0	T=12.0	T=13.0
6.5	1.90	1.88	1.86	1.84	1.82	1.81	1.80
6.6	1.90	1.88	1.86	1.84	1.82	1.81	1.80
6.7	1.90	1.88	1.86	1.84	1.83	1.81	1.80
6.8	1.90	1.88	1.86	1.84	1.83	1.81	1.80
6.9	1.90	1.88	1.86	1.84	1.83	1.81	1.80
7.0	1.90	1.88	1.86	1.84	1.83	1.81	1.80
7.1	1.90	1.88	1.86	1.84	1.83	1.81	1.80
7.2	1.90	1.88	1.86	1.85	1.83	1.81	1.80
7.3	1.90	1.88	1.86	1.85	1.83	1.82	1.80
7.4	1.90	1.88	1.87	1.85	1.83	1.82	1.80
7.5	1.91	1.88	1.87	1.85	1.83	1.82	1.81
7.6	1.91	1.89	1.87	1.85	1.84	1.82	1.81
7.7	1.91	1.89	1.87	1.86	1.84	1.83	1.81
7.8	1.63	1.62	1.60	1.59	1.57	1.56	1.55
7.9	1.38	1.36	1.35	1.34	1.33	1.32	1.31
8.0	1.16	1.15	1.14	1.13	1.12	1.11	1.10
8.1	0.922	0.914	0.906	0.899	0.893	0.887	0.882
8.2	0.736	0.730	0.724	0.718	0.714	0.709	0.706
8.3	0.588	0.583	0.579	0.575	0.571	0.568	0.566
8.4	0.471	0.467	0.464	0.461	0.458	0.456	0.455
8.5	0.377	0.375	0.372	0.370	0.369	0.367	0.366
8.6	0.303	0.301	0.300	0.298	0.297	0.297	0.296
8.7	0.244	0.243	0.242	0.241	0.241	0.240	0.240
8.8	0.197	0.197	0.196	0.196	0.196	0.196	0.196
8.9	0.160	0.160	0.160	0.160	0.160	0.161	0.161
9.0	0.131	0.131	0.131	0.131	0.132	0.132	0.133

Temperature (T) in degrees Celsius

pH	T=14.0	T=15.0	T=16.0	T=17.0	T=18.0	T=19.0	T=20.0
6.5	1.78	1.77	1.64	1.52	1.41	1.31	1.22
6.6	1.78	1.77	1.64	1.52	1.41	1.31	1.22
6.7	1.78	1.77	1.64	1.52	1.41	1.31	1.22
6.8	1.78	1.77	1.64	1.52	1.42	1.32	1.22
6.9	1.78	1.77	1.64	1.53	1.42	1.32	1.22
7.0	1.79	1.77	1.64	1.53	1.42	1.32	1.22
7.1	1.79	1.77	1.65	1.53	1.42	1.32	1.23
7.2	1.79	1.78	1.65	1.53	1.42	1.32	1.23
7.3	1.79	1.78	1.65	1.53	1.42	1.32	1.23
7.4	1.79	1.78	1.65	1.53	1.42	1.32	1.23
7.5	1.80	1.78	1.66	1.54	1.43	1.33	1.23
7.6	1.80	1.79	1.66	1.54	1.43	1.33	1.24
7.7	1.80	1.79	1.66	1.54	1.44	1.34	1.24
7.8	1.54	1.53	1.42	1.32	1.23	1.14	1.07
7.9	1.31	1.30	1.21	1.12	1.04	0.970	0.904
8.0	1.10	1.09	1.02	0.944	0.878	0.818	0.762
8.1	0.878	0.874	0.812	0.756	0.704	0.655	0.611
8.2	0.703	0.700	0.651	0.606	0.565	0.527	0.491
8.3	0.564	0.562	0.523	0.487	0.455	0.424	0.396
8.4	0.453	0.452	0.421	0.393	0.367	0.343	0.321
8.5	0.366	0.365	0.341	0.318	0.298	0.278	0.261
8.6	0.296	0.296	0.277	0.259	0.242	0.227	0.213
8.7	0.241	0.241	0.226	0.212	0.198	0.186	0.175
8.8	0.197	0.198	0.185	0.174	0.164	0.154	0.145
8.9	0.162	0.163	0.153	0.144	0.136	0.128	0.121
9.0	0.134	0.135	0.128	0.121	0.114	0.108	0.102

1. The average of the measured values must be less than the average of the corresponding individual values.

2. Each measured value is compared to the corresponding individual values.

3. No more than one in five of the measured values can be greater than 1.5 x the corresponding guidelines values.

Reference 3

Table 5. Maximum Concentration of Total Ammonia Nitrogen for Protection of Aquatic Life

Temperature (T) in degrees Celsius

pH	T=0.0	T=1.0	T=2.0	T=3.0	T=4.0	T=5.0	T=6.0
6.5	27.7	28.3	27.9	27.5	27.2	26.8	26.5
6.6	27.9	27.5	27.2	26.8	26.4	26.1	25.8
6.7	26.9	26.5	26.2	25.9	25.5	25.2	24.9
6.8	25.8	25.5	25.1	24.8	24.5	24.2	23.9
6.9	24.6	24.2	23.9	23.6	23.3	23.0	22.7
7.0	23.2	22.8	22.5	22.2	21.9	21.6	21.4
7.1	21.6	21.3	20.9	20.7	20.4	20.2	19.9
7.2	19.9	19.6	19.3	19.0	18.8	18.6	18.3
7.3	18.1	17.8	17.5	17.3	17.1	16.9	16.7
7.4	16.2	16.0	15.7	15.5	15.3	15.2	15.0
7.5	14.4	14.1	14.0	13.8	13.6	13.4	13.3
7.6	12.6	12.4	12.2	12.0	11.9	11.7	11.6
7.7	10.8	10.7	10.5	10.4	10.3	10.1	10.0
7.8	9.26	9.12	8.98	8.88	8.77	8.67	8.57
7.9	7.82	7.71	7.60	7.51	7.42	7.33	7.25
8.0	6.55	6.46	6.37	6.29	6.22	6.14	6.08
8.1	5.21	5.14	5.07	5.01	4.95	4.90	4.84
8.2	4.15	4.09	4.04	3.99	3.95	3.90	3.86
8.3	3.31	3.27	3.22	3.19	3.15	3.12	3.09
8.4	2.64	2.61	2.57	2.54	2.52	2.49	2.47
8.5	2.11	2.08	2.06	2.03	2.01	1.99	1.98
8.6	1.69	1.67	1.65	1.63	1.61	1.60	1.59
8.7	1.35	1.33	1.32	1.31	1.30	1.29	1.28
8.8	1.08	1.07	1.06	1.05	1.04	1.04	1.03
8.9	0.871	0.863	0.856	0.849	0.844	0.839	0.836
9.0	0.703	0.697	0.692	0.688	0.685	0.682	0.681

Temperature (T) in degrees Celsius

pH	T=7.0	T=8.0	T=9.0	T=10.0	T=11.0	T=12.0	T=13.0
6.5	26.2	26.0	25.7	25.5	25.2	25.0	24.8
6.6	25.5	25.2	25.0	24.7	24.5	24.3	24.1
6.7	24.6	24.4	24.1	23.9	23.7	23.5	23.3
6.8	23.6	23.4	23.1	22.9	22.7	22.5	22.3
6.9	22.5	22.2	22.0	21.8	21.6	21.4	21.3
7.0	21.1	20.9	20.7	20.5	20.3	20.2	20.0
7.1	19.7	19.5	19.3	19.1	18.9	18.8	18.7
7.2	18.1	17.9	17.8	17.6	17.4	17.3	17.2
7.3	16.5	16.3	16.2	16.0	15.9	15.7	15.6
7.4	14.8	14.7	14.5	14.4	14.2	14.1	14.0
7.5	13.1	13.0	12.9	12.7	12.6	12.5	12.4
7.6	11.5	11.4	11.3	11.2	11.1	11.0	10.9
7.7	9.92	9.83	9.73	9.65	9.57	9.50	9.43
7.8	8.48	8.40	8.32	8.25	8.18	8.12	8.07
7.9	7.17	7.10	7.04	6.98	6.92	6.88	6.83
8.0	6.02	5.96	5.91	5.86	5.81	5.78	5.74
8.1	4.80	4.75	4.71	4.67	4.64	4.61	4.59
8.2	3.83	3.80	3.76	3.74	3.71	3.69	3.67
8.3	3.06	3.03	3.01	2.99	2.97	2.96	2.94
8.4	2.45	2.43	2.41	2.40	2.38	2.37	2.36
8.5	1.96	1.95	1.94	1.93	1.92	1.91	1.91
8.6	1.58	1.57	1.56	1.55	1.55	1.54	1.54
8.7	1.27	1.26	1.26	1.25	1.25	1.25	1.25
8.8	1.03	1.02	1.02	1.02	1.02	1.02	1.02
8.9	0.833	0.832	0.831	0.831	0.832	0.834	0.838
9.0	0.681	0.681	0.681	0.682	0.684	0.688	0.692

Temperature (T) in degrees Celsius

pH	T=14.0	T=15.0	T=16.0	T=17.0	T=18.0	T=19.0	T=20.0
6.5	24.6	24.5	24.3	24.2	24.0	23.9	23.8
6.6	23.9	23.8	23.6	23.5	23.3	23.3	23.2
6.7	23.1	23.0	22.8	22.7	22.6	22.5	22.4
6.8	22.2	22.0	21.9	21.8	21.7	21.6	21.5
6.9	21.1	21.0	20.8	20.7	20.6	20.5	20.4
7.0	19.9	19.7	19.6	19.5	19.4	19.3	19.2
7.1	18.5	18.4	18.3	18.2	18.1	18.0	17.9
7.2	17.1	16.9	16.8	16.8	16.7	16.6	16.5
7.3	15.5	15.4	15.3	15.2	15.2	15.1	15.1
7.4	13.9	13.9	13.8	13.7	13.6	13.6	13.5
7.5	12.4	12.3	12.2	12.2	12.1	12.1	12.0
7.6	10.8	10.8	10.7	10.7	10.6	10.6	10.5
7.7	9.37	9.31	9.26	9.22	9.18	9.15	9.12
7.8	8.02	7.97	7.93	7.90	7.87	7.84	7.82
7.9	6.79	6.75	6.72	6.69	6.67	6.65	6.64
8.0	5.71	5.68	5.66	5.64	5.62	5.61	5.60
8.1	4.56	4.54	4.53	4.51	4.50	4.49	4.49
8.2	3.65	3.64	3.63	3.62	3.61	3.61	3.61
8.3	2.93	2.92	2.92	2.91	2.91	2.91	2.91
8.4	2.36	2.35	2.35	2.35	2.35	2.35	2.36
8.5	1.90	1.90	1.90	1.90	1.90	1.91	1.92
8.6	1.54	1.54	1.54	1.55	1.55	1.56	1.57
8.7	1.25	1.25	1.26	1.26	1.27	1.28	1.29
8.8	1.02	1.03	1.03	1.04	1.05	1.06	1.07
8.9	0.842	0.847	0.853	0.861	0.870	0.880	0.891
9.0	0.698	0.704	0.711	0.720	0.729	0.740	0.752

Reference 3

Table 6. Summary of Water Quality Guidelines for Aluminum

Water Use	maximum aluminum in mg/L (use instantaneous pH value)	30-day mean aluminum in mg/L (use median pH value)
Drinking Water Supply	0.2 mg/L dissolved Al	None proposed
Fresh Water Aquatic Life (pH greater than or equal to 6.5)	0.1 mg/L dissolved Al	0.05 mg/L dissolved Al
Fresh Water Aquatic Life (pH less than 6.5)	dissolved Al = $\exp(1.209 - 2.426 K + 0.286 K^2)$ [where K = pH]	dissolved Al = $\exp(1.6 - 3.327 \text{ median } K + 0.402 K^2)$ [where K = median pH]
Wildlife Water Supply	5 mg/L total Al	None proposed
Livestock Water Supply	5 mg/L total Al	None proposed
Marine and Estuarine Aquatic Life	None proposed	None proposed
Irrigation Water Supply	5 mg/L total Al	None proposed
Recreation and Aesthetics	0.2 mg/L dissolved Al	None proposed

1. When detailed knowledge of the bioavailable forms of aluminum is available, the form of aluminum in the guidelines for aquatic life can be modified, as justified by the data.

2. The average is calculated from at least 5 weekly samples taken in a period of 30 days.

3. Tables 7a and 7b give maximum and 30-day average guidelines specified by the regression equations. (If the natural levels exceed the guidelines, the increase in aluminum levels above background to be allowed, if any, should be based on site-specific data).

Reference 4

Table 7. Examples of Freshwater Aluminum Guidelines Specified by the Regression Equations

Table 7a. Maximum Dissolved Aluminum Concentration (mg/L) at pH Less Than 6.5

pH	Maximum	pH	Maximum	pH	Maximum
pH 4.0 - 4.6	0.020 mg/L	pH 5.3	0.027 mg/L	pH 5.9	0.043 mg/L
pH 4.7 - 4.8	0.021 mg/L	pH 5.4	0.029 mg/L	pH 6.0	0.047 mg/L
pH 4.9	0.022 mg/L	pH 5.5	0.031 mg/L	pH 6.1	0.052 mg/L
pH 5.0	0.023 mg/L	pH 5.6	0.033 mg/L	pH 6.2	0.059 mg/L
pH 5.1	0.024 mg/L	pH 5.7	0.036 mg/L	pH 6.3	0.066 mg/L
pH 5.2	0.025 mg/L	pH 5.8	0.039 mg/L	pH 6.4	0.074 mg/L

Reference 4

Table 7b. 30-Day Average Dissolved Aluminum Concentration (mg/L) at pH Less Than 6.5

Median pH	30-day mean	Median pH	30-day mean	Median pH	30-day mean
pH 4.0 - 4.5	0.005 mg/L	pH 5.5	0.011 mg/L	pH 6.0	0.020 mg/L
pH 4.6 - 4.9	0.006 mg/L	pH 5.6	0.012 mg/L	pH 6.1	0.024 mg/L
pH 5.0 - 5.1	0.007 mg/L	pH 5.7	0.013 mg/L	pH 6.2	0.028 mg/L
pH 5.2	0.008 mg/L	pH 5.8	0.015 mg/L	pH 6.3	0.033 mg/L
pH 5.3	0.009 mg/L	pH 5.9	0.018 mg/L	pH 6.4	0.040 mg/L
pH 5.4	0.010 mg/L	—	—	—	—

Reference 4

Table 8. Summary of Water Quality Guidelines for Microbiological Indicators

Water Use	Escherichia coli	Enterococci	Pseudomonas aeruginosa	Fecal coliforms
Raw drinking water - no treatment	0/100 mL	0/100 mL	0/100 mL	0/100 mL
Raw drinking water - disinfection only	less than or equal to 10/100 mL 90th percentile	less than or equal to 3/100 mL 90th percentile	None applicable	less than or equal to 10/100 mL 90th percentile
Raw drinking water - partial treatment	less than or equal to 100/100 mL 90th percentile	less than or equal to 25/100 mL 90th percentile	None applicable	less than or equal to 100/100 mL 90th percentile
Raw drinking water - complete treatment	None applicable	None applicable	None applicable	None applicable
Aquatic life - shellfish harvesting	less than or equal to 43/100 mL 90th percentile	less than or equal to 11/100 mL 90th percentile	None applicable	less than or equal to 43/100 mL 90th percentile
Aquatic life - shellfish harvesting	less than or equal to 14/100 mL median	less than or equal to 4/100 mL median	None applicable	less than or equal to 14/100 mL median
Wildlife	None applicable	None applicable	None applicable	None applicable
Livestock - free range animals	None applicable	None applicable	None applicable	None applicable
Livestock - general livestock use	200/100 mL maximum	50/100 mL maximum	None applicable	200/100 mL maximum
Livestock - closely confined (no treatment)	0/100 mL maximum	0/100 mL maximum	None applicable	0/100 mL maximum
Livestock - closely confined (disinfection only)	less than or equal to 10/100 mL 90th percentile	less than or equal to 3/100 mL 90th percentile	None applicable	less than or equal to 10/100 mL 90th percentile
Livestock - closely confined (partial treatment)	less than or equal to 100/100 mL 90th percentile	less than or equal to 25/100 mL 90th percentile	None applicable	less than or equal to 100/100 mL 90th percentile
Livestock - closely confined (complete treatment)	None applicable	None applicable	None applicable	None applicable
Irrigation - crops eaten raw	less than or equal to	less than or equal to	None applicable	less than or equal to

	77/100 mL geometric mean	20/100 mL geometric mean		200/100 mL geometric mean
Irrigation - public access - livestock access	less than or equal to 385/100 mL geometric mean	less than or equal to 100/100 mL geometric mean	less than or equal to 10/100 mL 75th percentile	None applicable
Irrigation - general irrigation	less than or equal to 1000/100 mL geometric mean	less than or equal to 250/100 mL geometric mean	None applicable	less than or equal to 1000/100 mL geometric mean
Recreation - aesthetics - non contact	None applicable	None applicable	None applicable	None applicable
Recreation - secondary contact - crustacean harvesting	less than or equal to 385/100 mL geometric mean	less than or equal to 100/100 mL geometric mean	less than or equal to 10/100 mL 75th percentile	None applicable
Recreation - primary contact	less than or equal to 77/100 mL geometric mean	less than or equal to 20/100 mL geometric mean	less than or equal to 2/100 mL 75th percentile	less than or equal to 200/100 mL geometric mean
Industrial water (dairy, food processing) - no treatment	0/100 mL	0/100 mL	None applicable	0/100 mL
Industrial water (dairy, food processing) - disinfection only	less than or equal to 10/100 mL 90th percentile	less than or equal to 3/100 mL 90th percentile	None applicable	less than or equal to 10/100 mL 90th percentile
Industrial water (dairy, food processing) - partial treatment	less than or equal to 100/100 mL 90th percentile	less than or equal to 25/100 mL 90th percentile	None applicable	less than or equal to 100/100 mL 90th percentile
Industrial water (dairy, food processing) - complete treatment	None applicable	None applicable	None applicable	None applicable
Industrial water - other industries	less than or equal to 385/100 mL geometric mean	less than or equal to 100/100 mL geometric mean	less than or equal to 10/100 mL 75th percentile	None applicable

1. Fecal coliform guidelines that presently exist will apply on an interim basis until use of the other preferred indicators is adopted.

2. For the dairy industry there is an additional guideline of less than or equal to 5/100 mL lipolytic and/or proteolytic bacteria.

3. Medians and geometric means are calculated from at least 5 samples in a 30-day period. Ten samples are required for 90th percentiles.

4. These recreation and shell harvesting guidelines are applicable to fresh and marine waters, except the E. coli guidelines that apply only to fresh water.

5. Only a few salad greens that cannot be adequately washed to remove adhering or trapped pathogens are of concern under the crops eaten raw section of irrigation. Examples include lettuce, cabbage, broccoli, cauliflower and similar crops.

6. These primary contact recreation guidelines may be subject to revision depending upon the future results of a federal/provincial study group on Canadian recreational water quality.

Reference 5

Table 9. Summary of Water Quality Guidelines for Copper

Water Use	30-day averages µg/L total copper	Maximum µg/L total copper
Raw Drinking Water Supply	—	500 µg/L
Fresh Water Aquatic Life (when average water hardness as CaCO ₃ is less than or equal to 50 mg/L)	less than or equal to 2 µg/L	(0.094(hardness)+2) µg/L (hardness as mg/L CaCO ₃)
Fresh Water Aquatic Life (when average water hardness as CaCO ₃ is greater than 50 mg/L)	less than or equal to 0.04 (mean hardness) µg/L	(0.094(hardness)+2) µg/L (hardness as mg/L CaCO ₃)
Wildlife	None proposed	300 µg/L
Livestock Water Supply	None proposed	300 µg/L
Irrigation Water Supply	None proposed	200 µg/L
Recreation and Aesthetics	None proposed	1000 µg/L
Marine and Estuarine Aquatic Life	less than or equal to 2 µg/L	3 µg/L

1. The average is calculated from at least 5 weekly samples taken in a period of 30 days.

2. When detailed knowledge on the the bioavailable forms of copper is available, the form of copper in the guidelines for aquatic life can be modified, as justified by the data.

3. If natural background levels exceed the guidelines for aquatic life, the increase in total copper above natural levels to be allowed, if any, should be based on site-specific data.

Reference 6

Table 10. Summary of Water Quality Guidelines for Cyanide

Water Use	Strong-acid dissociable cyanide plus thiocyanate µg/L (as CN)	Strong-acid dissociable cyanide µg/L (as CN)	Weak-acid dissociable cyanide µg/L (as CN)
Raw Drinking Water - includes food processing water (maximum at any time)	200 µg/L	Not applicable	Not applicable
Freshwater Aquatic Life (30-day average)	Not applicable	None proposed	less than or equal to 5 µg/L
Freshwater Aquatic Life (maximum at any time)	Not applicable	None proposed	10 µg/L
Marine and Estuarine Aquatic Life (maximum at any time)	Not applicable	None proposed	1 µg/L

- 1. All characteristics apply to unfiltered water.**
- 2. The average is calculated from at least 5 weekly samples taken in a period of 30 days.**
- 3. Measure strong-acid dissociable cyanide in addition to weak-acid dissociable cyanide. If tests show that strong-acid dissociable cyanide is greater than the guidelines for weak-acid dissociable cyanide, further sampling of the receiving water is recommended at the same site during bright sunlight, and from sites further from the cyanide source.**
- 4. If it can be shown for a particular water supply, that treatment methods (chlorination, ozonation or ultraviolet irradiation) do not produce free cyanide or cyanogen chloride from the dissociation of thiocyanate, then the guideline should apply only to strong-acid dissociable cyanide.**

Reference 7

Table 11. Summary of Water Quality Guidelines for Lead

Water Use	30-day average (µg/L total lead)	maximum (µg/L total lead)
Drinking Water Supply	None proposed	50 µg/L total lead
Fresh Water Aquatic Life (water hardness as CaCO ₃ less than or equal to 8 mg/L)	None proposed	3 µg/L total lead
Fresh Water Aquatic Life (water hardness as CaCO ₃ less than or equal to 8 mg/L)	less than or equal to $3.31 + e^{(1.273 \ln [\text{mean hardness}] - 4.704)}$	$e^{(1.273 \ln [\text{hardness}] - 1.460)}$
Wildlife Water Supply	None proposed	100 µg/L total lead
Livestock Water Supply	None proposed	100 µg/L total lead
Marine and Estuarine Aquatic Life	less than or equal to 2 µg/L total lead — (80% of the values less than or equal to 3 µg/L total lead)	140 µg/L total lead
Irrigation Water Supply (neutral and alkaline fine-textured soils)	None proposed	400 µg/L total lead
Irrigation Water Supply (all other soils)	None proposed	200 µg/L total lead
Industrial Water Supply (food processing industry)	None proposed	50 µg/L total lead
Recreation and Aesthetics	None proposed	50 µg/L total lead

1. The average is calculated from at least 5 weekly samples taken in a period of 30 days.

2. If natural levels exceed the guidelines for aquatic life, the increase in total lead above natural levels to be allowed, if any, should be based on site-specific data.

3. The alert level for total lead in the edible portions of fish and shellfish for human consumption is 0.8 µg/g wet weight. A site-specific investigation should be done if levels approach or exceed this level.

Reference 8

Table 12. Details of Freshwater Aquatic Life Guidelines for Lead

Water Hardness (mg/L CaCO₃)	30-day average concentration (µg/L total lead)	maximum concentration (µg/L total lead)
less than or equal to 8 mg/L	None proposed	3 µg/L total lead
20 mg/L	4 µg/L	10 µg/L
30 mg/L	4 µg/L	18 µg/L
40 mg/L	4 µg/L	25 µg/L
50 mg/L	5 µg/L	34 µg/L
80 mg/L	6 µg/L	61 µg/L
100 mg/L	6 µg/L	82 µg/L
200 mg/L	11 µg/L	197 µg/L
300 mg/L	16 µg/L	330 µg/L

1. At least 80% of the measurements should be less than or equal to 1.5 times the 30-day average guideline.

Reference 8

Table 13. Summary of Water Quality Guidelines for Mercury

Water Use	30-day average µg/L total Hg	maximum at any time µg/L total Hg
Drinking Water Supply	None proposed	1 µg/L
Fresh Water Aquatic Life	0.02 µg/L	0.1 µg/L
Marine and Estuarine Aquatic Life	0.02 µg/L	2.0 µg/L
Wildlife	None proposed	Table 13a
Livestock Water Supply	None proposed	3.0 µg/L
Irrigation Water Supply	None proposed	2.0 µg/L
Primary Contact Recreation	None proposed	1.0 µg/L
Industrial Water Supply - food processing industry	None proposed	1.0 µg/L

1. The average is calculated from at least 5 weekly samples taken in a period of 30 days.

2. If natural levels exceed the guidelines for aquatic life, the increase in total mercury above natural levels to be allowed, if any, should be based on site-specific data.

3. Great Lakes Water Quality Initiative has recommended a guideline of 1.3 nanogram/L for the protection of wildlife (reference 26).

4. These guidelines may not be protective against Hg bioaccumulation in fish tissue; hence, they should be assessed in conjunction with the tissue residue guidelines for Hg in Table 14.

*** The maximum guideline for total Hg changes when the MeHg concentration in the environment changes. See Table 13a.**

References 9 and 9a

Table 13a. Relationship between Methyl Mercury (MeHg) Concentration in the Environment and the Total Hg Guideline

% MeHg (of Total Hg)	Total Hg guideline in µg/L
≤0.5	0.02
1	0.01
2.5	0.004
5	0.002

Table 13b. Tissue Residue Guideline to Protect Wildlife from Hg Toxicity

Maximum concentration of methyl Hg in fish or shellfish consumed by wildlife
0.033 µg as methyl Hg
<i>References 9 and 9a</i>

Table 14. Variations in (the Mercury) Aquatic Life Guidelines for Fish/Shellfish When the (Human) Diet is Based Primarily on Fish

Concentration of total Hg in the edible portion of fish and shellfish (µg Hg/g wet weight fish)	Safe quantity for weekly consumption on a regular basis (g fish wet weight)
0.5 µg/g	210 g
0.4 µg/g	260 g
0.3 µg/g	350 g
0.2 µg/g	525 g
0.1 µg/g	1050 g

1. The maximum concentration of total Hg in the edible portion of fish/shellfish should not exceed 0.5 µg/g wet weight. For people whose diet is based primarily on fish or shellfish, this guideline may need to be varied as indicated above.

References 9 and 9a

Table 15. Summary of Water Quality Guidelines for Molybdenum

Water Use	30-day averages mg/L total molybdenum	Maximum mg/L total molybdenum
Raw Untreated Drinking Water	None proposed	0.25 mg/L
Fresh Water Aquatic Life	less than or equal to 1 mg/L	2 mg/L
Wildlife	None proposed	0.05 mg/L
Livestock Water Supply (consuming forages not irrigated or if no molybdenum containing fertilizers are applied to grow feed consumed by livestock)	None proposed	0.08 mg/L
Livestock Water Supply (all other cases)	None proposed	0.05 mg/L
Irrigation Water - Poorly Drained Soil - Cu:Mo ratio is less than 2:1 in the irrigation water - (forage crops)	less than or equal to 0.01 mg/L	0.05 mg/L
Irrigation Water - Poorly Drained Soil - Cu:Mo ratio is greater than 2:1 in the irrigation water - (forage crops)	less than or equal to 0.02 mg/L	0.05 mg/L
Irrigation Water - Well Drained Soil (forage crops)	less than or equal to 0.02 mg/L	0.05 mg/L
Irrigation Water - All Soils (non-forage crops)	less than or equal to 0.03 mg/L	None proposed

1. The average is calculated from at least 5 weekly samples taken in a period of 30 days.

Reference 10

Table 16. Summary of Water Quality Guidelines for Nitrogen

Water Use	Nitrate mg/L as nitrogen	Nitrite mg/L as nitrogen	Ammonia (total) mg/L as nitrogen
Drinking Water	10 mg/L (maximum)	1 mg/L (maximum)	None proposed
Fresh Water Aquatic Life - maximum	200 mg/L (maximum)	0.06 mg/L (maximum) when the chloride is less than 2 mg/L - also see Table 17	see Tables 4 and 5
Fresh Water Aquatic Life - average	less than or equal to 40 mg/L (average)	less than or equal to 0.02 mg/L (average) when the chloride is less than 2 mg/L - also see Table 17	see Tables 4 and 5
Marine Aquatic Life - maximum	None proposed	None proposed	see Table 21
Marine Aquatic Life - average	None proposed	None proposed	see Table 22
Livestock Watering	100 mg/L (maximum)	10 mg/L (maximum)	None proposed
Wildlife	100 mg/L (maximum)	10 mg/L (maximum)	None proposed
Recreation and Aesthetics	10 mg/L (maximum)	1 mg/L (maximum)	None proposed

1. The average value is calculated from at least 5 weekly samples taken in a period of 30 days.

2. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.

3. These levels are too high for some amphibians. For example the 96-h LC_{50} for the eastern American toad is 13.6 mg/L N.

4. Chronic effects are observed at lower levels, 5 to 10 mg/L N (reference 27)

Reference 3

14

Table 17. Guidelines for Nitrite for Protection of Freshwater Aquatic Life

Chloride in mg/L	Nitrite (maximum) mg/L as nitrogen	Nitrite (average) mg/L as nitrogen
less than 2 mg/L	0.06 mg/L	0.02 mg/L
2 to 4 mg/L	0.12 mg/L	0.04 mg/L
4 to 6 mg/L	0.18 mg/L	0.06 mg/L
6 to 8 mg/L	0.24 mg/L	0.08 mg/L
8 to 10 mg/L	0.30 mg/L	0.10 mg/L
greater than 10 mg/L	0.60 mg/L	0.20 mg/L

1. The 30-day average chloride concentration should be used to determine the appropriate 30-day average nitrite guideline.

Reference 3

Table 18. Summary of Water Quality Guidelines for Dissolved Oxygen for the Protection of Fresh, Marine and Estuarine Life

Life Stages	All Life Stages other than buried embryo/alevin	Buried embryo/alevin life stages	Buried embryo/alevin life stages
Dissolved oxygen - concentration	Water column mg/L O ₂	Water column mg/L O ₂	Interstitial water mg/L O ₂
Instantaneous minimum	5	9	6
30-day mean	8	11	8

1. For the buried embryo/alevin life stages these are in-stream concentrations from spawning to the point of yolk sac absorption or 30 days post-hatch for fish; the water column concentrations recommended to achieve interstitial dissolved oxygen values when the latter are unavailable. Interstitial oxygen measurements would supersede water column measurements in comparing to guidelines.

2. The instantaneous minimum level is to be maintained at all times.

3. The mean is based on at least five approximately evenly spaced samples. If a diurnal cycle exists in the water body, measurements should be taken when oxygen levels are lowest (usually early morning).

Reference 11

Table 19. Summary of Water Quality Guidelines for Chlorine

Water Use	Average exposure - continuous µg/L (as TRC or CPO)	Average exposure - controlled - intermittent µg/L (as TRC or CPO)	Maximum exposure - controlled - intermittent µg/L (as TRC or CPO)
Freshwater Aquatic Life	2 µg/L	1074 (duration) ^{-0.74}	100 µg/L regardless of either duration or exposure
Marine and Estuarine Aquatic Life	3 µg/L	20.36 (duration) ^{-0.4}	40 µg/L regardless of either duration or exposure
Irrigation Water	None proposed	None proposed	1000 µg/L

- 1. The continuous exposure average should be based on at least 5 samples, equally spaced in time and the averaging period should be not less than 4 days nor more than 30 days for freshwater and not less than 2 hours nor more than 30 days for marine or estuarine water. This is the threshold of chronic toxicity.**
- 2. The duration in controlled intermittent exposures is the exposure period in minutes. This is the threshold of acute toxicity.**
- 3. For the maximum controlled, intermittent exposure of aquatic life, the total duration of exposure in any consecutive 24-hour period should not exceed 2 hours. This is the threshold of acute toxicity.**
- 4. TRC is the total residual chlorine in fresh water.**
- 5. CPO is the chlorine-produced oxidants in marine or estuarine water.**
- 6. The irrigation guideline applies to plants grown in soil-less media and should be applied as a maximum under continuous or intermittent exposure situations.**

Reference 12

Table 20. Summary Table of Recommended Guidelines for Fluoride

Water Use	Guidelines (in mg/L as total fluoride)
Raw Drinking Water	1.0 mg/L as a 30-day mean — 1.5 mg/L as a maximum
Fresh Water Aquatic Life	0.2 mg/L maximum where water hardness is less than 50 mg/L as CaCO ₃ — 0.3 mg/L maximum where water hardness is greater than or equal to 50 mg/L as CaCO ₃
Marine Aquatic Life	1.5 mg/L maximum
Wildlife	1.0 mg/L as a 30-day mean — 1.5 mg/L as a maximum
Dairy Cows, Breeding Stock - long-lived animals	1.0 mg/L as a 30-day mean — 1.5 mg/L as a maximum
Livestock - high fluoride diets - mineral or bone meal feed additives	1.0 mg/L as a 30-day mean — 2.0 mg/L as a maximum
All Other Livestock - normal diet	2.0 mg/L as a 30-day mean — 4.0 mg/L as a maximum
Irrigation - all soils	1.0 mg/L as a 30-day mean — 2.0 mg/L as a maximum
Recreation	No guideline set
Industrial - beer - beverages - processed foods	1.0 mg/L as a 30-day mean — 1.5 mg/L as a maximum

1. Table values are in mg/L of total fluoride.

2. The freshwater aquatic life guidelines are interim until carefully controlled experiments can determine the appropriate levels of fluoride under various combinations of water temperature and hardness, measured as calcium carbonate.

Reference 13

Table 21. Maximum Concentration of Total Ammonia Nitrogen for Protection of Saltwater Aquatic Life (mg/L of Nitrogen)

Salinity equals 10 g/kg; Temperature (T) in degrees Celsius

pH	T = 0	T = 5	T = 10	T = 15	T = 20	T = 25
7.0	270	191	131	92	62	44
7.2	175	121	83	58	40	27
7.4	100	77	52	35	25	17
7.6	69	48	33	23	16	11
7.8	44	31	21	15	10	7.1
8.0	27	19	13	9.4	6.4	4.6
8.2	18	12	8.5	5.8	4.2	2.9
8.4	11	7.9	5.4	3.7	2.7	1.9
8.6	7.3	5.0	3.5	2.5	1.8	1.3
8.8	4.6	3.3	2.3	1.7	1.2	0.92
9.0	2.9	2.1	1.5	1.1	0.85	0.67

Salinity equals 20 g/kg; Temperature (T) in degrees Celsius

pH	T = 0	T = 5	T = 10	T = 15	T = 20	T = 25
7.0	291	200	137	96	64	44
7.2	183	125	87	60	42	29
7.4	116	79	54	37	27	18
7.6	73	50	35	23	17	11
7.8	46	31	23	15	11	7.5
8.0	29	20	14	9.8	6.7	4.8
8.2	19	13	8.9	6.2	4.4	3.1
8.4	12	8.1	5.6	4.0	2.9	2.0
8.6	7.5	5.2	3.7	2.7	1.9	1.4
8.8	4.8	3.3	2.5	1.7	1.3	0.94
9.0	3.1	2.3	1.6	1.2	0.87	0.69

Salinity equals 30 g/kg; Temperature (T) in degrees Celsius

pH	T = 0	T = 5	T = 10	T = 15	T = 20	T = 25
7.0	312	208	148	102	71	48
7.2	196	135	94	64	44	31
7.4	125	85	58	40	27	19
7.6	79	54	37	25	21	12
7.8	50	33	23	16	11	7.9
8.0	31	21	15	10	7.3	5.0
8.2	20	14	9.6	6.7	4.6	3.3
8.4	12.7	8.7	6.0	4.2	2.9	2.1
8.6	8.1	5.6	4.0	2.7	2.0	1.4
8.8	5.2	3.5	2.5	1.8	1.3	1.0
9.0	3.3	2.3	1.7	1.2	0.94	0.71

1. g/kg salinity is equivalent to parts per thousand (ppt)

2. The guideline value is obtained by using the average pH, temperature and salinity field values, and is compared to the mean of the measured ammonia concentrations.

3. Intermediate values of pH, temperature or salinity should be interpolated linearly.

4. The freshwater guidelines apply at salinity less than 10 g/kg (see Tables 4 and 5)

Reference 14

Table 22. Average 5 to 30-day Concentration of Total Ammonia Nitrogen for Protection of Saltwater Aquatic Life (mg/L of Nitrogen)

Salinity equals 10 g/kg; Temperature (T) in degrees Celsius

pH	T = 0	T = 5	T = 10	T = 15	T = 20	T = 25
7.0	41	29	20	14	9.4	6.6
7.2	26	18	12	8.7	5.9	4.1
7.4	17	12	7.8	5.3	3.7	2.6
7.6	10	7.2	5.0	3.4	2.4	1.7
7.8	6.6	4.7	3.1	2.2	1.5	1.1
8.0	4.1	2.9	2.0	1.4	0.97	0.69
8.2	2.7	1.8	1.3	0.87	0.62	0.44
8.4	1.7	1.2	0.81	0.56	0.41	0.29
8.6	1.1	0.75	0.53	0.37	0.27	0.20
8.8	0.69	0.50	0.34	0.25	0.18	0.14
9.0	0.44	0.31	0.23	0.17	0.13	0.10

Salinity equals 20 g/kg; Temperature (T) in degrees Celsius

pH	T = 0	T = 5	T = 10	T = 15	T = 20	T = 25
7.0	44	30	21	14	9.7	6.6
7.2	27	19	13	9.0	6.2	4.4
7.4	18	12	8.1	5.6	4.1	2.7
7.6	11	7.5	5.3	3.4	2.5	1.7
7.8	6.9	4.7	3.4	2.3	1.6	1.1
8.0	4.4	3.0	2.1	1.5	1.0	0.72
8.2	2.8	1.9	1.3	0.94	0.66	0.47
8.4	1.8	1.2	0.84	0.59	0.44	0.30
8.6	1.1	0.78	0.56	0.41	0.28	0.20
8.8	0.72	0.50	0.37	0.26	0.19	0.14
9.0	0.47	0.34	0.24	0.18	0.13	0.10

Salinity equals 30 g/kg; Temperature (T) in degrees Celsius

pH	T = 0	T = 5	T = 10	T = 15	T = 20	T = 25
7.0	47	31	22	15	11	7.2
7.2	29	20	14	9.7	6.6	4.7
7.4	19	13	8.7	5.9	4.1	2.9
7.6	12	8.1	5.6	3.7	3.1	1.8
7.8	7.5	5.0	3.4	2.4	1.7	1.2
8.0	4.7	3.1	2.2	1.6	1.1	0.75
8.2	3.0	2.1	1.4	1.0	0.69	0.50
8.4	1.9	1.3	0.90	0.62	0.44	0.31
8.6	1.2	0.84	0.59	0.41	0.30	0.22
8.8	0.78	0.53	0.37	0.27	0.20	0.15
9.0	0.50	0.34	0.26	0.19	0.14	0.11

- 1. g/kg salinity is equivalent to parts per thousand (ppt)*
 - 2. The guideline value is obtained by using the average pH, temperature and salinity field values, and is compared to the mean of the measured ammonia concentrations.*
 - 3. Intermediate values of pH, temperature or salinity should be interpolated linearly.*
 - 4. The freshwater criteria apply at salinity less than 10 g/kg (see Tables 4 and 5)*
- Reference 14**

Table 23. Summary of Guidelines for Polychlorinated Biphenyls (PCBs)

Water Use	PCBs	Recommended Maximum Concentration
Drinking Water Supply	—	None proposed
Wildlife	—	None proposed
Livestock Water Supply	—	None proposed
Irrigation Water	Total	0.5 µg/L
Primary Contact Recreation	—	None proposed
Freshwater and Marine Aquatic Life - water	Total PCB #105 PCB #169 PCB #77 PCB #126	0.1 ng/L 0.09 ng/L 0.06 ng/L 0.04 ng/L 0.00025 ng/L
Freshwater and Marine Aquatic Life - fish and/or shellfish (for wildlife consumption: whole animal)	Total	0.1 µg/g wet weight
Freshwater and Marine Aquatic Life - fish and/or shellfish (for human consumption: edible tissue only)	Total	2.0 µg/g wet weight
Freshwater and Marine Aquatic Life - sediment (*containing 1% organic carbon)	Total	0.02 µg/g dry weight

0

1. If sediment organic carbon is not 1%, the guideline is = (0.02 µg/g) x (% organic carbon content).

Reference 15

Table 24. Summary of Guidelines for Polycyclic Aromatic Hydrocarbons (PAHs)

Water Use	PAHs	Recommended Concentration
Drinking Water Supply	B[a]P	0.01 µg/L
Wildlife Water Supply	—	None proposed
Livestock Water Supply	—	None proposed
Irrigation Water Supply	—	None proposed
Fish and/or Shellfish (edible tissue for human consumption) - low consumption of 50 g/week	B[a]P	4 µg/kg wet weight
Fish and/or Shellfish (edible tissue for human consumption) - moderate consumption of 100 g/week	B[a]P	2 µg/kg wet weight
Fish and/or Shellfish (edible tissue for human consumption) - heavy consumption of 200 g/week	B[a]P	1 µg/kg wet weight
Primary Contact Recreation	—	None proposed
Food Processing Industries	B[a]P	0.01µg/L

1. B[a]P = Benzo[a]pyrene

Reference 16

Table 25. Summary of Aquatic Life and Sediment Guidelines for Polycyclic Aromatic Hydrocarbons (PAHs)

PAH	Fresh Water (chronic)	Fresh Water (phototoxic)	Marine Water	Sediments (Fresh Water)	Sediments (Marine)
Naphthalene	1 µg/L	NR	1 µg/L	0.01 µg/g	0.01 µg/g
Methylated naphthalene	NR	NR	1 µg/L	NR	NR
Acenaphthene	6 µg/L	NR	6 µg/L	0.15 µg/g	0.15 µg/g
Fluorene	12 µg/L	NR	12 µg/L	0.2 µg/g	0.2 µg/g
Anthracene	4 µg/L	0.1 µg/L	NR	0.6 µg/g	NR
Phenanthrene	0.3 µg/L	NR	NR	0.04 µg/g	NR
Acridene	3 µg/L	0.05 µg/L	NR	1 µg/g	NR
Fluoranthene	4 µg/L	0.2 µg/L	NR	2 µg/g	NR
Pyrene	NR	0.02 µg/L	NR	NR	NR
Chrysene	NR	NR	0.1 µg/L	NR	0.2 µg/g
Benz[a]anthracene	0.1 µg/L	0.1 µg/L	NR	0.2 µg/g	NR
Benzo[a]pyrene	0.01 µg/L	NR	0.01 µg/L	0.06 µg/L	0.06 µg/L

1. NR — not recommended due to insufficient data

2. *sediment containing 1% organic carbon

Reference 16

Table 26. Summary of Water Quality Guidelines for Chlorophenols

Water Use	Guidelines (maximum)
Raw Drinking Water - aesthetics (taste and odour)	MCPs: 0.1 µg/L DCPs: 0.3 µg/L TCPs: 2.0 µg/L TTCPs: 1.0 µg/L PCP: 30.0 µg/L
Raw Drinking Water - toxicity	2,4-DCP: 900 µg/L 2,4,6-TCP: 5 µg/L 2,3,4,6-TTCP: 100 µg/L PCP: 60 µg/L
Livestock and Wildlife Drinking Water - aesthetics	MCPs: 0.1 µg/L DCPs: 0.3 µg/L TCPs: 2.0 µg/L TTCPs: 1.0 µg/L PCP: 30.0 µg/L
Livestock and Wildlife Drinking Water - toxicity for lactating animals (high temperatures and high water intake rates)	MCPs: 185 mg/L DCPs: 46 mg/L TCPs: 21 mg/L TTCPs: 41 mg/L PCP: 17.5 mg/L
Livestock and Wildlife Drinking Water - toxicity for non-lactating animals (normal temperatures and low water intake rates)	MCPs: 1854 mg/L DCPs: 460 mg/L TCPs: 210 mg/L TTCPs: 410 mg/L PCP: 175 mg/L
Aquatic Life (fresh, marine and estuarine waters) - flavour impairment guidelines for fish muscle	all CPs: use Table 27b
Aquatic Life (fresh, marine and estuarine waters) - flavour impairment guidelines for water (when harvesting fish, crustaceans and shellfish)	MCPs: 0.1 µg/L DCPs: 0.2 µg/L TCPs: use Table 27a TTCPs: use Table 27a PCP: use Table 27a
Aquatic Life (fresh, marine and estuarine waters) - toxicity guidelines for aquatic life	all CPs: use Table 27a
Recreation - primary contact	MCPs: 0.1 µg/L DCPs: 0.3 µg/L TCPs: 2.0 µg/L TTCPs: 1.0 µg/L PCP: 30.0 µg/L
Recreation - secondary contact	MCPs: 0.3 µg/L DCPs: 0.3 µg/L TCPs: 11 µg/L TTCPs: 600 µg/L PCP: 860 µg/L
Irrigation	No guideline set

Industrial - food processing	MCPs: 0.1 µg/L DCPs: 0.3 µg/L TCPs: 2.0 µg/L TTCPs: 1.0 µg/L PCP: 30.0 µg/L
Industrial - other uses	No guideline set

CP = Chlorophenol

MCP = Monochlorophenol

DCP = Dichlorophenol

TCP = Trichlorophenol

TTCP = Tetrachlorophenol

PCP = Pentachlorophenol

References 17, 17a

Table 27. Summary of Interim Aquatic Life and Tissue Residue Guidelines for Chloropheno

Table 27a. Aquatic Life Toxicity Guidelines

Chlorophenol Congeners	pH 5.7	pH 6.2	pH 6.7	pH 7.2	pH 7.7	pH 8.2	pH 8.7	pH 9.2
2-MCP	3.9	6.4	11	17	29	48	79	130
3-MCP	3.4	5.6	9.3	15	25	42	70	115
4-MCP	1.7	2.9	4.8	7.8	13	22	36	59
2,3-DCP	1.1	1.8	3.1	5.1	8.3	14	23	38
2,4-DCP	0.6	1.0	1.6	2.6	4.3	7.2	12	20
2,5-DCP	0.5	0.8	1.4	2.3	3.7	6.2	10	17
2,6-DCP	2.0	3.3	5.5	9.1	15	25	41	68
3,4-DCP	0.6	1.0	1.6	2.7	4.4	7.4	12	20
3,5-DCP	0.5	0.7	1.2	2.0	3.4	5.6	9.2	15
2,3,4-TCP	0.5	0.8	1.3	2.2	3.6	6.0	9.9	16
2,3,5-TCP	0.5	0.8	1.3	2.2	3.7	6.1	10	17
2,3,6-TCP	1.6	2.6	4.4	7.2	12	20	33	54
2,4,5-TCP	0.5	0.7	1.2	2.0	3.3	5.6	9.2	15
2,4,6-TCP	1.2	1.9	3.2	5.3	8.8	15	24	40
3,4,5-TCP	0.2	0.3	0.5	0.9	1.4	2.4	3.9	6.4
2,3,4,5-TTCP	0.4	0.6	1.0	1.7	2.8	4.7	7.8	13
2,3,4,6-TTCP	1.1	1.8	2.9	4.9	8.0	13	22	36
2,3,5,6-TTCP	0.5	0.8	1.3	2.2	3.6	6.1	10	17
2,3,4,5,6-PCP	0.2	0.3	0.5	0.7	1.2	2.0	3.4	5.5

- 1. Multiply the table values by 2 at 0 degrees C and by 0.5 at 20 degrees C.**
- 2. These are maximum values in µg/L.**
- 3. These are final guidelines for PCP and interim guidelines for the other chlorophenol congeners.**

References 17, 17a

Table 27b. Interim Fish Muscle Tissue Flavour Impairment Guidelines

Chlorophenol	Guidelines (µg/g)
2-MCP	10
3-MCP	20
4-MCP	40
2,3-DCP	80
2,4-DCP	0.2
2,5-DCP	20
2,6-DCP	30
2,4,6-TCP	50
2,3,4,5,6-PCP	20

1. These guidelines are based on the wet weight of muscle tissue.

2. They are maximum values.

References 17, 17a

Table 28. Summary of the pH Guidelines

Water Use	Guidelines - pH Units	Comments
Drinking Water Supply	pH 6.5 to pH 8.5	Designed to minimize solubilization of heavy metals and salts from water distribution pipes and the precipitation of carbonate salts in the distribution system, and maximize the effectiveness of chlorination. However, natural source water outside the guidelines may be safe to drink from a public health perspective.
Fresh Water Aquatic Life	pH less than 6.5	No statistically significant decrease in pH from background. No restriction on the increase in pH except in boggy areas that have a unique fauna and flora. Site-specific ambient water quality objectives to restrict the pH increase in areas with a unique fauna and flora are recommended.
Fresh Water Aquatic Life	pH from 6.5 to 9.0	Unrestricted change permitted within this range. This component of the freshwater guidelines should be used cautiously if the pH change causes the carbon dioxide concentration to decrease below a 10 µmol/L minimum or exceed a 1360 µmol/L maximum.
Fresh Water Aquatic Life	pH over 9.0	No statistically significant increase in pH from background. Short-term increase (2-3 days) to pH 9.5 are permitted for lake restoration projects. Decreases in pH are permitted as long as carbon dioxide concentrations are not elevated above 1360 µmol/L. Carbon dioxide concentrations above 1360 µmol/L may be toxic to fish.
Wildlife Water Supply	None proposed	There is adequate protection from the aquatic life guidelines.
Livestock Water Supply	pH 5.0 to 9.5	pH does not interfere with the palatability of water or the health of livestock.
Marine Aquatic Life	7.0 to 8.7	Unrestricted change within this range (for the protection of mollusc embryo development).
Irrigation Water Supply	pH 5.0 to 9.0	Recognizes that soil acidity, alkalinity and salinity are a concern in agriculture.
Recreational Waters	pH 5.0 to 9.0	No irritation to eyes. Note that lakes with naturally low or high pH are not in contravention of the guideline.
Industrial Water Supply	None proposed	See Canadian Water Quality Guidelines.

Aesthetics (Marl Lakes only)	No change in pH that will reduce the saturation index of calcium carbonate	Guideline applies to marl or limed lakes only. Temporary increases in pH to 9.5 for lake restoration projects is permitted as long as the maximum pH is not toxic to fish.
------------------------------	--	--

Sampling Requirements for Guidelines:

1. Streams: Statistical comparison of background (upstream) and downstream results should use a 1-tailed, two sample t-test, at the 0.05 probability level. The average is calculated from at least 5 weekly samples taken in a period of 30 days. The two sample t-test requires the different stations to have similar variances (use the F test). If, at the downstream site, data from spills or discharge events are pooled with steady state data, the variance may increase and become dissimilar to the upstream site invalidating the two sample t-test. To reduce the variance, consider the data from the steady state and the event as independent data sets. Additional pH measurements, or a pH sensor with an automatic recorder are recommended for sites subject to event-driven pH fluctuations.

2. Lakes: Same as streams or, if background stations are not available, pre-discharge data should be collected near the zone of influence, once every three weeks for one or two years to determine the temporal variation. A pH sensor with an automatic recorder would collect more data and provide a better understanding of the temporal variability than normal field sampling.

Reference 18

Table 29. Recommended Guidelines for the Protection of Marine and Freshwater Life for Silver

Environment	Guidelines as total Silver	Conditions
Fresh Water	0.05 µg/L as a 30-day mean	hardness less than or equal to 100 mg/L
Fresh Water	0.1 µg/L maximum	hardness less than or equal to 100 mg/L
Fresh Water	1.5 µg/L as a 30-day mean	hardness greater than 100 mg/L
Fresh Water	3.0 µg/L maximum	hardness greater than 100 mg/L
Marine Water	1.5 µg/L as a 30-day mean	open coast and estuaries
Marine Water	3.0 µg/L maximum	open coast and estuaries

Reference 19

Table 30. Summary of Guidelines for Total Gas Pressure (TGP)

Water Use	Recommended Guideline
Drinking Water Supply	None proposed
Freshwater and Marine Aquatic Life - local water depth greater than 1 m	maximum DP is less than or equal to 76 mm Hg or less than or equal to 110% at sea level
Freshwater and Marine Aquatic Life - background levels exceed guidelines	no increase in DP or % TGP
Freshwater and Marine Aquatic Life - hatchery environments	maximum DP = 24 mm Hg or 103% at sea level DP=0 mm Hg when pO ₂ is less than or equal to 100 mm Hg
Wildlife	None proposed
Livestock Water Supply	None proposed
Irrigation	None proposed
Primary Contact Recreation	None proposed

1. DP = excess gas pressure in mm Hg.

**2. pO₂ = partial pressure of dissolved
oxygen in mm of Hg.**

References 20 and 20a

Table 31. Summary of Water Quality Guidelines for Colour

Water Use	Colour Units	Recommended Guidelines
Drinking Water Supply (without treatment for colour removal)	True	15 mg/L Pt
Aquatic Life Fresh, Marine and Estuarine	Apparent	30-day average transmission of white light greater than or equal to 80% of background.
Aquatic Life Fresh, Marine and Estuarine	True	30-day average true colour of filtered water samples shall not exceed background levels by more than 5 mg/L Pt in clearwater systems or 20% in coloured systems.
Wildlife	Apparent	30-day average transmission of white light greater than or equal to 80% of background.
Wildlife	True	30-day average true colour of filtered water samples shall not exceed background levels by more than 5 mg/L Pt in clearwater systems or 20% in coloured systems.
Recreation and Aesthetics - fresh, marine and estuarine	Apparent	Secchi disc sighting range greater than or equal to 1.5 m (30-day average).
Recreation and Aesthetics - fresh, marine and estuarine	True	15 mg/L Pt (30-day average)

1. A value of 15 mg/L platinum is the existing Ministry of Health value.

Reference 29

Table 32. Summary of Water Quality Guidelines for Organic Carbon

Water Use	Organic Carbon	Recommended Guidelines
Drinking Water Supply - with chlorination	TOC	4 mg/L source water
Drinking Water Supply - other disinfection	—	Not recommended
Aquatic Life - fresh water	TOC	30-day median \pm 20% of the median background concentration.
Aquatic Life - fresh water	DOC	30-day median \pm 20% of the median background concentration.
Wildlife	TOC	30-day median \pm 20% of the median background concentration.
Wildlife	DOC	30-day median \pm 20%
Industrial Water Supply	—	None recommended
Irrigation	—	None recommended
Recreation and Aesthetics	—	None recommended
Livestock Watering	—	None recommended

TOC = Total organic carbon

DOC = Dissolved organic carbon

Reference 30

Table 33. Recommended Guidelines for Zinc

Water Use	Guideline (µg/L Total Zinc)
Drinking Water	5000
Recreation and Aesthetics	5000
Marine Life	10
Livestock Watering	2000
Irrigation - soil pH less than 6	1000
Irrigation - soil pH equal to or greater than 6 and less than 7	2000
Irrigation - soil pH greater than or equal to 7	5000
Freshwater Aquatic Life - maximum concentration — water hardness less than or equal to 90 water hardness equal to 100 water hardness equal to 200 water hardness equal to 300 water hardness equal to 400	use the equation $33 + 0.75 \times (\text{hardness} - 90)$ — 33 40 115 190 265
Freshwater Aquatic Life - 30-day average concentration — water hardness less than or equal to 90 water hardness equal to 100 water hardness equal to 200 water hardness equal to 300 water hardness equal to 400	use the equation $7.5 + 0.75 \times (\text{hardness} - 90)$ — 7.5 15 90 165 240

1. When the ambient zinc concentration in the environment exceeds the guideline, then further degradation of the ambient or existing water quality should be avoided.

2. These are instantaneous maximums.

3. Averages are of five weekly measurements taken over a 30-day period.

4. Water hardness is measured as mg/L of CaCO₃.

Reference 31

Table 34. Recommended Guidelines for Ethylbenzene

Water Use	Guideline (mg/L Ethylbenzene)
Raw Drinking Water (aesthetics)	0.0024 mg/L
Fresh Water Aquatic Life	0.20* mg/L
Marine Aquatic Life	0.25* mg/L
Recreation	0.0024 mg/L
Crop Irrigation	insufficient data
Livestock Watering	insufficient data

***1. Revised B.C. guidelines based on review of CCME Water Quality Guidelines for Ethylbenzene**

2. All guidelines are maximum values.

Reference 28

Table 35. Summary of Water Quality Guidelines for Toluene

Water Use	Guideline (mg/L Toluene)
Raw Drinking Water (aesthetics)	0.024 mg/L
Fresh Water Aquatic Life	0.039 mg/L
Marine Estuarine Aquatic Life	0.33 mg/L
Recreation	none proposed
Crop Irrigation	none proposed
Livestock Watering	0.024 mg/L

1. All guidelines are maximum total values.

Reference 33

Table 36. Summary of Water Quality Guidelines for Sulphate

Water Use	Guideline (mg/L sulphate)
Raw Drinking Water (aesthetics)	500 mg/L
Fresh Water Aquatic Life (maximum)	100 mg/L
Fresh Water Aquatic Life (alert level)	50 mg/L

1. Maximum concentration: not to be exceeded at any time.

2. Alert level: monitor the health of aquatic moss populations occasionally.

Reference 34

Table 37. Examples of the Recommended Acute Guidelines to Protect Freshwater Aquatic Life from the Toxic Effects of Manganese

Maximum at Specified CaCO ₃ Hardness	Guideline (mg/L total Manganese)
25 mg/L	0.8 mg/L
50 mg/L	1.1 mg/L
100 mg/L	1.6 mg/L
150 mg/L	2.2 mg/L
300 mg/L	3.8 mg/L

1. When the ambient manganese concentration in the environment exceeds the guideline then further degradation of the ambient or existing water quality should be avoided.

2. The instantaneous maximum is calculated from less than or equal to $0.01102 \text{ hardness} + 0.54$.

Reference 35

Table 38. Examples of the Recommended Chronic Guidelines to Protect Freshwater Aquatic Life from the Toxic Effects of Manganese

30-Day Mean at Specified CaCO ₃ Hardness	Guideline (mg/L total Manganese)
25 mg/L	0.7mg/L
50 mg/L	0.8 mg/L
100 mg/L	1.0 mg/L
150 mg/L	1.3 mg/L
300 mg/L	1.9 mg/L

1. When the ambient manganese concentration in the environment exceeds the guideline then further degradation of the ambient or existing water quality should be avoided.

2. The mean of 5 weekly measurements over a 30-day period is calculated from less than or equal to 0.0044 hardness + 0.605.

Reference 35

Table 39. Recommended Guidelines for Methyl Tertiary-Butyl Ether (MTBE)

Water Use	Recommended Guidelines
Raw Drinking Water (aesthetics)	0.02 mg/L maximum
Recreation and Aesthetics	0.02 mg/L maximum
Livestock Watering	11.0 mg/L maximum
Wildlife, Irrigation	Insufficient Data
Aquatic Life (freshwater)	3.4 mg/L maximum
Aquatic Life (marine, estuarine)	0.44 mg/L maximum

For livestock watering, concentrations above the taste and odour thresholds that are below the livestock guideline may result in certain livestock avoiding water, reducing consumption and suffering associated adverse effects.

Reference 36

Table 40. Recommended Guideline for Selenium

Water Use	Guideline for Total Selenium
Drinking Water	10 µg/L maximum
Aquatic Life (freshwater)	2.0 µg/L mean
Aquatic Life (marine)	2.0 µg/L mean
Aquatic Life (sediments)	2.0 µg/g (dry weight) mean
Aquatic Life (tissue)	1.0 µg/g body weight (wet weight) mean
Wildlife	4.0 µg/L mean
Irrigation	10 µg/L mean
Livestock Watering	30.0 µg/L mean

1. For the aquatic life sediment guideline the total organic carbon in the sediment is assumed to be 5%.

2. The aquatic life sediment and tissue values are interim guidelines and apply to both freshwater and marine environments.

3. The mean concentrations in the water column are based on at least 5 weekly samples taken over a 30-day period; in tissue or sediment samples they are based on 5 independent samples.

Reference 37

Table 41. Recommended Guidelines for Temperature

Water Use	Recommended Guideline
Drinking Water Supply	15 degrees Celsius maximum
Freshwater Aquatic Life - streams with bull trout and/or Dolly Varden	maximum 10 degrees Celsius-spawning maximum 15 degrees Celsius-rearing maximum 10 degrees Celsius-incubation minimum 2 degrees Celsius-incubation
Freshwater Aquatic Life - streams with known fish distribution	+ or - 1 degree Celsius change beyond optimum temperature range as shown in Table 42 for each life history phase of the most sensitive salmonid species present Hourly rate of change not to exceed 1 degree Celsius
Freshwater Aquatic Life - streams with unknown fish distribution	Mean Weekly Maximum Temperature (MWMT) = 18 degrees Celsius (maximum daily temperature = 19 degrees Celsius) Hourly rate of change not to exceed 1 degree Celsius maximum incubation temperature = 12 degrees Celsius (in the Spring and the Fall)
Freshwater Aquatic Life - lakes and impoundments	+ or - 1 degree Celsius change from natural ambient background
Marine and Estuarine Aquatic Life	+ or - 1 degree Celsius change from natural ambient background hourly rate of change up to 0.5 degrees Celsius
Wildlife and Livestock Watering Irrigation and Industrial Water Supplies	+ or - 1 degree Celsius change from natural ambient background
Recreation and Aesthetics	30 degrees Celsius maximum The thermal characteristics of waters used for bathing and swimming should not cause an appreciable increase or decrease in the deep body temperature of bathers and swimmers.

Reference 38

Table 42. Optimum Temperature Ranges of Specific Life History Stages of Salmonids and Other Cold water species for Guideline Application

Species	Incubation	Rearing	Migration	Spawning
<i>Salmon</i>				
Chinook	5.0-14.0	10.0-15.5	3.3-19.0	5.6-13.9
Chum	4.0-13.0	12.0-14.0	8.3-15.6	7.2-11.8
Coho	4.0-13.0	9.0-16.0	7.2-15.6	4.4-12.8
Pink	4.0-13.0	9.3-15.5	7.2-15.6	7.2-12.8
Sockeye	4.0-13.0	10.0-15.0	7.2-15.6	10.6-12.8
<i>Trout</i>				
Brown	1.0-10.0	6.0-17.6	—	7.2-12.8
Cutthroat	9.0-12.0	7.0-16.0	—	9.0-12.0
Rainbow	10.0-12.0	16.0-18.0	—	10.0-15.5
<i>Char</i>				
Arctic char	1.5-5.0	5.0-16.0	—	4.0
Brook Trout	1.5-9.0	12.0-18.0	—	7.1-12.8
Bull Trout	2.0-6.0	6.0-14.0	—	5.0-9.0
Dolly Varden	—	8.0-16.0	—	—
Lake Trout	5.0	6.0-17.0	—	10.0
<i>Grayling</i>				
Arctic grayling	7.0-11.0	10.0-12.0	—	4.0-9.0
<i>Whitefish</i>				
Lake Whitefish	4.0-6.0	12.0-16.0	—	greater than 8.0
Mountain Whitefish	less than 6.0	9.0-12.0	—	less than 6.0
<i>Other Species</i>				
Burbot	4.0-7.0	15.6-18.3	—	0.6-1.7
White Sturgeon	14.0-17.0	—	—	14.0

Reference 38

Table 43. Summary of Water Quality Guidelines for Arsenic

Water Use	Recommended Guideline (µg/L of Total Arsenic)
Source Drinking Water	25 (interim guideline)
Aquatic Life	
Freshwater	5
Marine and Estuarine	12.5 (interim guidelines)
Agriculture	
Irrigation	100 (interim guideline)
Livestock Watering	25 (interim guideline)
Wildlife	25 (interim guideline)
Recreation and Aesthetics	None recommended

Reference 39

Table 44. Summary of Chlorate Guidelines

Water Use	Guidelines
Raw Drinking Water	2.4 mg/L
Wildlife and Livestock	3 mg/L
Freshwater Aquatic Life	30 mg/L
Marine Aquatic Life	5 µg/L

Reference 40

Table 45. Summary of Recommended Water Quality Guidelines for Diisopropanolamine (DIPA)

Water Use	Guideline (mg DIPA/L)
Freshwater Aquatic Life	1.6 mg/L maximum
Marine Aquatic Life	Insufficient data
Irrigation	3.9 mg/L maximum
Livestock Watering	38 mg/L maximum

Reference 41

Table 46. Summary of Recommended Guidelines for Sulpholane

Water Use	Guideline (mg Sulpholane/L)
Freshwater Aquatic Life	50 maximum
Marine Aquatic Life	Insufficient data
Irrigation	8.4 maximum
Livestock Watering	14 maximum

Reference 42

Table 47. Recommended Guidelines for Chloride

Water Use	Guideline (mg Chloride/L)
Drinking Water	250
Recreation and Aesthetics	None
Freshwater Aquatic Life ¹	
Instantaneous Maximum Concentration	600
30-d Average Concentration (5 weekly measurements)	150
Marine Aquatic Life	Human activities should not cause the chloride of marine and estuarine waters to fluctuate by more than 10% of the natural chloride expected at that time or depth.
Irrigation	100
Livestock Watering	600
Wildlife	600

1. When ambient chloride concentration in the environment exceeds the guideline, then further degradation of the ambient or existing water quality should be avoided.

Reference 43

Table 48. Recommended Guidelines for Cobalt

Water Use	Guideline (µg/L Total Cobalt)
Aquatic Life: Freshwater	
Maximum	110
30-d Average (5 weekly measurements)	4
Aquatic Life: Marine	Not recommended
Wildlife	Not recommended
Irrigation	Not recommended
Livestock watering	Not recommended

Reference 44

Table 49. Recommended Guidelines for Boron

Water Use	Guideline (mg/L Total Boron)
Drinking Water	5
Aquatic Life	
Freshwater	1.2
Marine	1.2
Wildlife	5
Irrigation	0.5 to 6 (depends on crop; see Table 50)
Livestock watering	5

Table 50. Recommended Irrigation Water Guidelines for Boron

Tolerance	Boron in Irrigation Water (mg/L)	Agricultural Crop
Very Sensitive	<0.5	Blackberry
Sensitive	0.5 to 1	Peach, cherry, plum grape, cowpea, onion, garlic, sweet potato, wheat, barley sunflower, mung bean, sesame, lupin, strawberry, Jerusalem artichoke, kidney bean, lima bean
Moderately Sensitive	1 to 2	Red pepper, pea, carrot, radish, potato, cucumber
Moderately Tolerant	2 to 4	Lettuce, cabbage, celery, turnip, Kentucky bluegrass, oat, corn, artichoke, tobacco, mustard, clover, squash, muskmelon
Tolerant	4 to 6	Sorghum, tomato, alfalfa, purple vetch, parsley, red beet, sugar beet
Very Tolerant	6 to 15	Asparagus

Reference 45

References

1. Singleton, H. J. 1985. Water Quality Criteria for Particulate Matter, Resource Quality Section, Water Management Branch, Ministry of Environment, Victoria, BC.
2. Nordin, R. N. 1985. Water Quality Criteria for Nutrients and Algae. Resource Quality Section, Water Management Branch, Ministry of Environment, Victoria, BC.
3. Nordin, R. N. and L. W. Pommen. 1986. Water Quality Criteria for Nitrogen (Nitrate, Nitrite, and Ammonia). Resource Quality Section, Water Management Branch, Ministry of Environment and Parks, Victoria, BC.
4. Butcher, G. A. 1988. Water Quality Criteria For Aluminum. Resource Quality Section, Water Management Branch, Ministry of Environment and Parks, Victoria, BC.
5. Warrington, P. D. 1988. Water Quality Criteria For Microbiological Indicators. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.
6. Singleton, H. J. 1987. Water Quality Criteria For Copper. Resource Quality Section, Water Management Branch, Ministry of Environment and Parks, Victoria, BC.
7. Singleton, H. J. 1986. Water Quality Criteria For Cyanide. Resource Quality Section, Water Management Branch, Ministry of Environment, Victoria, BC.

8. Nagpal, N. K. 1987. Water Quality Criteria For Lead. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.
9. Nagpal, N. K. 1989. Water Quality Criteria for Mercury. Resource Quality Section, Water Management Branch, Ministry of Environment, Victoria, BC.
- 9a. Nagpal, N.K. 2001. Ambient Water Quality Guidelines for Mercury. Overview. First Update. Ministry of Environment, Lands and Parks, Victoria, BC.
10. Swain, L. 1986. Water Quality Criteria for Molybdenum. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.
11. Truelson, R. 1997. Ambient Water Quality Criteria For Dissolved Oxygen. Ministry of Environment, Lands and Parks, Water Quality Branch, Victoria, BC.
12. Singleton, H. J. 1989. Water Quality Criteria for Chlorine. Resource Quality Section, Water Management Branch, Ministry of Environment, Victoria, BC.
13. Warrington, P. D. 1990. Ambient Water Quality Criteria For Fluoride. Ministry of Environment, Water Management Branch, Resource Quality Section, Victoria, BC.
14. Nordin, R. N. 1990. Ambient Water Quality Criteria For Ammonia To Protect Marine Aquatic Life. Ministry of Environment, Water Management Branch, Resource Quality Section, Victoria, BC.
15. Nagpal, N. K. 1992. Water Quality Criteria for Polychlorinated Biphenyls. Water Quality Branch, Water Management Division, Ministry of Environment, Lands and Parks, Victoria, BC.
16. Nagpal, N. K. 1993. Ambient Water Quality Criteria for Polycyclic Aromatic Hydrocarbons. Water Quality Branch, Water Management Division, Ministry of Environment, Lands and Parks, Victoria, BC.
17. Warrington, P. D. 1993. Water Quality Criteria for Chlorophenols. Water Quality Branch, Water Management Division, Ministry of Environment, Lands and Parks, Victoria, BC.
- 17a. Warrington, P. D. 1997. Ambient Water Quality Guidelines for Chlorophenols. First Update. Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC.
18. McKean, C. J. P. and N. K. Nagpal. 1991. Ambient Water Quality Criteria for pH. Water Quality Branch, Water Management Division, Ministry of Environment, Lands and Parks, Victoria, BC.
19. Warrington, P. D. 1996. Ambient Water Quality Criteria For Silver. Ministry of Environment, Lands and Parks, Water Quality Branch, Victoria, BC.
20. Water Quality Criteria for Total Gas Pressure. 1997. Water Quality Section, Water Management Branch, Ministry of Environment, Lands and Parks.
- 20a. Water Quality Guidelines for Total Gas Pressure. 2004. First Update. Overview. Ministry of Water, Land and Air Protection.
21. Health and Welfare Canada. 1992. Guidelines for Canadian Drinking Water Quality. Fourth Edition. Supply and Services Canada, Ottawa, Ontario.
22. Health and Welfare Canada. Federal Provincial Subcommittee on Drinking Water. April 1993 Meeting
23. Health and Welfare Canada. 1996. Guidelines for Canadian Drinking Water Quality. Sixth

Edition. ©Minister of Supply and Services Canada. Canada Communication Group - Publishing, Ottawa, Canada K1A 0S9. ISBN 0-660-16295-4.

24. Health and Welfare Canada. 1983. Guidelines For Canadian Recreation-al Water Quality. Federal-Provincial Working Group on Recreational Water Quality of the Federal-Provincial Advisory Committee on Environ-mental and Occupational Health. Canadian Government Publishing Centre, Ottawa, Canada.

25. Guidelines for Canadian Recreational Water Quality. 1992. Health and Welfare Canada.

26. Final Water Quality Guidance for the Great Lakes System: Final Rule. 1995. Excerpted from the Federal Register March 23, 1995. Volume 60: 15366-15425. Water Environment Federation, 601 Wythe Street, Alexandria, Va 22314-1994 USA.

27. Hecnar, S.J. 1995. Acute and chronic toxicity of ammonium nitrate fertilizer to amphibians from southern Ontario. Env. Toxicol. Chem. 14: 2131-2137.

28. Moss, S. A. 1999. Water Quality Criteria For Ethylbenzene. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.

29. Water Quality Criteria for Colour. 1999. Water Quality Section, Water Management Branch, Ministry of Environment, Lands and Parks.

30. Water Quality Criteria for Organic Carbon. 1999. Water Quality Section, Water Management Branch, Ministry of Environment, Lands and Parks.

31. Nagpal, N. K. 1999. Water Quality Criteria For Zinc. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.

32. Caux, P.-Y., D. R. J. Moore and D. MacDonald. 1997. Sampling Strategy for Turbidity, Suspended and Benthic Sediments. Prepared for Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC. by Cadmus Group Inc. and MacDonald Environmental Sciences Ltd.

33. Swain, L. 2000. Ambient Water Quality Guidelines For Toluene. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.

34. Singleton, H. J. 2000. Ambient Water Quality Guidelines For Sulphate. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.

35. Nagpal, N. K. 2001. Ambient Water Quality Guidelines For Manganese. Ministry of Environment and Parks, Water Management Branch, Resource Quality Section, Victoria, BC.

36. Swain, L. 2001. Ambient Water Quality Guidelines For Methyl Tertiary-Butyl Ether (MTBE). Prepared for Ministry of Environment and Parks, Water Management Branch, Water Quality Section, Victoria, BC. by Komex International Ltd.

37. Nagpal, N. K. 2001. Ambient Water Quality Guidelines For Selenium. Ministry of Water, Land and Air Protection, Water Protection Branch, Victoria, BC.

38. Singleton, H. J. 2001. Ambient Water Quality Guidelines For Temperature. Prepared for Ministry of Water, Land and Air Protection, Water Protection Branch, Victoria, BC. by G. G. Oliver and L. E. Fidler of Aspen Applied Sciences Ltd.

39. Ambient Water Quality Guidelines for Arsenic. 2002. Overview. Ministry of Water, Land and Air Protection, Victoria, B.C.

40. Warrington, P.D. 2002. Ambient Water Quality Guidelines for Chlorate. Overview Report. Ministry of Water, Land and Air Protection, Victoria, B.C.
41. Nagpal, N.K. 2003. Ambient Water Quality Guidelines for Diisopropanolamine (DIPA). Overview Report. Ministry of Water, Land and Air Protection, Victoria, B.C.
42. Nagpal, N.K. 2003. Ambient Water Quality Guidelines for Sulpholane. Overview Report. Ministry of Water, Land and Air Protection, Victoria, B.C. 43. Nagpal, N.K., D.A. Levy, and D.D. MacDonald. 2003. Ambient Water Quality Guidelines for Chloride. Overview. Ministry of Water, Land and Air Protection, Victoria, B.C.
43. Nagpal, N.K. 2003. Ambient Water Quality Guidelines for Chloride. Overview Report. Ministry of Water, Land and Air Protection, Victoria B.C.
44. Nagpal, N.K. 2004. Ambient Water Quality Guidelines for Cobalt. Overview. Ministry of Water, Land and Air Protection, Victoria, B.C.
45. Moss, S.A. and N.K. Nagpal. 2003. Ambient Water Quality Guidelines for Boron. Ministry of Water, Land and Air Protection, Victoria, B.C.