



British Columbia and Yukon Territory Water Quality Report (2001–2004)

AN APPLICATION OF THE CANADIAN WATER QUALITY INDEX



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British Columbia and Yukon Territory
Water Quality Report (2001–2004)

**An Application of the
Canadian Water Quality Index**

Environment Canada

BC Ministry of Environment

Yukon Department of Environment

March 2007

British Columbia and Yukon Territory Water Quality Report (2001–2004)

Ecosystem Goal

Environment Canada, BC Ministry of Environment and Yukon Department of Environment share a common goal to attain the highest level of environmental quality as a means to preserve our natural ecosystem and enhance the health and well-being of our society. In this report, the Canadian Water Quality Index indicates how close we are to achieving this goal for the protection of aquatic life for specific waterbodies. This report elaborates on results for British Columbia and the Yukon Territory, following the recent 2006 Canadian Environmental Sustainability Indicators (CESI) Report, which provided a summary of Water Quality Index results across Canada.

Water Quality Index

The Canadian Water Quality Index is a freshwater quality indicator endorsed by the Canadian Council of Ministers of the Environment (CCME). Nationally, the indicator is intended to incorporate environmental values into decision making frameworks. It augments familiar economic indicators, such as Gross Domestic Product (GDP) and the Consumer Price Index (CPI) with data on the environment. Trends in the Water Quality Index can be evaluated relative to trends in economic indicators and may be useful in evaluating relationships between the economy and the environment.

The Index compares water quality monitoring data to site-specific water quality guidelines for the protection of aquatic life, which are values that define water quality conditions beyond which aquatic life may be adversely affected. The Index then ranks waterbodies as **Excellent, Good, Fair, Marginal** or **Poor**, according to their overall suitability to support aquatic life.

Data Sources

This report is based on data collected regularly and consistently from 2001 to 2004 under the Canada–British Columbia Water Quality Monitoring Agreement and additional monitoring conducted by Environment Canada in British Columbia and the Yukon Territory. These water quality monitoring programs play an important role in determining long-term trends in water quality and identifying emerging aquatic ecosystem concerns. Data generated from these water quality monitoring programs are available at: www.waterquality.ec.gc.ca.

Waterbodies Considered

Water quality data are summarized for 36 rivers and streams: 33 in British Columbia and three in the Yukon Territory. The waterbodies range from those that are relatively pristine to those affected by human activity. Since there is a tendency to measure in areas where people are active, this report is biased to a view of water quality in developed areas, rather than for undeveloped watersheds where water is in a more natural state. The Yukon Territory is an exception, where there are few anthropogenic influences on monitored sites.

Ranking Overall Water Quality

Of the 36 monitoring sites profiled in this Water Quality Report, 56% are ranked as Good (19 sites) or Excellent (1 site). Thirty-three percent (12 sites) are rated as Fair, while 11% (4 sites) are Marginal. These rankings reflect higher Water Quality Index scores in British Columbia and the Yukon Territory than were found in the national profiles for 2001 to 2003, which ranked 44% of sites as Excellent or Good, 31% as Fair and 25% as Marginal or Poor. The 2002 to 2004 national profile similarly ranked 44% of sites as Excellent or Good, 34% as Fair and 22% as Marginal or Poor. The primary reason for the difference in ratings is likely due to the location of the monitoring sites. In British Columbia and the Yukon Territory more sites are located in protected areas than the national average.

Future Directions

Water quality monitoring will continue at these sites in British Columbia and the Yukon Territory and changes in water quality over time will be presented in future reporting. The water quality monitoring network will be expanded to more broadly represent the distribution of waterbodies in British Columbia and the Yukon Territory and ensure local and ecological relevance of the water quality variables being measured. Biological assessments will be conducted where possible to complement the chemical and physical data and verify that aquatic life is protected.

Rapport sur la qualité des eaux de la Colombie-Britannique et du Yukon (2001 - 2004)

Objectif visé pour l'écosystème

Environnement Canada, le ministère de l'Environnement de la Colombie-Britannique et le ministère de l'Environnement du Yukon ont pour objectif commun d'obtenir le plus haut niveau de qualité de l'environnement possible afin d'assurer la préservation de notre écosystème naturel et d'améliorer la santé et le bien-être des membres de notre société. Le présent rapport fait appel à l'indice canadien de la qualité des eaux pour déterminer la mesure dans laquelle nous nous rapprochons de cet objectif pour ce qui est de la protection de la vie aquatique dans certains plans d'eau. Il traite des résultats obtenus pour la Colombie-Britannique et le Yukon dans le contexte du récent rapport sur les indicateurs canadiens de durabilité de l'environnement (ICDE) de 2006 qui résume les valeurs de l'indice de la qualité des eaux pour l'ensemble du Canada.

Indice de la qualité des eaux

L'indice canadien de la qualité des eaux est un indicateur de la qualité des eaux douces entériné par le Conseil canadien des ministres de l'environnement (CCME). À l'échelle nationale, cet indicateur permet d'intégrer des paramètres environnementaux à des cadres décisionnels. Il complète des indicateurs économiques usuels, comme le produit intérieur brut (PIB) et l'indice des prix à la consommation (IPC), par des données sur l'environnement. Les tendances de l'indice de la qualité des eaux peuvent être évaluées par rapport à celles des indicateurs économiques, ce qui peut s'avérer utile pour évaluer les relations entre l'économie et l'environnement.

L'indice met en relation des données de surveillance de la qualité des eaux avec des lignes directrices spécifiques au site sur la qualité des eaux pour la protection de la vie aquatique. Ces lignes directrices précisent des niveaux de la qualité des eaux au delà desquels la vie aquatique peut subir des effets nocifs. L'indice permet d'attribuer à un plan d'eau une cote **Excellente**, **Bonne**, **Moyenne**, **Médiocre** ou **Mauvaise** en fonction de sa capacité générale à satisfaire les besoins des organismes aquatiques.

Sources des données

Le présent rapport est fondé sur les données qui ont été recueillies de façon régulière et uniforme de 2001 à 2004 dans le cadre de l'Accord entre le Canada et la Colombie-Britannique sur le contrôle de la qualité de



l'eau et d'autres activités de surveillance réalisés par Environnement Canada en Colombie-Britannique et au Yukon. Ces programmes de surveillance sont importants pour déterminer les tendances à long terme de la qualité des eaux et pour cerner des nouveaux problèmes à l'égard des écosystèmes aquatiques. Les données recueillies grâce à ces programmes peuvent être consultées à l'adresse www.waterquality.ec.gc.ca.

Plans d'eau examinés

Les données sur la qualité des eaux sont résumées pour 36 cours d'eau: 33 en Colombie-Britannique et trois au Yukon. Les plans d'eau varient entre ceux qui sont relativement intacts à ceux qui sont altérés par les activités humaines. Comme il existe une tendance à effectuer des mesures dans les régions où il y a des activités humaines, le rapport présente un biais et met plus l'accent sur la qualité des eaux des zones aménagées plutôt qu'à celle des bassins non exploités où les eaux sont dans un état plus naturel. Le Yukon fait exception car on note peu d'influences anthropiques dans les lieux surveillés.

Classement de la qualité générale des eaux

Des 36 sites de surveillance évalués dans le présent rapport, 56% ont la cote Bonne (19 sites) ou Excellente (1 site). Trente-trois pour cent (12 sites) ont la cote Moyenne et 11% (4 sites) la cote Médiocre. Ce classement indique des valeurs de l'indice de la qualité des eaux pour la Colombie-Britannique et le Yukon plus élevées que celles des profils nationaux pour 2001 à 2003 où l'on note que 44% des sites présentent la cote Excellente ou Bonne, 31% la cote Moyenne et 25% la cote Médiocre ou Mauvaise. De même, le profil national pour la période de 2002 à 2004 indique que 44% des sites présentent la cote Excellente ou Bonne, 34% la cote Moyenne et 22% la cote Médiocre ou Mauvaise. Les écarts entre les cotes s'expliquent probablement par l'emplacement des sites de surveillance. En Colombie-Britannique et au Yukon, plus de sites se trouvent dans les zones protégées comparativement à la moyenne nationale.

Orientations futures

Les travaux de surveillance de la qualité des eaux à ces sites en Colombie-Britannique et au Yukon seront poursuivis, et les variations au fil du temps seront décrites dans les rapports futurs. Le réseau de surveillance sera élargi afin d'être plus représentatif de la répartition des plans d'eau dans cette province et ce territoire et de garantir la pertinence géographique et écologique des variables de la qualité des eaux mesurées. Lorsque cela sera possible, des évaluations biologiques seront réalisées pour compléter les données chimiques et physiques et pour déterminer si la vie aquatique est protégée.

Acknowledgements



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Welcome to the British Columbia and Yukon Territory Water Quality Report – An Application of the Canadian Water Quality Index

The following questions and answers will introduce you to the Water Quality Report, explain what the Water Quality Index means, how it was derived and lead you through its use.

Why prepare a British Columbia and Yukon Territory Water Quality Report?

Reporting about the state of water quality can guide people in their decisions about water and land use management in their watersheds. This information will also promote action to correct water quality problems. A joint federal-provincial report on water quality trends, *Water Quality Trends in Selected British Columbia Waterbodies*, was issued in 2000 and the BC Ministry of Environment, Lands and Parks published a *British Columbia Water Quality Status Report* in 1996. This *2006 Water Quality Report* is a companion piece to those reports. These reports are available at: www.waterquality.ec.gc.ca/EN/navigation/publications.htm or www.env.gov.bc.ca/wat/wq/public/bcwqsr/bcwqsr1.html.

This report also complements the Canadian Environmental Sustainability Indicators (CESI) reports that were produced in December 2005 and November 2006 by Environment Canada, Health Canada and Statistics Canada. The Freshwater Quality Indicator (which is represented by the Water Quality Index) was one of three indicators summarized nationally in the reports. The purpose of this report is to present further information on the Water Quality Index for each station evaluated in British Columbia and the Yukon Territory. The 2005 CESI report used data from 2001 to 2003 to calculate the Index, while the 2006 CESI report used data from 2002 to 2004. In this report we include data from both of these periods.

Why use 3 years of data for reporting on the Water Quality Index?

Each year, the CESI report calculates the Water Quality Index using three years of data. This approach was selected to reduce the year-to-year variability in water quality data. The 2005 CESI report used data from 2001 to 2003. The 2006 CESI report used data from 2002 to 2004. Subsequent reports will also follow this reporting pattern of removing the oldest year of data and adding a new year of data.

What is the Water Quality Index?

The Water Quality Index is a communication tool that allows experts to translate large amounts of complex water quality data into a simple overall rating for a given site and time period.

The Water Quality Index, otherwise known as the Freshwater Quality Index, is endorsed by the Canadian Council of Ministers of the Environment (www.ccme.ca). The Index compares monitoring data to water quality guidelines, which are values that define water quality conditions beyond which aquatic life may be adversely affected. The Index takes into account the number of water quality variables that do not meet guidelines, how frequently this occurs and by how much. It then ranks waterbodies as being Excellent, Good, Fair, Marginal or Poor, according to their overall suitability to support aquatic life.

What do the Index categories mean?

Excellent (95–100)	indicates that water quality measurements never or very rarely exceed water quality guidelines. Aquatic life is not threatened or impaired.
Good (80–94)	indicates that measurements rarely exceed water quality guidelines and, usually, by a narrow margin. Aquatic life is protected with only a minor degree of threat or impairment.
Fair (65–79)	indicates that measurements sometimes exceed water quality guidelines and, possibly, by a wide margin. Aquatic life is protected, but at times may be threatened or impaired.
Marginal (45–64)	indicates that measurements often exceed water quality guidelines by a considerable margin. Aquatic life frequently may be threatened or impaired.
Poor (0–44)	indicates the measurements usually exceed water quality guidelines by a considerable margin. Aquatic life is threatened, impaired or even lost.

For more detail on the index, please consult the CCME web site: www.ccme.ca/ourwork/water.html?category_id=102.

What is the Water Quality Report based on?

Environment Canada and the BC Ministry of Environment have been collecting data on surface water quality for many years through the Canada–British Columbia Water Quality Monitoring Agreement. Additional monitoring is conducted by Environment Canada in British Columbia and the Yukon, largely in national parks. Further monitoring in the Yukon has recently been initiated through a cooperative program between Environment Canada and the Yukon Territorial government.

This report is based on data collected regularly and consistently from 2001 to 2004. Consistent monitoring means making the same measurement in the same way at the same location each time the waterbody is sampled over a period of time. Regular monitoring means measuring at regular intervals (e.g., once per week, month or year) that are frequent enough to be representative of water quality for the waterbody.

The rivers and streams included in this report are usually monitored every two weeks or at least once a month. At a few remote stations monitoring is conducted four to six times per year. Data generated from these water quality monitoring programs are available at: www.waterquality.ec.gc.ca.

What is the difference between this Water Quality Report, and previous status and trends reports?

The primary differences between this report and previous status and trends reports are the current focus on aquatic life and the period of data reflected in each report. Whereas previous reports considered the suitability of water quality for a number of water uses that varied from site to site, this report considers water quality for the protection of aquatic life at all sites.

The 1996 BC Water Quality Status Report presented a snapshot of water quality from specific months (when site-specific guidelines were most likely to be exceeded) over a period of three years. The 2000 Water Quality Trends report considered year-round data for five to ten year periods or more, to assess whether water quality was changing over the longer term. The current report considers year-round data collected regularly and consistently over two three year periods (2001 to 2003 and 2002 to 2004).

What are guidelines and objectives?

Water quality guidelines are specific limits developed for water quality variables (such as temperature or lead concentrations) by the BC Ministry of Environment and the Canadian Council of Ministers of the Environment to support and maintain a designated water use, such as aquatic life or drinking water. Site-specific guidelines are science-based limits developed by regional water quality managers for specific sites or river reaches. They take into account the local water quality conditions and establish a reference against which the state of water quality at that site can be compared.

In this report, the site-specific guidelines used were developed for the protection of aquatic life. Guidelines were established for variables that could potentially be affected by human activities in the watershed. Guidelines were also developed for variables that showed trends over time, or approached or exceeded national or provincial water quality guidelines on occasion. Some guidelines are static, while others vary with certain water quality characteristics. For example the guidelines for a number of metals vary with hardness because hardness modifies the toxicity of these metals. This is illustrated in a number of graphs in the report (e.g., see Figure 1).

Water quality objectives are similar to site-specific guidelines and are developed by the BC Ministry of Environment. Unlike site-specific guidelines, objectives consider the protection of all water uses (e.g., aquatic life, wildlife, drinking water, recreation and agriculture) and take into account socio-economic factors. Further information relating to the BC Ministry of Environment water quality objectives is available at: www.env.gov.bc.ca/wat/wq/wq_objectives.html.

Which uses of water are we talking about?

This report assesses the suitability of water for use by aquatic life, such as fish, invertebrates and aquatic plants. This specific use requires a high quality of water and must be protected from human sources of water pollution such as waste discharges and land use.

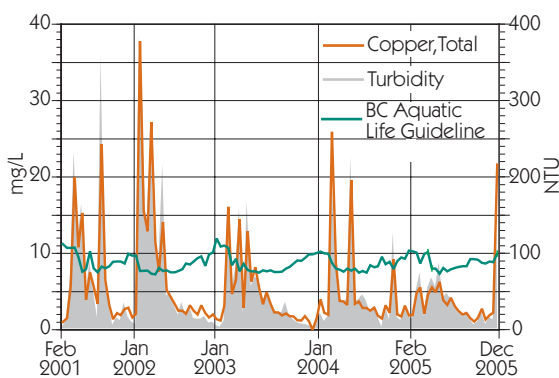
How well does the ranking represent actual water quality?

The Index provides a broad overview of water quality and is calculated based on variables that characterize or may be of concern at a particular site. Although the monitoring programs measure commonly expected chemicals in rivers and streams it is not possible to measure all chemicals that may be present. Therefore, some chemicals of concern may not be included in the Index calculation for some sites.

In some cases the Index may produce a ranking that presents water as poorer in quality than it actually is. One example is when high suspended sediment concentrations occur in the water. In these instances, the metal concentrations will often exceed a guideline because the metals can be attached to sediment particles (e.g., Figure 1). However, they are likely not available for uptake by aquatic organisms. Thus, the metal concentration may not reflect what is available to affect aquatic life and the aquatic life is likely not threatened.

The aquatic organisms present at a given site also reflect water quality conditions. Currently, assessments based on aquatic organisms such as benthic macroinvertebrates are not included in the calculation of the Index. However, biological assessment information, when available, is included in this report as another measure for site assessment.

FIGURE 1
Total Copper Concentration and Turbidity in the Fraser River at Marguerite



Examples of benthic macroinvertebrates



stonefly



caddisfly larvae



mayfly

What are additional tools for assessing water quality to protect aquatic life?

Bioassessment methods use living organisms to provide insight into environmental conditions. One of the most useful groups of organisms for bioassessments are **benthic (bottom-dwelling) macroinvertebrates**, which include mayflies, freshwater shrimps, stoneflies, caddisflies and worms. Benthic invertebrates are ideal for use in bioassessments for a number of reasons:

- ◆ they are an important part of the community life found in and around waterbodies;
- ◆ they are sedentary, and thus constantly exposed to the effects of pollution;
- ◆ they are reasonably long-lived (1–3 years in north-temperate waters), so the effects of environmental stressors can be integrated over time;
- ◆ they occur in high diversity, so many different species can potentially react to many different types of impacts; and
- ◆ they are relatively easy to collect.

In this report, benthic macroinvertebrate assessment data were used, where available, to assist with Water Quality Index interpretation.



logging



mining



agriculture



dam



urban development



industrial plants

What are the sources of water pollution?

The main potential sources of pollution are described in the Water Quality Report by the six pictograms shown opposite. Look for these pictograms on the detailed maps as these represent point and non-point sources of pollution, which may affect water quality. Note that industrial plants encompass a range of operations from pulp mills to smelters to fish hatcheries and that urban development includes wastewater, septic system effluent, combined sewer overflows and stormwater runoff. More information about threats to aquatic ecosystem health can be found in documents at the following website: www.nwri.ca/threats/index-e.html.

What water quality characteristics were measured?

A wide variety of physical and chemical characteristics of water quality are measured in the monitoring programs. The characteristics evaluated for each waterbody in the Index calculation are listed in the description of the waterbody. Characteristics typically monitored at sites in British Columbia and the Yukon are listed below:

- ◆ **Streamflow** has an important effect on the concentration of many water quality variables. Typically, peak flows have increased levels of suspended sediments and adsorbed substances such as metals, while low flows are usually associated with increased levels of the dissolved ions.
- ◆ **Major ions** include calcium, magnesium and sulphate. These are present in all natural waters, but can be affected by waste discharges and land disturbances.

- ◆ **Hardness** is the sum of calcium and magnesium. Hardness can affect the toxicity of metals as well as their availability to organisms.
- ◆ **Trace elements** include arsenic, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, selenium and zinc. These metals are normally present in trace amounts, but can be increased to harmful levels by waste discharges and runoff from land disturbances, transportation corridors and other developed areas. They are often related to turbidity and therefore increase as turbidity increases (see "Turbidity" description below).
- ◆ **Nutrients** include forms of nitrogen and phosphorus. Nutrients are essential for aquatic plants such as algae. The use of fertilizers and manure, as well as septic tank effluent, can result in elevated concentrations of nutrients. These higher nutrient levels in water can cause increases in algal, fungal or bacterial growth, thus decreasing water quality. Conversely, dams can trap nutrients and decrease the nutrient concentration in downstream waters, resulting in too few algae to support fish populations.
- ◆ **pH** is a measure of the acid nature of the water, which can be affected by waste discharges, acid precipitation or excessive algal growth.
- ◆ **Alkalinity** is a measure of the ability of the water to neutralize acids. Acid rock drainage and other acidic inputs can affect alkalinity.
- ◆ **Cyanide** is a substance that may be discharged from mining, smelting and petroleum industries. Gold milling is a notable source of cyanide in BC and the Yukon Territory. Cyanide can be toxic to humans, plants and animals.
- ◆ **Temperature** is governed by the climate and weather conditions in the watershed. It may be affected on a global scale by greenhouse gases and on a local scale by dams, water diversions, stream flow reductions or increases, removal or planting of shade trees and discharges of heated cooling waters from industrial plants.
- ◆ **Total dissolved gases** represent the amount of air that is dissolved in water. Spillways of dams are the main human cause of too much air dissolved in water, which can be harmful to fish and cause gas bubble disease.
- ◆ **Turbidity** is a measure of the suspended sediments in the water. Turbidity tends to increase as streamflow increases. Certain substances (trace metals, some nutrients) are often attached to sediment particles. When turbidity increases these substances also increase, often to the point of exceeding water quality guidelines. Under these conditions however, metals and other constituents are likely not available for uptake by aquatic life, as they are bound to the sediments.
- ◆ **Dissolved oxygen** is a vital part of the air that is dissolved in water. Minimum amounts are essential for aquatic organisms to breathe. It can be depleted to harmfully low levels in waterbodies by bacteria consuming the organic matter from wastewaters, industrial effluent, agricultural waste and decaying algal blooms.

How well does the Water Quality Report represent Yukon and BC waters?

There are many rivers and streams where water is in a relatively natural state. There are also bodies of water where problems exist, but where we do not have enough data to calculate a Water Quality Index score for this report. The 36 sites included in this report represent only a small sample of the many waterbodies in the province and the territory and the water quality characteristics measured represent only a fraction of the characteristics that could be measured. Because of this, the Water Quality Report should be viewed as being representative only of the waterbodies and characteristics measured, as opposed to being indicative of the status in water quality of the province or territory as a whole. Another consideration is that the water quality at a monitoring station may only be representative of the condition of the waterbody at, or near the station – there may be localized conditions in the waterbody that are quite different.

How is the report organized?

The waterbodies are compiled according to whether they are in the Yukon Territory or British Columbia as shown on the map on page 11. Additionally throughout the report, they are organized according to water basins. Each waterbody has one or two pages describing the water quality at that site. Waterbody locations are shown on a basin map that indicates the main factors that can influence water quality. An alphabetical listing of all waterbodies is provided at the back of this report.

What will Governmental Agencies do with this information?

The Water Quality Report states what is being done or will be done to improve water quality where there are water quality concerns. Relative rankings can also be used to prioritize restoration or other management efforts.

What can I do, as a member of the public, to improve water quality?

We might feel that our individual actions do not make any difference. But each of us, through our actions and purchasing habits, can encourage changes within our families, workplaces and local communities that can have immediate, positive effects on water quality.

Around your home or cottage

For information, check out: www.ec.gc.ca/eco/wycd/home_e.html and www.ec.gc.ca/eco/wycd/recreation3_e.html.

For onsite sewage system users

For information, check out: www.ec.gc.ca/eco/wycd/recreation5_e.html.



Reduce ♦ Reuse ♦ Recycle ♦ Recover

For boaters

For information, check out: www.ec.gc.ca/eco/wycd/recreation1_e.html.

Around your farm or ranch

For information, check out: www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/EFP_Refguide/refguide_toc.htm.

What else can I do to make a difference?

- ◆ Joining or forming a community stewardship group to care for a local waterbody (see stewardshipcanada.ca or waterquality.ec.gc.ca for watershed groups near you).
- ◆ Participating in local community planning and regional growth strategies.
- ◆ Encouraging your neighbours, local employers and community leaders to implement water quality protection measures.

For more information, check out www.ec.gc.ca/eco/main_e.htm.

Where can I get more information on water quality?

Staff in the BC Ministry of Environment's regional offices, the Yukon Government's Department of Environment or Environment Canada can provide information on the specifics for each evaluated site in this report. The regional staff can also handle concerns about waterbodies not listed here. For more general information on the water quality trends and on water quality objectives or guidelines, please contact:

BC Ministry of Environment

PO Box 9341 Station Provincial Government
Victoria, British Columbia V8W 9M1
(250) 387-1288
www.gov.bc.ca/env

Yukon Department of Environment

Government of Yukon
Box 2703
Whitehorse, Yukon Y1A 2C6
(867) 667-5652
www.environmentyukon.gov.yk.ca

Environment Canada

Suite 201 – 401 Burrard Street
Vancouver, British Columbia V6C 3S5
(604) 664-9100
www.waterquality.ec.gc.ca

FIGURE 2
2001–2003 and 2002–2004 Water Quality
Index Rankings in Canada



A national assessment of surface water quality was conducted for the Canadian Environmental Sustainability Indicators reports (CESI, 2005, 2006). In 2005, freshwater quality was rated as Excellent or Good at 44% of the sites, Fair at 31% and Marginal or Poor at 25% of the sites, in terms of protection of aquatic life. Similarly in 2006, 44% of sites were ranked as Excellent or Good. This was followed by 34% of sites ranking as Fair and 22% as Marginal or Poor. The quality of drinking water for human consumption was not assessed.

Results for 2005 reflect water quality data collected from 2001 to 2003 at 345 selected monitoring sites, while 2006 results are based on data from 2002 to 2004 at 340 sites across the country. Most selected sites were located in southern Canada in areas of human activity, including areas near human settlements, agricultural regions and to a lesser extent, areas potentially influenced by acid deposition, industrial facilities and dams. These are typically places where water quality has been a concern. These sites do not reflect the state of water quality of all freshwaters in Canada.

FIGURE 3
2001–2003 and 2002–2004 Index Rankings in British Columbia and the Yukon Territory

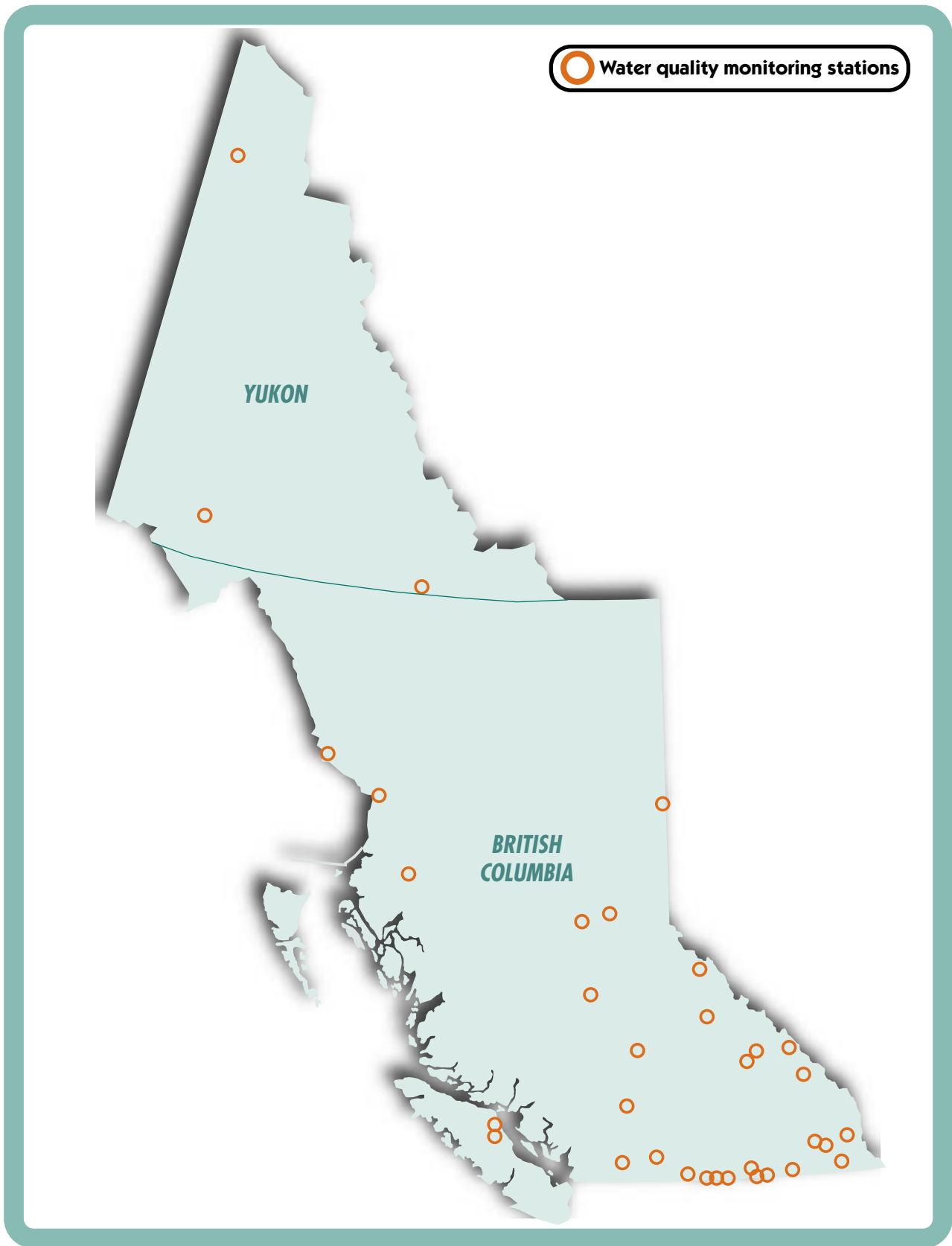


TABLE 1
2001–2003 and 2002–2004 Water Quality Index Scores at Monitoring Sites

Water Quality Monitoring Station	Water Quality Index Scores	
	2001-2003	2002-2004
Porcupine River above Old Crow	85.6	
Liard River at Upper Crossing	100	93.6
Dezadeash River at Haines Junction	89.5	83.8
Iskut River below Johnson River	91.7	91.7
Salmon River at Hyder	61.4	61.1
Skeena River at Usk	90.4	82.7
Peace River above Alces River	79	84.2
Fraser River at Red Pass	91.8	100
Fraser River at Hansard	82.6	82.7
Nechako River at Prince George	92.8	92.8
Fraser River at Marguerite	74.2	74.2
Salmon River at Salmon Arm	39.8	45.8
Thompson River at Spences Bridge	71.1	65.2
Fraser River at Hope	84.2	84.2
Sumas River at the International Boundary	73.9	68.1
Elk River at Sparwood		65.1
Elk River at Highway 93 near Elko	73.1	73.2
Kootenay River at Kootenay Crossing	82.7	88.5
Kootenay River near Fenwick Station	67.8	67.9
St. Mary River at Wycliffe	54.1	60.2
Kootenay River at Creston	71	71.1
Kicking Horse River above Field, BC	87	87.2
Beaver R. near East Gate of Glacier National Park	87.2	88.4
Illecillewaet River at Park Entrance	88.4	82.6
Columbia River at Birchbank	90.4	87.2
Columbia River at Waneta	80.2	80
Pend'Oreille River at the International Boundary	84.7	
Pend'Oreille River at Waneta	85.2	80
Kettle River at Carson	82.6	71
Kettle River at Midway	71.1	76.7
Myers Creek at the International Boundary	65.3	65.2
Okanagan River at Oliver	71	70.8
Similkameen River at Princeton	87.5	83.2
Similkameen River near the International Border	83.1	82.7
Quinsam River near the Mouth	64.4	65.3
Tsolum River below Murex Creek	49.1	

Of the 35 monitoring sites profiled for 2001–2003 in this British Columbia and Yukon Water Quality Report, 57% ranked as Good (19 sites) or Excellent (1 site). Twenty-nine percent (10 sites) are Fair, while 11% are Marginal (4 sites) and 3% are Poor (1 site). In the 2002–2004 data, results are similar with a few changes between categories. These ratings reflect higher Water Quality Index scores than in the national profile. In addition to areas of human activity, 11% of British Columbia and Yukon Territory monitoring sites are located in protected areas and national parks, which is a higher percentage than other areas looked at in the national profile and may explain this difference.

Overall, these rankings suggest that for the majority of selected monitoring sites, water quality measures rarely exceed site-specific guidelines and if so, usually only by a narrow margin. At these sites, aquatic life is protected with only a minor degree of threat or impairment. Sites with Marginal or Poor water quality, where aquatic life may frequently be threatened or impaired, include Salmon River at Hyder, Salmon River at Salmon Arm, St. Mary at Wycliffe and the Tsolum River on Vancouver Island. The main activities that likely affect water quality in these watersheds include agriculture, forestry and some residential development (for the Salmon River) and abandoned mining (for the Tsolum River). The Elk River in the Kootenay Basin ranked Fair, but was very close to Marginal at the upstream site. Human activities such as agriculture, urban development and mining are likely contributing factors in this watershed.



British Columbia and Yukon Territory Summary

YUKON TERRITORY SUMMARY

Three water quality monitoring stations in the **Yukon Territory** are evaluated in this report: the **Porcupine River above Old Crow**, **Liard River at Upper Crossing** and **Dezadeash River at Haines Junction**.

The Porcupine River is a major tributary of the Yukon River, which has its headwaters in the Yukon Territory and flows from the Territory through Alaska, finally emptying into the Bering Sea. The water quality station on the river is located two kilometres upstream of the village of Old Crow in the Yukon Territory. The Liard River is a major tributary of the Mackenzie River, flowing southeast from the Yukon Territory into British Columbia, then flowing northeast into the Northwest Territories to the Mackenzie River. Water quality samples are collected from the Liard River near the Alaska Highway crossing in the village of Upper Liard. The Dezadeash River flows southwest from the Yukon Territory through Kluane National Park and Reserve and Tatshenshini-Alsek Provincial Park into the Alsek River in British Columbia. Water quality samples are collected at the Alaska Highway bridge crossing at Haines Junction. Water quality at all of these sites is assessed as being either Good or Excellent. Monitoring was initiated at four more sites in the Yukon River basin in 2005 by Environment Canada and Yukon Department of Environment; these will be assessed in future Water Quality Reports.

The Yukon Department of Environment office is located in Whitehorse. If you have any questions on this Water Quality Report or want more information on other waterbodies in the Territory, please contact:

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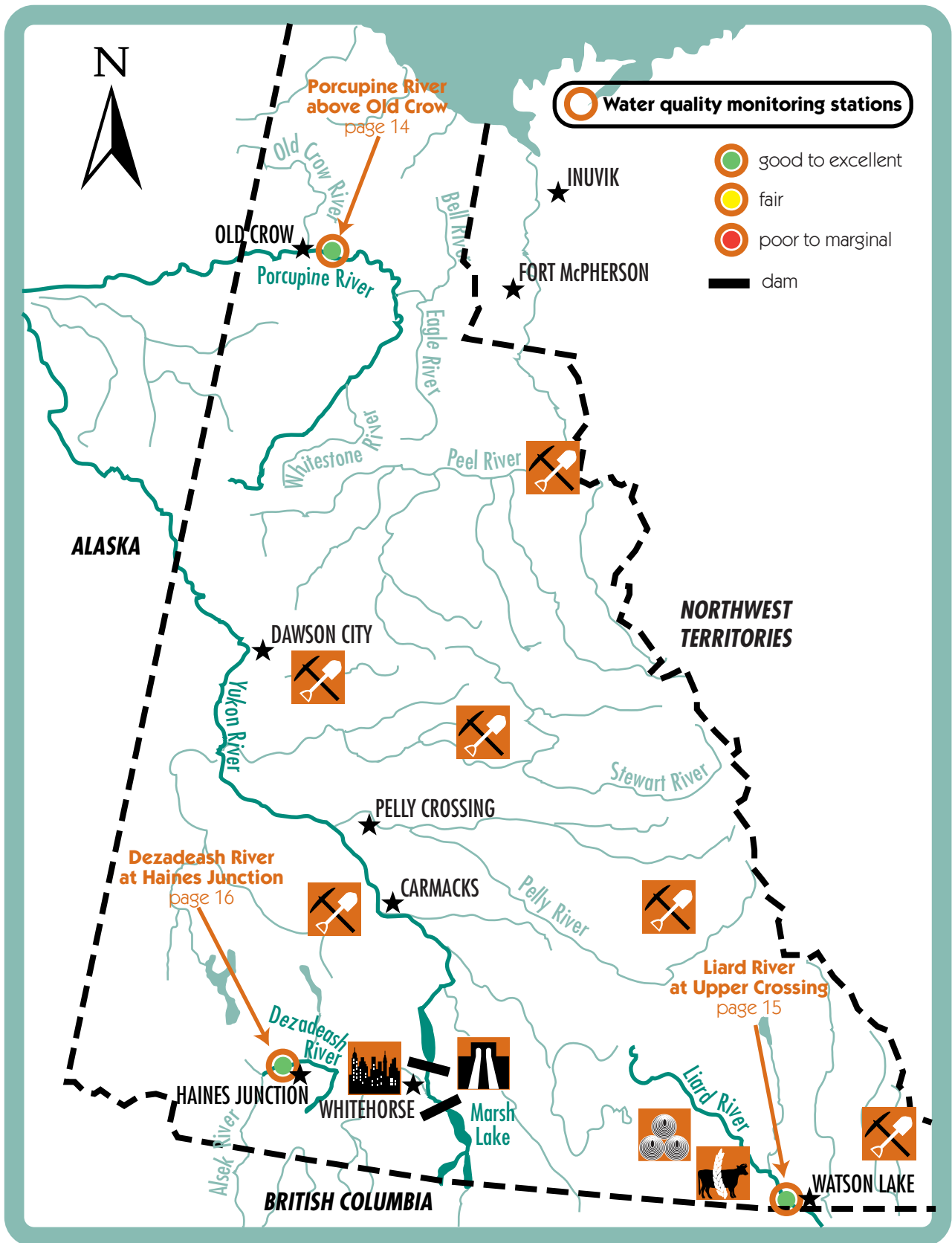
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Yukon Territory Summary



Index 85.6 in 2001–2003

Main Attributes

The Porcupine River drains 61,530 km² of the northeast Yukon and northwest Alaska and flows into the Yukon River in Alaska. The Porcupine River supports an important traditional chum fishery for the Vuntut Gwitchin people, as well as other fish species. The Porcupine watershed provides vital habitat for the Porcupine caribou herd, which has been an important part of the northern Yukon's natural environment for thousands of years. The Gwitchin people of the Yukon still rely heavily on the Porcupine caribou herd for their food.

Main Influences

There are few anthropogenic influences on the water quality of the Porcupine River. The water quality station is located upstream of the community of Old Crow and the basin has relatively pristine water quality.

Site-specific Guidelines

Site-specific guidelines were developed for chromium, copper, silver, sulphate, zinc, phosphorus, pH and temperature. One temperature and one chromium measurement exceed the site-specific guidelines by small amounts, which would have little or no effect on aquatic life.

Other Water Quality Concerns

None at this time.



Environment Canada, in cooperation with the Vuntut Gwitchin community of Old Crow, will continue to monitor water quality in the Porcupine River above Old Crow to confirm that this good water quality is maintained. Mabsi cho to the community of Old Crow.



Index 100.0 in 2001–2003; 93.6 in 2002–2004

Main Attributes

The Liard River at Upper Crossing drains 33,400 km² of the Yukon Territory into northern British Columbia near Watson Lake, Yukon Territory. The Liard River supports at least 21 species of fish with arctic grayling being the most abundant sports fish. Fishing pressure for subsistence and recreation is light. There are few or no other uses of the water in this lightly populated and undeveloped watershed.

Main Influences

The main potential influences on water quality are mining exploration in the headwaters of the Liard basin and forestry around the Meister, Rancheria and Liard rivers, but the basin is lightly developed at present with pristine water quality.

Site-specific Guidelines

Site-specific water quality guidelines were developed for arsenic, chromium, copper, silver, zinc, nitrate, nitrite, phosphorus, pH and temperature. All site-specific guidelines are met during the period from January 2001 to December 2003. One phosphorus measurement exceeds the guideline in 2004. This is likely due to light human pressure in the watershed. Aquatic life in the river is afforded a high level of protection.

Other Water Quality Concerns

None at this time. No environmentally significant trends were reported in the 2000 Water Quality Trends report.



Environment Canada will continue monitoring the Liard River at Upper Crossing to confirm that good water quality is maintained.



Index 89.5 in 2001–2003; 83.8 in 2002–2004

Main Attributes

The Dezadeash River at Haines Junction drains 23,454 km² of the southwestern Yukon. The river enters rugged Kluane National Park and Reserve before its confluence with the Alsek River. The glacier-fed Dezadeash and Alsek watersheds are important wetland and wildlife habitats.

Main Influences

There are few anthropogenic influences on the water quality of the Dezadeash River. The river flows by the small community of Haines Junction. An upstream tributary, the Aishihik River, is regulated by a hydro-electric dam. The main influences on water quality are expected to be limited run-off from the Haines Junction community and recreational activities such as river rafting. Additionally, a relatively pristine, glacially fed river such as the Dezadeash may be influenced by contaminants associated with increased glacial melting due to climate change. In general, the basin has relatively pristine water quality.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, copper, lead, silver, sulphate, zinc, nitrate, nitrite, phosphorus, pH and temperature. Copper often exceeds the site-specific guideline during glacial and snowmelt periods (May–July) when water flow and turbidity are very high. Cadmium, zinc and phosphorus measurements also exceed guidelines on occasion. However, because these variables are primarily related to turbidity and associated with the suspended sediment, they are likely unavailable to aquatic life.

Other Water Quality Concerns

None at this time.



Environment Canada, in partnership with Parks Canada, will continue to monitor the Dezadeash River at Haines Junction to confirm that this good water quality is maintained. For the Kluane National Park and Reserve Management Plan visit: www.pc.gc.ca/pn-np/yt/kluane.

NORTH COAST AND PEACE RIVER SUMMARY

The **North Coast** drainage basin comprises several watersheds located in the northwestern part of British Columbia. All of the rivers in this basin drain to the Pacific Ocean, many passing through the Alaska panhandle in their lower reaches. The major rivers, from north to south, are the Taku, Stikine, Iskut, Unuk, Salmon, Nass and Skeena rivers. There are three water quality monitoring stations in this drainage basin area: one each on the **Iskut**, **Salmon** and **Skeena** rivers. The water quality is assessed as Good at the Iskut and Skeena rivers sites and Marginal at the Salmon River site.

The **Peace River** basin is located in the northeastern part of British Columbia, bordering northern Alberta. There is one long-term water quality monitoring station in this region, on the Peace River above Alces River. The water quality of the Peace River site is assessed as Fair to Good.

The main BC Ministry of Environment regional office for the North Coast drainage basin is located in Smithers and the main BC Ministry of Environment regional office for the Peace River basin is located in Prince George. If you have any questions on this Water Quality Report or want more information on other waterbodies in this area, please contact:

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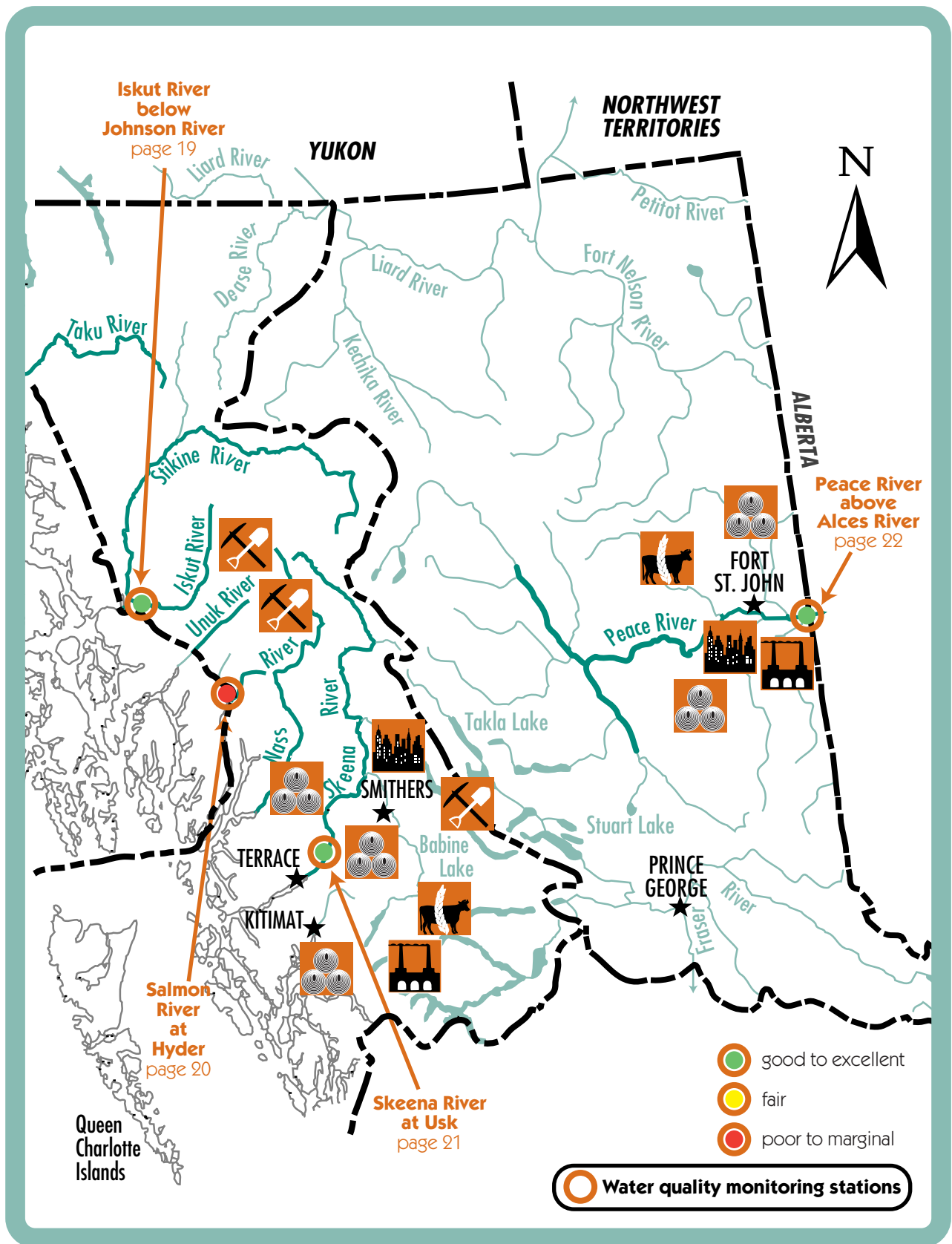
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North Coast and Peace River Summary



Index 91.7 in both 2001–2003 and 2002–2004

Main Attributes

The Iskut River below Johnson River drains 9,350 km² of northern British Columbia. The water sampling station is located just upstream from the confluence with the Stikine River, which lies 12 km upstream from the Alaska–BC border. Together, the Stikine and Iskut rivers drain approximately 51,600 km² of BC into Alaska and the Pacific Ocean and support important commercial salmon runs.

Main Influences

Glacial melt and seasonal flows have a strong influence on water quality, specifically on turbidity and associated concentrations of cadmium, copper, lead, silver and zinc. Potential human influences on water quality are mines located south from the river. Forestry may also affect the river, but is not a major industry in the watershed at this time due to the remoteness of the area. In general, the basin is lightly developed with relatively pristine water quality.

Site-Specific Guidelines

Site-specific guidelines were developed for arsenic, manganese, nickel, silver, total dissolved nitrogen, pH and temperature. Silver is the only variable that exceeds the site-specific guideline on occasion during periods of high flow and turbidity. These infrequent elevated levels are likely due to natural glacial outflows and are not expected to have an effect on aquatic life.

Other Water Quality Concerns

None at this time. No environmentally significant trends have been identified in data collected from 1969–2002.



BC Ministry of Environment and Environment Canada are involved in environmental assessments for proposed development projects in the basin and will be involved with permitting processes to ensure water quality impacts are avoided or mitigated. Monitoring of the Iskut River below Johnson River will also continue to confirm that good water quality is maintained.

Index 61.4 in 2001–2003; 61.1 in 2002–2004

Main Attributes

The Salmon River at Hyder drains about 300 km² of the Coast Mountains in Alaska and northcentral British Columbia into the Portland Canal at Hyder, Alaska. The basin straddles the Alaska–British Columbia border, with the Salmon River and Cascade Creek flowing from BC and Texas Creek flowing from Alaska. The three streams meet in Alaska just downstream from the border and support important salmon runs. The Salmon and Texas glaciers dominate the headwaters of the basin.

Main Influences

Glacial erosion and natural mineralization are significant natural influences on water quality. The major potential human influences on water quality are inactive mines in the basin.

Site-Specific Guidelines

Site-specific guidelines were developed for arsenic, cadmium, copper, cyanide, lead, selenium, silver, zinc, nitrogen, alkalinity, pH and temperature. Alkalinity, cadmium, copper, nitrogen, selenium, silver and zinc occasionally exceed site-specific guidelines. These exceedances are likely due to glacial outflows and natural background levels of these variables, although historic mining activity is also a potential influence. It is unlikely that these occasional exceedances have much of an impact on aquatic life. The river itself is highly turbid and chum and pink salmon return to spawn every year in the clear tributaries downstream from the sampling site.

Other Water Quality Concerns

None at this time. The 2000 Water Quality Trends report noted that cyanide levels had declined since 1990, likely due to improvements at an upstream mine that is now inactive. The report also identified the exceedance of selenium guidelines for aquatic life and wildlife as a potential concern. While some old mines may be discharging selenium, natural sources are also suspected due to the geology of the area and similar levels in the adjacent watershed, which is less populated.



Environment Canada and the BC Ministry of Environment will continue to monitor water quality in the Salmon River at Hyder to measure any changes in water quality due to drainage from old mining activity and as background information for any new mining activity or development in the basin.

Index 90.4 in 2001–2003; 82.7 in 2002–2004

Main Attributes

The Skeena River at Usk drains 42,200 km² of the Coast Mountains in northcentral British Columbia and supports major runs of salmon. Its major tributaries are the Bulkley and Babine rivers.

Main Influences

The main potential influences on water quality are forestry, mining, agriculture, urban development and treated municipal wastewater from Houston, Telkwa, Smithers and Hazelton.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, silver, zinc, nitrate, total phosphorus, pH and temperature. Silver, pH and chromium exceed the site-specific guidelines very occasionally, possibly due to glacial outflows. The metals in particular are related to turbidity and therefore likely unavailable to aquatic life. Further, it is unlikely that aquatic life would be impacted by these short-term periods when values are in excess of site-specific guidelines.

Other Water Quality Concerns

None at this time. There were no environmentally significant trends identified in the 2000 Water Quality Trends report.



Environment Canada will continue to monitor the Skeena River at Usk to confirm that good water quality is maintained or improved. This station is also monitored for the Global Environment Monitoring System (GEMS, visit www.gemstat.org). This is an international, multi-partnered United Nations Environment program that develops and maintains a global freshwater quality information system for reporting globally and regionally.



Index 79 in 2001–2003; 84.2 in 2002–2004

Main Attributes

The Peace River above Alces River drains 118,000 km² of northern British Columbia into Alberta. About three-quarters of the flow at the border comes from the Williston Reservoir behind the W.A.C. Bennett Dam, while one-quarter comes from the many tributaries to the Peace downstream from the dam. The river is used for raw drinking water for Taylor and Hudson's Hope, sports fishing, recreation and irrigation. The Peace River was declared a BC Heritage River in 1998 because of its historical, cultural, recreational and wildlife values.

Main Influences

There is a strong association between turbidity and metal concentrations at this site. The primary source of turbidity and elevated metals concentrations has not been distinguished between natural and human influences. Land cover in the basin is mostly natural, with forested, alpine or subalpine areas covering the majority of the land. The main potential human influences on water quality are the W.A.C. Bennett Dam and its massive reservoir, Williston Lake, the Peace Canyon Dam, a gas processing plant and pulp mill at Taylor, treated municipal wastewater from the city of Fort St. John, oil and gas production, agriculture and forestry.

Site-specific Guidelines

Site-specific guidelines were developed for arsenic, cadmium, copper, lead, nickel, selenium, zinc, total dissolved nitrogen, total dissolved phosphorus, pH and temperature. The site-specific guideline for cadmium is frequently exceeded and single low measurements of arsenic, zinc and dissolved nitrogen in excess of site-specific guidelines are also measured. Stressors potentially responsible for these guideline exceedances include agriculture, forestry, the gas refinery and pulp mill. Where guidelines have been exceeded, there is a risk of adverse effects to aquatic life, however the duration of exposure, which also determines the level of risk, was not determined.

Other Water Quality Concerns

The 1996 BC Water Quality Status Report rated the water quality of the Peace River as Fair, because site-specific objectives for fecal coliforms, suspended solids, turbidity, metals and the growth of algae were sometimes not met. Similarly, suspended solids and turbidity levels were high in the Peace River above Alces River during snowmelt and heavy rains, causing the site-specific guidelines for several metals to be exceeded at times. Because the metals were associated with suspended solids, they likely were not available to harm aquatic life.



Monitoring of the Peace River above Alces River is continuing to better assess the biological availability of metals. The provincial and federal governments are involved in environmental assessments for proposed development projects in the area and will be involved with permitting processes to confirm water quality impacts are avoided or mitigated.

FRASER RIVER BASIN SUMMARY

The **Fraser River Basin** ranges from central British Columbia, to southwest British Columbia and east to the Rocky Mountains near Jasper. The southern part of the basin borders on Washington State. The Fraser River is distinguished as a Canadian Heritage River for having outstanding natural, cultural and historic values. Major tributaries of the Fraser are the Nechako, Thompson and Harrison rivers. There are eight long-term water quality monitoring stations in this basin: four on the **Fraser River** and one on each of the **Nechako, Thompson, Salmon and Sumas** rivers. The Fraser River at Hansard, Fraser River at Hope, Fraser River at Red Pass and Nechako River are ranked as Good or Excellent. The Thompson River at Spences Bridge, Fraser River at Marguerite and Sumas River are ranked Fair. The Salmon River at Salmon Arm is assessed as Poor to Marginal.

The main BC Ministry of Environment regional offices are located in Prince George, Kamloops, Williams Lake and Surrey. If you have any questions on this Water Quality Report or want more information on other waterbodies in the basin, please contact:

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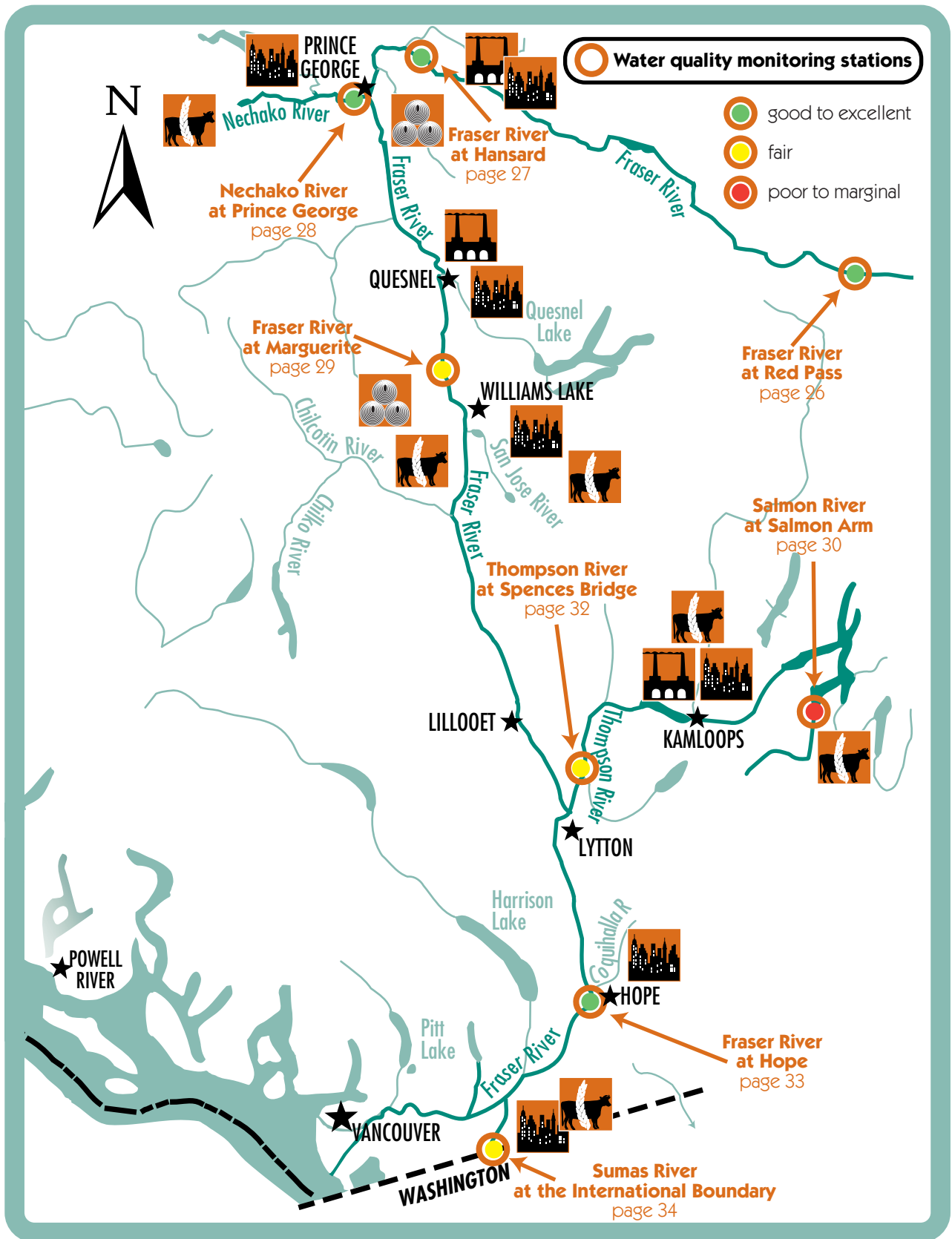
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Fraser River Basin Summary



Index 91.8 in 2001–2003; 100 in 2002–2004

Main Attributes

The Fraser River at Red Pass drains 1,700 km² of the Rocky Mountains entirely within Mount Robson Provincial Park at the headwaters of the Fraser River. This is a relatively pristine watershed with high recreational values.

Main Influences

The main potential influences on water quality are the Yellowhead Highway and the Canadian National Railway, which run alongside the Fraser River and Moose Lake through Mount Robson Park. Additional potential influences at this relatively pristine, mountainous location may include recreational activities in the park and atmospheric deposition of contaminants carried by rain and snow.

Site-specific Guidelines

Site-specific guidelines were developed for copper, lead, silver, zinc, total dissolved phosphorus, pH and temperature. One copper measurement exceeds the site-specific guideline, likely due to high turbidity. Aquatic life is unlikely to be impacted by small one-time events such as this. Benthic macroinvertebrate communities measured downstream from the site in 1996 indicated excellent water quality.

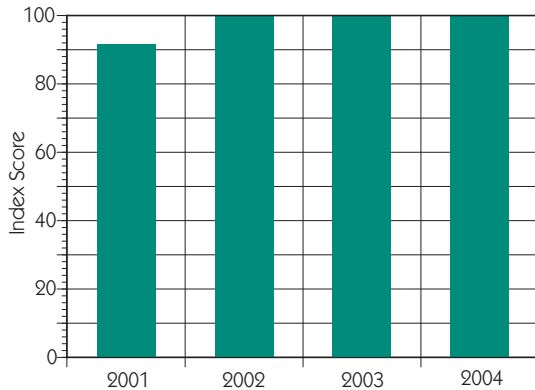
Other Water Quality Concerns

None at this time. There were no environmentally significant trends identified in the 2000 Water Quality Trends report.



Environment Canada and BC Ministry of Environment will continue to monitor the Fraser River at Red Pass to confirm that good water quality is maintained or improved. The site is important as a relatively pristine control station for the Fraser basin and the province, as well as for quality assurance of the monitoring network, for detecting trends due to atmospheric changes and for assessing downstream forest harvesting effects.

FIGURE 4
2001–2004 Annual Water Quality Index Scores for Fraser River at Red Pass





Index 82.6 in 2001–2003; 82.7 in 2002–2004

Main Attributes

The Fraser River at Hansard is located in the Rocky Mountain Trench between the Columbia and Rocky Mountains, draining 18,000 km² of the headwaters of the Fraser River that lie in these mountain ranges. The water in this reach is used for drinking, irrigation, recreation and industry and sustains significant fish (27 resident species, including four migrating salmon species) and wildlife resources. The Fraser River from Tete Jaune Cache to Greater Vancouver has been designated as a BC and a Canadian Heritage River.

Main Influences

The main potential influences on water quality are municipal wastewater from McBride, non-point source influences from forestry, agriculture and both the Yellowhead Highway and the Canadian National Railway, which run alongside the river most of the way from the headwaters to Hansard.

Site-specific Guidelines

Site-specific guidelines were developed for arsenic, copper, silver, zinc, total dissolved nitrogen, total dissolved phosphorus, dissolved oxygen, pH and temperature. Four copper values, two zinc and two lead values exceed site-specific guidelines between 2001 and 2004. Metal exceedances are associated with high turbidity during periods of high flow and therefore the metals are likely not biologically available. The benthic macroinvertebrate community measured near the site in 1996 indicated excellent water quality.

Other Water Quality Concerns

There are no other water quality concerns at this time. No environmentally significant trends have been identified in data collected from 1984–2004.



Environment Canada and BC Ministry of Environment will continue to monitor water quality in the Fraser River at Hansard, which serves as a control station for the Fraser basin upstream from the industrial and municipal waste discharges at Prince George and further downstream.



Index 92.8 in 2001–2003 and 2002–2004

Main Attributes

The Nechako River drains about 46,000 km² of the interior plateau to the Fraser River at Prince George. The Nechako is used for irrigation, livestock watering, recreation, drinking water and sustains significant aquatic life and wildlife, including important salmon runs.

Main Influences

The main influences on water quality are the Kenney Dam and the Nechako Reservoir, which divert water from the Nechako basin for the Kemano hydroelectric project and reduce river flows significantly. Other influences include treated municipal wastewater from Fort Fraser and Vanderhoof, agriculture and forestry.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, selenium, zinc, dissolved oxygen, pH and temperature. Cadmium occasionally exceeds the site-specific guideline due to high turbidity levels, but likely is not biologically available.

Other Water Quality Concerns

None at this time. No environmentally significant trends have been identified in data collected from 1984–2004.



Environment Canada and BC Ministry of Environment are continuing to monitor water quality in the Nechako River at Prince George to detect any trends and to confirm that the water quality is maintained or improved.



Index 74.2 in 2001–2003 and 2002–2004

Main Attributes

The Fraser River at Marguerite drains 114,000 km² of the central part of the province. The river is used for industrial water supply, recreation, livestock watering and irrigation.

Main Influences

Main influences on water quality include effluent from three pulp mills near Prince George and two pulp mills at Quesnel (though not likely sources of metals), treated municipal wastewater effluent from Prince George and Quesnel and non-point source runoff from forestry, agriculture and urban areas.

Site-specific Guidelines

Site-specific guidelines were developed for arsenic, copper, lead, silver, zinc, total phosphorus, dissolved oxygen, pH and temperature. Copper, lead, silver and phosphorus values occasionally exceed site-specific guidelines. Metal guidelines are exceeded when turbidity levels are high due to a strong association between trace metals and turbidity during periods of high flow. At such times, aquatic life may experience minimal stress as these metals are not likely biologically available. Temperature exceeds the guideline on one occasion, by one degree in the summer for the period of record. This is likely associated with elevated air temperatures at this time and is therefore not of biological concern. Benthic macroinvertebrate communities assessed at the site in the mid-1990's indicated good water quality based on community structure.

Other Water Quality Concerns

There are no other known water quality concerns at this time. Improvements in water quality were noted in the 2000 Water Quality Trends report for fecal coliforms, dissolved chloride and adsorbable organic halides. The latter two are indicators for chlorinated organic compounds and showed improving trends due to waste abatement at the upstream pulp mills.



Water quality will continue to be monitored in the Fraser River at Marguerite, as it provides a window on water quality in the central part of the Fraser River watershed.



Index 39.8 in 2001–2003 and 45.8 in 2002–2004

Main Attributes

The Salmon River at Salmon Arm drains 1,510 km² of the Interior Plateau to Tappen Bay on the Salmon Arm of Shuswap Lake in the City of Salmon Arm. The river is heavily used for irrigation, including lawns and gardens, livestock watering and provides significant habitat for spawning and rearing of salmonids and other fish species.

Main Influences

Main influences on water quality include widespread non-point sources of pollution from agriculture, forestry, transportation (roads and railway) and some residential development at Westwold, Falkland, Silver Creek, Yankee Flats and Salmon Arm.

Site-specific Guidelines

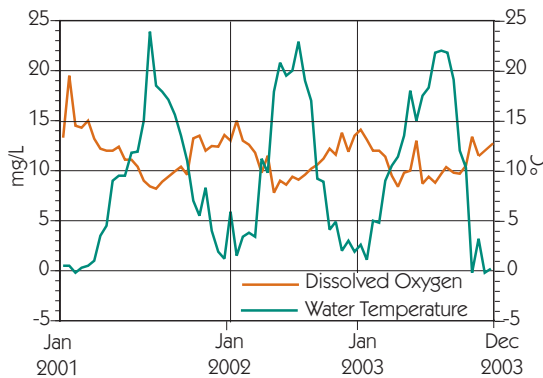
Site-specific guidelines were developed for cadmium, chromium, total nitrogen, total phosphorus, dissolved oxygen, pH and temperature. All variables tested exceed site-specific guidelines at times. Dissolved oxygen, total phosphorus, total cadmium, total chromium and water temperature frequently exceed the guidelines. The primary stressor on water quality at the site is agriculture.

Aquatic life at the site may be affected particularly during sensitive life stages, due to decreased dissolved oxygen and elevated temperatures. The possibility of increased algal growth due to an over-supply of nitrogen and phosphorus (or eutrophication potential), particularly downstream in Shuswap Lake, is also of concern.

Other Water Quality Concerns

Elevated turbidity from agricultural and forestry non-point sources, as well as low flows and high water temperatures in summer, are the main water related concerns that may affect aquatic life in the Salmon River. The 2000 Water Quality Trends report showed a trend of increasing turbidity from non-point sources. Fecal bacteria levels were also high, but declining. Bacteria are not assessed for this current Water Quality Report because they do not directly affect aquatic life.

FIGURE 5
Dissolved Oxygen Concentration and Water Temperature in the Salmon River at Salmon Arm





The Salmon River Watershed Roundtable is coordinating a host of remedial measures and public education to reduce non-point source pollution from agriculture and forestry. Eroding river banks are being stabilized, revegetated and fenced to protect them from livestock. This is being done in cooperation with the Department of Fisheries and Oceans. Agencies including the BC Ministry of Environment, BC Ministry of Agriculture and Land, and Agriculture and Agri-Food Canada are all continuing to work with farmers and ranchers to reduce pollution from agricultural sources, including the use of Beneficial Management Practices. Monitoring of the Salmon River at Salmon Arm by BC Ministry of Environment and Environment Canada is continuing in order to track trends in water quality.



Index 71.1 in 2001–2003; 65.2 in 2002–2004

Main Attributes

The Thompson River drains over 55,000 km² of the Interior Plateau, Shuswap Highlands and Columbia Mountains to the Fraser River at Lytton. The river is important for fish spawning and rearing, migrating salmon, irrigation, livestock watering, drinking water and recreation such as rafting and steelhead fishing.

Main Influences

Main influences on water quality include treated effluent from a bleached kraft pulp mill and the City of Kamloops wastewater treatment plant, which discharge upstream from Kamloops Lake. Other small point sources include discharges from the Merritt, Clinton, Cache Creek and Ashcroft wastewater treatment plants. There are several large mines in the watershed, but only small amounts of seepage are discharged. There are also non-point source inputs from agriculture, urban development, forestry, transportation and stream bank erosion.

Site-specific Guidelines

Site-specific guidelines were developed for arsenic, cadmium, chromium, chloride, copper, lead, silver, zinc, total phosphorus, pH and temperature. Cadmium, copper, lead, zinc, phosphorus and temperature exceed guidelines occasionally. Where guidelines are exceeded, there is a risk of adverse effects to aquatic life, however the duration of exposure, which also determines the level of risk, was not determined.

Other Water Quality Concerns

The water quality of the Thompson River was rated as Fair in the 1996 BC Water Quality Status Report due to excessive growths of algae. There was an improving trend noted in the 2000 Water Quality Trends report for dissolved chloride, an indicator for chlorinated organics, due to waste abatement at the pulp mill in Kamloops. Values have stabilized since the mid-1990's.



There is a large partnership monitoring program being undertaken on the Thompson River/Kamloops Lake system, to determine long-term impacts of increased phosphorus on algal growth, benthic macroinvertebrates and fish. Major partners include Weyerhaeuser Canada, City of Kamloops, Village of Ashcroft, Environment Canada and the Department of Fisheries and Oceans. The results of this monitoring program will assist the provincial and federal environmental agencies in setting discharge limits to protect the Thompson River and Kamloops Lake.



Index 84.2 in both 2001–2003 and 2002–2004

Main Attributes

The Fraser River is one of British Columbia's most valued ecosystems, draining one-quarter of the province to the Strait of Georgia. Its drainage area at Hope is 217,000 km². The river near Hope is used for industrial water supply and recreation. It supports massive runs of all five species of Pacific salmon, as well as numerous species of resident fish. The Fraser River is a BC and Canadian Heritage River. Other upstream stations in the basin are the Fraser River at Red Pass, Hansard and Marguerite, the Nechako River at Prince George and the Thompson River at Spences Bridge.

Main Influences

Treated effluent from pulp mills at Prince George, Quesnel and Kamloops, treated municipal wastewater effluent from Prince George, Quesnel, Williams Lake and Kamloops and non-point sources of pollution from agriculture, forestry and urban areas are the main human influences on water quality.

Site-specific Guidelines

Site-specific guidelines were developed for arsenic, copper, lead, silver, thallium, zinc, total dissolved nitrogen, total dissolved phosphorus, dissolved oxygen, pH and temperature. Copper and phosphorus values frequently exceed site-specific guidelines and copper values are associated with high turbidity. Aquatic life may therefore experience minimal stress when guidelines are exceeded; however benthic macroinvertebrate assessments carried out near the site in 2003, 2004 and 2005 indicate that the benthic macroinvertebrate community is healthy.

Other Water Quality Concerns

There are no other known water quality concerns at this time. The Fraser River at Hope was assessed to be Good in the 1996 BC Water Quality Status Report. In the 2000 Water Quality Trends report, an environmentally significant decrease in absorbable organic halides was noted, due to abatement measures at upstream pulp mills and these low levels continue.



Water quality monitoring will continue in the Fraser River at Hope, which characterizes water quality in the upstream reach of the rapidly developing Fraser Valley.

Canadian Heritage Rivers System
www.chrs.ca

British Columbia Heritage Rivers Program
www.env.gov.bc.ca/bcparks/heritage_rivers_program/home.html



Index 73.9 in 2001–2003; 68.1 in 2002–2004

Main Attributes

The Sumas River has its headwaters in Washington State. In Canada it flows north from the border to the Vedder Canal just before the Vedder enters the Fraser River. The river has a drainage area of 62,600 km² and is important as rearing habitat for salmonids.

Main Influences

The main human influences on water quality in the Sumas River at the sampling site are agricultural impacts. The main agricultural activities in this watershed are dairy farms in Washington State and vegetable, dairy and livestock production in British Columbia. Some tributaries of the Sumas River in British Columbia are influenced by urban development.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, molybdenum, nickel, sulphate, zinc, nitrate, total phosphorus, dissolved oxygen, pH and temperature. One dissolved oxygen value, occasional nitrate values (in excess of guidelines to protect amphibians), copper values and several phosphorus values exceed the site-specific guidelines. Chromium values are also high, resulting in exceedances that are strongly correlated to turbidity. It is suspected that these chromium levels are naturally occurring and as chromium binds to sediment particles, a portion of the chromium may not be available for uptake by aquatic organisms. The benthic macro-invertebrate community has been assessed each year since 2003 and looks to be potentially stressed, relative to reference communities. Elevated phosphorus and nitrogen levels indicate the potential for eutrophication (increased algal growth) with possible influence on the benthic macro-invertebrate community. Trends were not evaluated in the 2000 Water Quality Trends report, while the 1996 BC Water Quality Status Report rated the river as Good.

Other Water Quality Concerns

Improvements to agricultural waste management and livestock practices are necessary for water quality improvements. Other reports suggest that elevated temperatures, low dissolved oxygen levels, high bacteriology measurements and excessive nutrient loading are of concern in the Sumas River.



Environmental Farm Plans and Beneficial Management Practices are strongly encouraged in agricultural areas in British Columbia, such as in the Sumas watershed. Environment Canada and BC Ministry of Environment will continue to monitor the Sumas River at the International Boundary to track changes in water quality.

KOOTENAY RIVER BASIN SUMMARY

The **Kootenay River Basin** is located in the southeastern part of British Columbia, bordering the province of Alberta and the states of Idaho and Montana. The river flows into the Columbia River at Castlegar, British Columbia and drains portions of the Rocky and Columbia mountains. Six water quality monitoring stations in the basin are assessed in this report. Sites are located on the **Kootenay**, **Elk** and **St. Mary** rivers. The two Elk River sites are ranked as Fair and St. Mary River is ranked as Marginal. Kootenay River at Creston and Kootenay River near Fenwick Station are also ranked as Fair, whereas Kootenay River at Kootenay Crossing is rated as Good.

The main BC Ministry of Environment regional offices are located in Nelson and Cranbrook. If you have any questions on this Water Quality Report or want more information on other waterbodies in the region, please contact:

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Kootenay River Basin Summary



Index 65.1 for 2002–2004

Main Attributes

The Elk River drains 4,450 km² of the Rocky Mountains into Kooacanusa Lake on the Kootenay River just before it enters Montana. It is the most heavily-fished river in the Kootenays, with large populations of westslope cutthroat trout, bull trout and whitefish.

Main Influences

Large scale coal mining began in the Elk River Valley in 1970 and has since expanded to five major coal mining operations producing over 25 million metric tons of coal in 2005. The Valley presently contains the largest producing coalfield in British Columbia.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, copper, selenium, zinc, dissolved nitrogen, nitrate, total dissolved phosphorus, pH and temperature. Guidelines are exceeded for selenium and total dissolved nitrogen and to a lesser extent cadmium, phosphorus and temperature. The soils of the Elk River Valley naturally contain elevated concentrations of selenium; however coal mining can enhance the natural release of selenium. Long-term trend analysis has shown that increasing selenium concentrations are associated with coal mining operations in the area. Nitrogen is also often associated with coal mining operations as explosives are employed. Aquatic life may be experiencing situations that can cause stress due to guideline exceedances, however no impacts on aquatic life have been noted to date.

The Fair ranking is driven primarily by elevated selenium concentrations in the water column. There is currently ongoing discussion among the scientific community about the use of selenium guidelines based on water concentrations versus concentrations in plant and animal tissue. The rationale for using tissue-based guidelines is that selenium accumulation occurs mainly through the food chain. Some agencies have moved to tissue-based selenium guidelines to evaluate aquatic health.

Other Water Quality Concerns

None at this time. A more detailed water quality assessment is currently underway.



BC Ministry of Environment, Environment Canada and the coal mining companies are collaborating through the Elk Valley Selenium Task Force to determine the potential environmental effects of selenium. The results of these investigations will help to identify the risks to aquatic biota from elevated selenium concentrations in water and the type of corrective action needed to reduce selenium levels. Monitoring of water quality is continuing in the Elk River.



Index 73.1 in 2001–2003; 73.2 in 2002–2004

Main Attributes

The Elk River drains 4,450 km² of the Rocky Mountains into Kootenay Lake on the Kootenay River just before it enters Montana. It is the most heavily-fished river in the Kootenays, with large populations of westslope cutthroat trout, bull trout and whitefish.

Main Influences

Large scale coal mining began in the Elk River Valley in 1970 and has since expanded to five major coal mining operations producing over 25 million metric tons of coal each year in 2005. The valley presently contains the largest producing coalfield in British Columbia.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, copper, selenium, zinc, dissolved nitrogen, nitrate, dissolved phosphorus, pH and temperature. Site-specific guidelines are not met for selenium and to a lesser extent temperature, phosphorus, nitrogen, cadmium, copper and zinc. Selenium originates from the mining operations and phosphorus comes from both mining and agriculture activities. Long-term trend analysis has shown that selenium concentrations are increasing due to coal mining operations in the area.

Other Water Quality Concerns

Significant increasing trends in selenium and nitrate have been identified in a report assessing data collected from 1968–2000.



BC Ministry of Environment, Environment Canada and the coal mining companies are collaborating through the Elk Valley Selenium Task Force to determine the potential environmental effects of selenium. The results of these investigations will help to show the type of corrective action that may be needed to reduce selenium levels. Monitoring of water quality is continuing in the Elk River.



Index 82.7 in 2001–2003; 88.5 in 2002–2004

Main Attributes

The Kootenay River at Kootenay Crossing drains 420 km² of the Rocky Mountains in the headwaters of the Kootenay-Columbia River basin. Most of its watershed lies within Kootenay National Park and Mount Assiniboine Park and has high recreational value.

Main Influences

The main human influences on water quality include Highway 93, recreational activities in the parks, timber harvesting in the northern part of the basin and wildfires. Additionally, this relatively pristine site may be affected by atmospheric deposition through rain and snow.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, silver, zinc, nitrate, total phosphorus, pH and temperature. Infrequent chromium values, two cadmium values, and a single copper and zinc value are in excess of site-specific guidelines. These concentrations are likely natural. It is unlikely that these infrequent exceedances affect aquatic life in this relatively undisturbed part of the river, as the organisms likely have adapted to these natural water quality events.

Other Water Quality Concerns

None at this time. No trends were reported in the 2000 Water Quality Trends report. Benthic macroinvertebrate monitoring was initiated at this site in 2004 to confirm the health of aquatic life at this site.



Monitoring by Environment Canada in partnership with Parks Canada is continuing, to detect any changes in water quality in Kootenay National Park, as well as to serve as a relatively pristine control station for the Kootenay watershed.



Index 67.8 in 2001–2003; 67.9 in 2002–2004

Main Attributes

The Kootenay River at Fenwick Station flows in the Rocky Mountain Trench, draining 12,000 km² of the Rocky Mountains to the east and the Purcell Mountains to the west. It is a transboundary river, which like the Elk River in British Columbia, flows into Kooconusa Lake. This reach of the river supports significant fisheries (e.g., westslope cutthroat trout, bull trout and whitefish) and the water is used for recreation and irrigation.

Main Influences

The kraft pulp mill at Skookumchuck is the main potential influence on water quality. The Teck Cominco Sullivan mine at Kimberley closed in 2001. Currently, Teck Cominco operates a drainage water treatment plant in the spring and fall to treat mine run-off.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, zinc, total dissolved nitrogen, total phosphorus, pH and temperature. Cadmium and chromium occasionally exceed site-specific guidelines. In one sample, levels of cadmium, chromium, copper, zinc and total phosphorus each exceed site-specific guidelines. Elevated levels are primarily due to high flow events. Potential stressors include nutrient enrichment and occasional elevated metals possibly from agriculture or discharge from the kraft pulp mill operation or drainage from the closed Sullivan mine.

Other Water Quality Concerns

None at this time. The water quality of the Kootenay River was not evaluated in the 1996 BC Water Quality Status Report. An improving trend in zinc was noted in the 2000 Water Quality Trends report. The zinc levels have declined since the early 1990's due to the ongoing abatement of acid rock drainage at the closed Sullivan mine.



Environment Canada and BC Ministry of Environment will continue monitoring of the Kootenay River at Fenwick Station.



Index 54.1 in 2001–2003; 60.2 in 2002–2004

Main Attributes

The St. Mary River watershed is located in the southeast corner of British Columbia. Its headwaters are located in the Purcell Mountains and the river flows east to join the Kootenay River at Fort Steele where it has a drainage area of 2,360 km². This reach of the river supports significant fisheries (e.g., westslope cutthroat trout, bull trout and whitefish).

Main Influences

The main human influences on water quality in the St. Mary River watershed are the former Sullivan lead-zinc mine, concentrator and fertilizer plant at Kimberley near Mark Creek, treated municipal wastewater from Kimberley, forestry, agriculture and residential and commercial development.

Site-specific Guidelines

Site-specific guidelines were developed for antimony, cadmium, copper, lead, silver, thallium, zinc, nitrate and temperature. There are frequent values of cadmium and zinc in excess of site-specific guidelines and occasional values of temperature, copper, lead and sulphate in excess of respective guidelines. It should be noted that the sulphate guideline is a generic alert level to monitor for aquatic moss health; at this time it is not known whether aquatic mosses are present in the St Mary River. Turbidity is generally very low and elevated concentrations of cadmium, copper, lead, sulphate and zinc are correlated with turbidity events. Where guidelines have been exceeded, there is a risk of adverse effects to aquatic life, however the duration of exposure which also determines the level of risk, was not determined.

Other Water Quality Concerns

There were dramatic improving trends in some water quality indicators during the 1970's and 1980's due to waste abatement for the Teck Cominco Sullivan mine operation and for municipal wastewater from the City of Kimberley. These indicators include the following: alkalinity, ammonia, arsenic, cadmium, hardness, chromium, fecal coliforms, copper, cyanide, fluoride, iron, lead, manganese, nitrogen-ammonia and organic, pH, phosphorus, silicon, sulphate, turbidity and zinc.



Environment Canada and BC Ministry of Environment will continue to monitor water quality, in partnership with Teck Cominco, in the St. Mary River at Wycliffe.



Index 71.0 in 2001–2003; 71.1 in 2002–2004

Main Attributes

The Kootenay River is a transboundary river that flows south from British Columbia into Kootenay Lake, which is the reservoir of the Libby Dam in Montana. After the dam, the river flows northward through Montana and Idaho, re-entering British Columbia south of Creston. Just north of Creston, the river enters Kootenay Lake, forming the main inflow to the southern arm of the lake. The Kootenay River near Creston has a drainage area of 36,700 km² and is used for irrigation and waterfowl conservation, while Kootenay Lake is an important fishery and recreation area.

Main Influences

The watershed upstream from Creston has been influenced to varying degrees over the years by hydroelectric development at Libby Dam, treated municipal wastewater discharges, agriculture and forestry. Another significant influence is coal mining in the watershed of the Elk River, a tributary of the Kootenay River.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, copper, lead, nickel, silver, zinc, total dissolved nitrogen, total phosphorus, pH and temperature. Lead, copper and total phosphorus often exceed site-specific guidelines and zinc and total phosphorus occasionally exceed site-specific guidelines. Turbidity peaks during spring freshet and high flow releases from Libby Dam result in increases in metals such as lead and copper.

Other Water Quality Concerns

Historically, decreased phosphorus levels and consequent decreases in fish production in Kootenay Lake resulted from the combined effect of construction of the Libby Dam in Montana and waste abatement at the Cominco operation on the St. Mary River. In 1992 this was addressed by BC Ministry of Environment through lake fertilization which continued to 1995, when the effort was taken over by the Columbia Basin Fish and Wildlife Compensation Program, a joint venture of BC Ministry of Environment and BC Hydro. Fertilization has resulted in significant increases in kokanee abundance. Nitrogen levels in the Kootenay River increased during 1981–2000. This increase was due, at least in part, to coal mining in the Elk River basin.

There has been little or no change in water quality in recent years due to impacts from construction of the Libby Dam and waste abatement at the Cominco operation on the St. Mary River, as these activities have

stabilized. However, there is current concern that the Libby Dam in Montana could cause high levels of total dissolved gases in the Kootenay River near Creston, should it be necessary to spill water due to a flood or other emergency. High levels of total dissolved gases did occur in 2005 and can cause physiological problems in fish and displace them from their natural habitat.



The Upper Columbia River International Task Force continues to investigate means to reduce total dissolved gases throughout the Columbia-Kootenay River basin in Canada. Water quality monitoring will include measurements of total dissolved gases in the Kootenay River at Creston in the event of a spill at Libby Dam. The water quality of Kootenay River at Creston was not evaluated in the 1996 BC Water Quality Status Report.

COLUMBIA RIVER BASIN SUMMARY

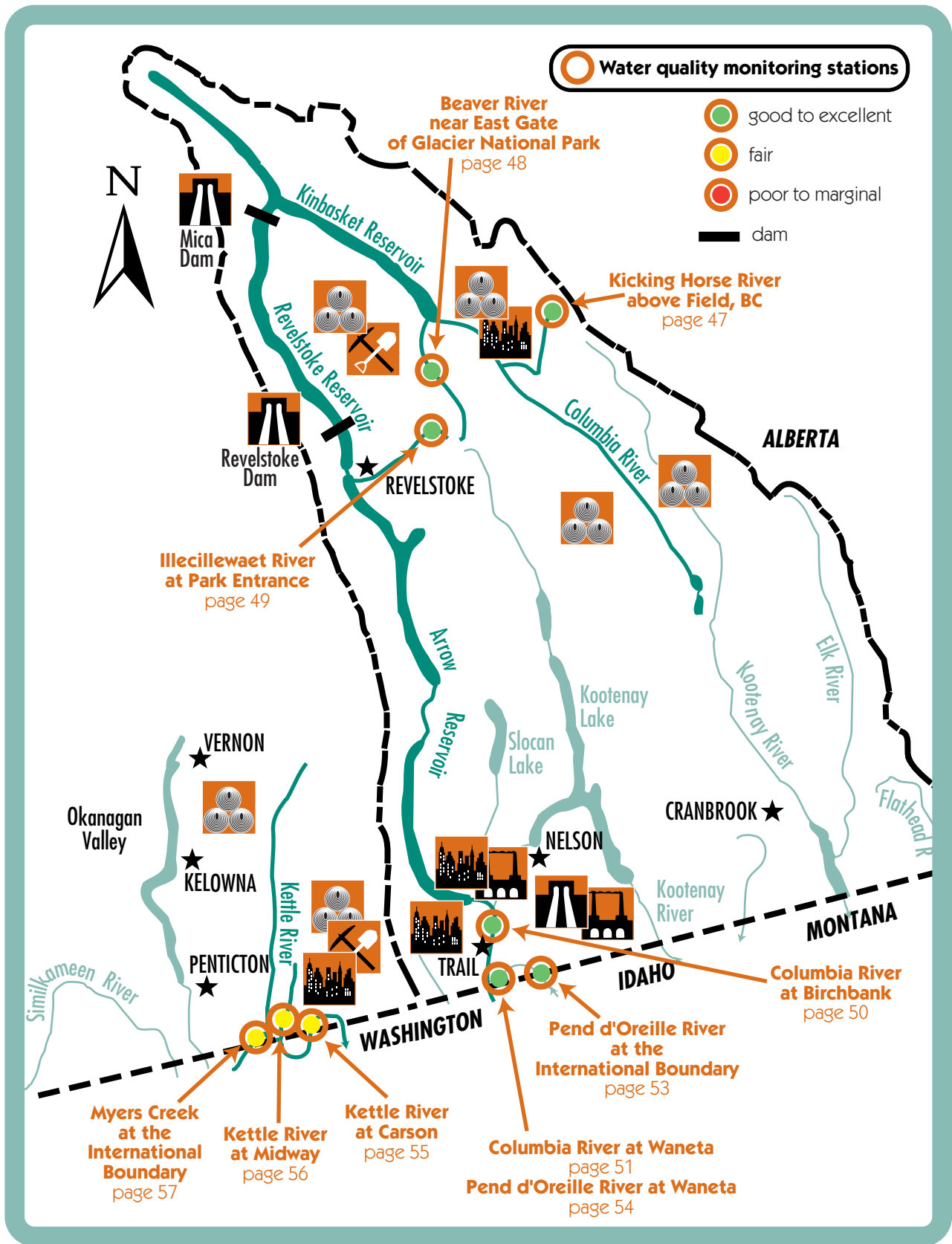
The **Columbia Basin** is located in the southeastern part of the Province, bordering the province of Alberta and the states of Washington, Idaho and Montana. It drains portions of the Rocky and Columbia mountains. Ten water quality monitoring stations are located within the basin. Additionally, the Kootenay and Okanagan-Similkameen rivers are also part of the Columbia Basin, but sites in these sub-basins are discussed separately in this report. Sites in the Columbia Basin are located on the **Kicking Horse, Beaver, Illecillewaet, Columbia, Pend d'Oreille** and **Kettle** rivers and **Myers Creek**. All sites within the basin are ranked as Good with the exception of Myers Creek and the Kettle River at Midway, which are ranked as Fair. Kettle River at Carson is ranked Good to Fair.

The main BC Ministry of Environment regional offices are located in Nelson and Cranbrook. If you have any questions on this Water Quality Report or want more information on other waterbodies in the region, please contact:

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Columbia River Basin Summary



Index 87.0 in 2001–2003; 87.2 in 2002–2004

Main Attributes

In the headwaters of the Columbia River basin, the Kicking Horse River above Field drains 344 km² of the Rocky Mountains. This is a relatively pristine watershed. The headwaters of the river are located in Yoho National Park and the river has high recreational value. The Kicking Horse River has been designated as a Heritage River by the Canadian Heritage Rivers Board, due to its outstanding natural and historical features.

Main Influences

The Trans-Canada highway, the Canadian Pacific Railway mainline and recreational activities in the national park are the main potential human influences on water quality. This relatively pristine site may also be influenced by melting of the Wapta and Waputik ice fields.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, silver, zinc, total phosphorus, pH and temperature. Cadmium and zinc values infrequently exceed site-specific water quality guidelines. As the site is quite pristine, these exceedances are likely natural, resulting from glacial outflows.

Other Water Quality Concerns

None at this time. In the 2000 Water Quality Trends report, no environmentally significant changes in Kicking Horse River water quality were identified. Benthic macroinvertebrate monitoring was initiated at this site in 2006 to confirm the health of aquatic life at this site.



Environment Canada in partnership with Parks Canada is continuing water quality monitoring to detect any changes in water quality in Yoho National Park.



Index 87.2 in 2001–2003; 88.4 in 2002–2004

Main Attributes

The Beaver River in Glacier National Park drains 472 km² of the Purcell Mountains in the headwaters of the Columbia River basin. This is a relatively pristine watershed with moderate recreational value and lies completely within the boundaries of Glacier National Park.

Main Influences

The main influences on water quality include the Trans-Canada highway, the Canadian Pacific Railway mainline and recreational activities, such as kayaking and canoeing in the national park. In addition the headwaters of the river are dominated by glaciers that likely influence water quality during periods of melt.

Site-specific Guideline

Site-specific guidelines were developed for cadmium, chromium, copper, lead, zinc, nitrate, pH, total dissolved phosphorus and temperature. Chromium, zinc, phosphorus and pH values exceed site-specific guidelines on very rare occasions. These small, infrequent exceedances are likely natural (resulting from glacial outflows) and are unlikely to have much affect on aquatic life.

Other Water Quality Concerns

None at this time. A slight declining trend in pH was observed in the 2000 Water Quality Trends report, but believed to be a natural variation as it only continued for a short period. However, as noted for the Illecillewaet River, the Beaver River (located in the same area) has relatively low pH levels naturally and it will be important to continue to observe these levels over time. Benthic macroinvertebrate monitoring was initiated at this site in 2006 to confirm the health of aquatic life at this site.



Environment Canada, in partnership with Parks Canada, will continue to monitor water quality in the Beaver River to confirm that good water quality is maintained and to identify any trends in water quality that may occur over time.



Index 88.4 in 2002–2003; 82.6 in 2002–2004

Main Attributes

The watershed upstream of the Illecillewaet River water quality station has a drainage area of 203 km² in the Selkirk Mountains and lies within the Glacier National Park. This is a relatively pristine watershed with moderate recreational values. The Illecillewaet River flows into the Upper Arrow Reservoir on the Columbia River near Revelstoke after draining about 1,200 km² of the Selkirk Mountains.

Main Influences

As for the previous two sites in the Columbia Basin, main influences on water quality at this site include the Trans-Canada highway, the Canadian Pacific Railway mainline and recreational activities in the national park. In addition contaminants carried by rain and snow or released from glacial melt in the headwaters can influence water quality.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, silver, zinc, lead, nitrite, total dissolved phosphorus, pH and temperature. Several metals (copper, cadmium and lead) exceed site-specific guidelines very infrequently. The infrequent values in excess of site-specific water quality guidelines are a result of glacial outflows, related to turbidity and likely have little effect on aquatic life. The guideline for pH is also exceeded on occasion, however pH levels in this river are naturally low during certain times of the year and therefore not of concern at this time.

Other Water Quality Concerns

None at this time. No environmentally significant changes were identified in the 2000 Water Quality Trends report. However, it will be important to continue to monitor pH, as alkalinity (a measure of the ability of the water to neutralize acids) is also low at this site. If pH were to decline appreciably then stream acidification could become a concern. Benthic macroinvertebrate monitoring was initiated at this site in 2006 to confirm the health of aquatic life at this site.



Environment Canada, in partnership with Parks Canada, will continue to monitor water quality in the Illecillewaet River at the entrance to Glacier National Park.



Index 90.4 in 2001–2003; 87.2 in 2002–2004

Main Attributes

The Columbia River at Birchbank is downstream from the river’s confluence with the Kootenay River and drains 88,100 km² of the Kootenay–Columbia basin. This reach of the river is used for municipal, industrial and agricultural water supply and supports significant fisheries. The Columbia River was declared a BC Heritage River in 1998.

Main Influences

Main influences on water quality include the Hugh Keenleyside, Mica and Revelstoke dams on the Columbia River upstream of Castlegar and the Libby and Brilliant dams on the Kootenay River. The pulp mill at Castlegar and treated municipal wastewater discharges from the Nelson-Castlegar area may also affect water quality.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, thallium, zinc, total phosphorus, pH and temperature. One cadmium and three water temperature measurements exceed site-specific guidelines. The temperature values in excess of guidelines are likely the result of upstream impoundments. These slight exceedances are unlikely to affect aquatic life; no impacts on aquatic life have been noted to date.

Other Water Quality Concerns

None at this time. Declining trends in aluminum, iron and phosphorus concentrations observed in the 2000 Water Quality Trends report were not present in a more recent evaluation. Some high values for total gas pressure reported at that time likely have been minimized with the additional generating capacity allowed through recent upgrades at the Hugh Keenleyside and Brilliant dams.



Water use planning has been conducted with BC Hydro and other utilities in the area for all dams in the Columbia basin to address total dissolved gas concerns. The Upper Columbia River International Task Force is investigating means to reduce total dissolved gases throughout the Columbia basin in Canada. Environment Canada and BC Ministry of Environment will continue to monitor water quality of the Columbia River at Birchbank.



Index 80.2 in 2002–2003; 80.0 in 2002–2004

Main Attributes

The Columbia River at Waneta is just upstream from the Columbia's confluence with the Pend d'Oreille River and the US border. At Waneta, the Columbia River drains 88,800 km² of the Kootenay-Columbia basin. This reach of the river is used for municipal, industrial and agricultural water supply and supports significant fisheries.

Main Influences

Main influences on water quality include the Hugh Keenleyside, Mica and Revelstoke dams on the Columbia River upstream from Castlegar, and the Libby and Brilliant dams on the Kootenay River. Further influences include the pulp mill at Castlegar, treated municipal wastewater discharges from the Nelson-Castlegar-Trail area and the lead-zinc smelter at Trail.

Site-Specific Guidelines

Site-specific guidelines were developed for cadmium, chromium, copper, lead, thallium, zinc, total phosphorus, pH and temperature. Cadmium routinely exceeds the long-term site-specific guideline for continuous exposure, although not by a large magnitude. Copper and water temperature also exceed site-specific guidelines on occasion. Cadmium and copper values that exceed guidelines are likely due to effluent from the smelter at Trail, BC; upstream wastewater treatment plant discharges may also contribute. Water temperatures in excess of guidelines probably result from upstream impoundment behind the dams.

The 2000 Water Quality Trends report identified that declines over time occurred for cadmium, chromium, iron, lead, zinc, fluoride, phosphorus and sulphate. These declines were due to waste abatement at the lead-zinc smelter; upstream dams may also have contributed to the decline in iron and phosphorus to some extent.

No impacts on aquatic life have been noted to date and fish health in the river appears good. However, sturgeon in the river are still endangered as a result of poor early life stage survival related to changes in water levels, temperature, turbidity, substrate and predators in the fish community (e.g., introduced walleye, rainbow trout).

Other Water Quality Concerns

There are concerns about total dissolved gas pressure levels that at times exceed the safe level for fish.

Further improvement is needed to reduce cadmium, chromium, copper and zinc to levels that are consistently safe for aquatic life. Waste abatement at the lead-zinc smelter in Trail is ongoing to achieve these reductions.



Water use planning has been conducted with BC Hydro and other utilities in the area for all dams in the Columbia basin to address total dissolved gas concerns. The Upper Columbia River International Task Force is investigating means to reduce total dissolved gases throughout the Columbia basin in Canada.

Index 84.7 in 2001–2003

Main Attributes

The drainage area of the Pend d'Oreille River at the International Boundary is approximately 65,300 km². The U.S. drainage area of the river has more industrial activity and a larger population than the short stretch of the river running through British Columbia and thus has a greater impact on downstream water quality.

Main Influences

The main potential influences on water quality are two lead-zinc mines in the Pend d'Oreille watershed and a pulp mill operation in eastern Washington State. There is also a nearby dam in Washington State, the Boundary Dam.

Site-specific Guidelines

Site-specific guidelines were developed for cadmium, copper, lead, total dissolved nitrogen, pH, total dissolved phosphorus, temperature and zinc. Total phosphorus exceeds the site-specific guideline roughly one-half of the time and water temperature exceeds the site-specific guideline about one-quarter of the time, in summer. Phosphorus levels may be elevated due to upstream agriculture while elevated water temperatures are likely due to upstream impoundments. These higher water temperatures in the summer potentially could be harmful to resident fish.

Other Water Quality Concerns

None at this time. No environmentally significant trends have been identified in data collected from 1997–2003.



Monitoring at this site was discontinued in 2004 by Environment Canada and the BC Ministry of Environment. Monitoring is continuing at the downstream site (Pend d'Oreille River at Waneta).



Index 85.3 in 2001–2003; 80.0 in 2002–2004

Main Attributes

The drainage area of the Pend d'Oreille River at Waneta is about 66,600 km², 98% of which is in the United States. Only the last 22 km of the river, upstream from where it joins the Columbia River at Waneta, is in British Columbia. This reach of the river is dominated by hydroelectric facilities.

Main Influences

We know little about the influences on water quality in the US portion of the watershed, except that there are two lead-zinc mines along the river in Washington State. There are also two closed lead-zinc mines in the British Columbia portion of the watershed. Three hydroelectric dams influence the British Columbia reach of the river: Boundary Dam at the US-Canada border and the Seven Mile and Waneta dams just upstream from the Pend d'Oreille's confluence with the Columbia River.

Site-Specific Guidelines

Site-specific guidelines were developed for cadmium, copper, lead, total dissolved nitrogen, pH, total phosphorus, temperature and zinc. Cadmium exceeds the guideline on occasion while water temperature exceeds the guideline about 25% of the time. Cadmium levels are likely elevated due to abandoned mine sites upstream. Elevated water temperatures are likely due to upstream impoundments.

Elevated water temperatures are unlikely to affect fish in the downstream reach of the Pend d'Oreille River, as it very quickly enters the larger Columbia River. As temperatures in the Columbia are also occasionally high during certain periods in the summer, fish below the confluence of the two rivers potentially could be affected if temperatures in both rivers are elevated.

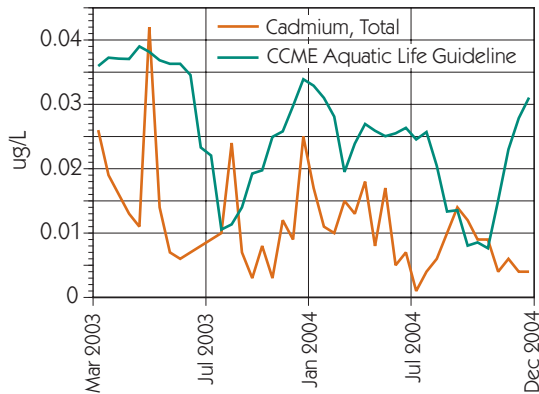
Other Water Quality Concerns

The levels of total dissolved gases have exceeded the safe level for fish downstream from the dams on the Pend d'Oreille River at times. Water use planning, that in part addresses total dissolved gas concerns, has been conducted with BC Hydro and other utilities in the area for all dams in the Columbia basin. The Upper Columbia River International Task Force is investigating means to reduce total dissolved gases throughout the Columbia basin in Canada and the U.S.



BC Ministry of Environment and Environment Canada will continue to monitor water quality in the Pend d'Oreille River at Waneta.

FIGURE 6
Total Cadmium Concentration
in Kettle Creek at Carson



Index 82.6 in 2001–2003; 71 in 2002–2004

Main Attributes

The Kettle River drains 5,750 km² of the Monashee Mountains and the Okanagan Highland in British Columbia south into Washington State at Midway. It then drains an additional 980 km² of the Monashee Mountains in northern Washington State before looping back into British Columbia at Carson, resulting in a drainage area totaling 6,730 km². Uses of the Kettle River include drinking and irrigation water supply. The river also supports several species of trout.

Main Influences

The main influences on water quality are forestry, agriculture and treated municipal wastewater from the Village of Midway.

Site-Specific Guidelines

Site-specific guidelines were developed for cadmium, cyanide, fluoride, lead, silver, zinc, total dissolved nitrogen, total dissolved phosphorus, pH and temperature. There are occasional values of cadmium, total dissolved phosphorus, fluoride (likely natural) and water temperature that are slightly in excess of these site-specific guidelines. Water quality conditions rarely depart from natural levels and there are no apparent effects on fish populations.

Other Water Quality Concerns

None at this time. No environmentally significant trends have been identified in a report evaluating data collected from 1980–2002.



Water quality monitoring by Environment Canada and BC Ministry of Environment is continuing in the Kettle River at Carson.



Index 71.1 in 2001–2003; 76.7 in 2002–2004

Main Attributes

The Kettle River drains 5,157 km² of the Monashee Mountains and the Okanagan Highland in British Columbia south into Washington State at Midway. It is joined at Midway by Boundary Creek, which drains 593 km² of the Monashee Mountains and together they flow into Washington State. The Kettle River upstream from Midway is a BC Heritage River.

Main Influences

The main potential influence on water quality is forestry.

Site-Specific Guidelines

Site-specific guidelines were developed for cadmium, cyanide, fluoride, lead, silver, zinc, total dissolved nitrogen, total dissolved phosphorus, pH and temperature. Phosphorus and natural fluoride levels in the Kettle River occasionally exceed site-specific guidelines, as do cadmium, zinc and lead. High sediment events are associated with the occasional high levels of zinc, lead and cadmium. Water temperature is reported as high as 24 degrees Celsius in the summer and as a result, aquatic life may infrequently experience situations that can cause stress.

Other Water Quality Concerns

None at this time. Fluoride levels that are naturally occurring can be above guidelines infrequently, but no affects to fish populations are currently known. No environmentally significant trends have been identified in data collected from 1972–2000.



Water quality monitoring is continuing in the Kettle River at Midway by Environment Canada and BC Ministry of Environment.

FIGURE 7
Dissolved Sulphate Concentration
in Myers Creek at the International Boundary

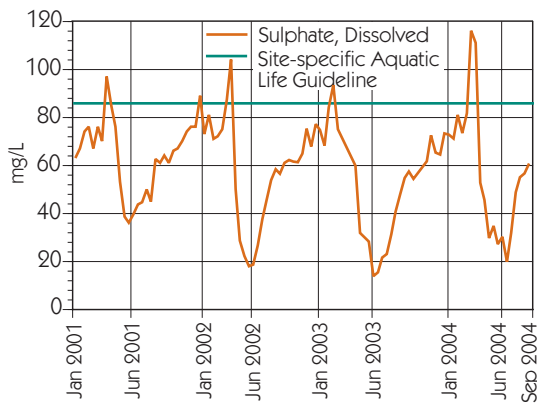
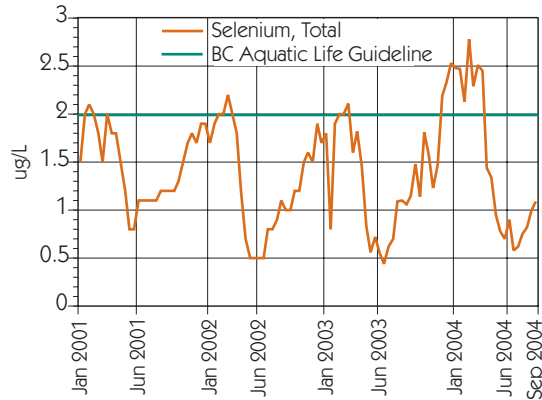


FIGURE 8
Total Selenium Concentration
in Myers Creek at the International Boundary



Index 65.3 in 2001–2003; 65.2 in 2002–2004

Main Attributes

Myers Creek is located in northern Washington State and southcentral British Columbia near Midway, British Columbia. Myers Creek flows north into British Columbia about 6 km south from Rock Creek and then turns east to flow into the Kettle River about 6 km upstream from Midway. Myers Creek drains 207 km² in Washington and about 90 km² in British Columbia. Myers Creek is used for drinking water, livestock watering and irrigation. Myers Creek has healthy populations of eastern brook and rainbow trout.

Main Influences

Forestry, agriculture and mining in Washington State are potential influences on the creek’s water quality.

Site-Specific Guidelines

Site-specific guidelines were developed for arsenic, cadmium, fluoride, selenium, sulphate, zinc, total dissolved nitrogen, phosphorus, pH and temperature. Measurements higher than site-specific guidelines are recorded for selenium, arsenic, sulphate, zinc, phosphorus and cadmium. These elevated levels are sometimes associated with high turbidity during spring freshet. A number of other variables (e.g., sulphate and selenium) appear to be naturally occurring in the creek.

Other Water Quality Concerns

None at this time. No environmentally significant trends have been identified in data collected from 1998–2002.



Environment Canada and BC Ministry of Environment have now established baseline water quality information at this site. Monitoring has been suspended and will recommence if new mining activities in the United States proceed.

OKANAGAN-SIMILKAMEEN BASIN SUMMARY

The **Okanagan** and **Similkameen** river basins are located in the middle southern part of British Columbia. The Okanagan Basin extends from just south of Shuswap Lake in the north, to the Okanagan Highlands in the east and the Similkameen Basin in the southwest. The Similkameen basin is bordered on the west by the Coast Range Mountains and joins the Okanagan River just south of the border at Oroville, Washington. The Okanagan River eventually joins with the Columbia River in the State of Washington at the "Big Bend". Two water quality stations on the **Similkameen River** and one on the **Okanagan River** are monitored for water quality. The two stations on the Similkameen are ranked as Good and the Okanagan River is ranked as Fair.

The main BC Ministry of Environment regional office is located in Penticton. If you have any questions on this Water Quality Report or want more information on other waterbodies in the region, please contact:

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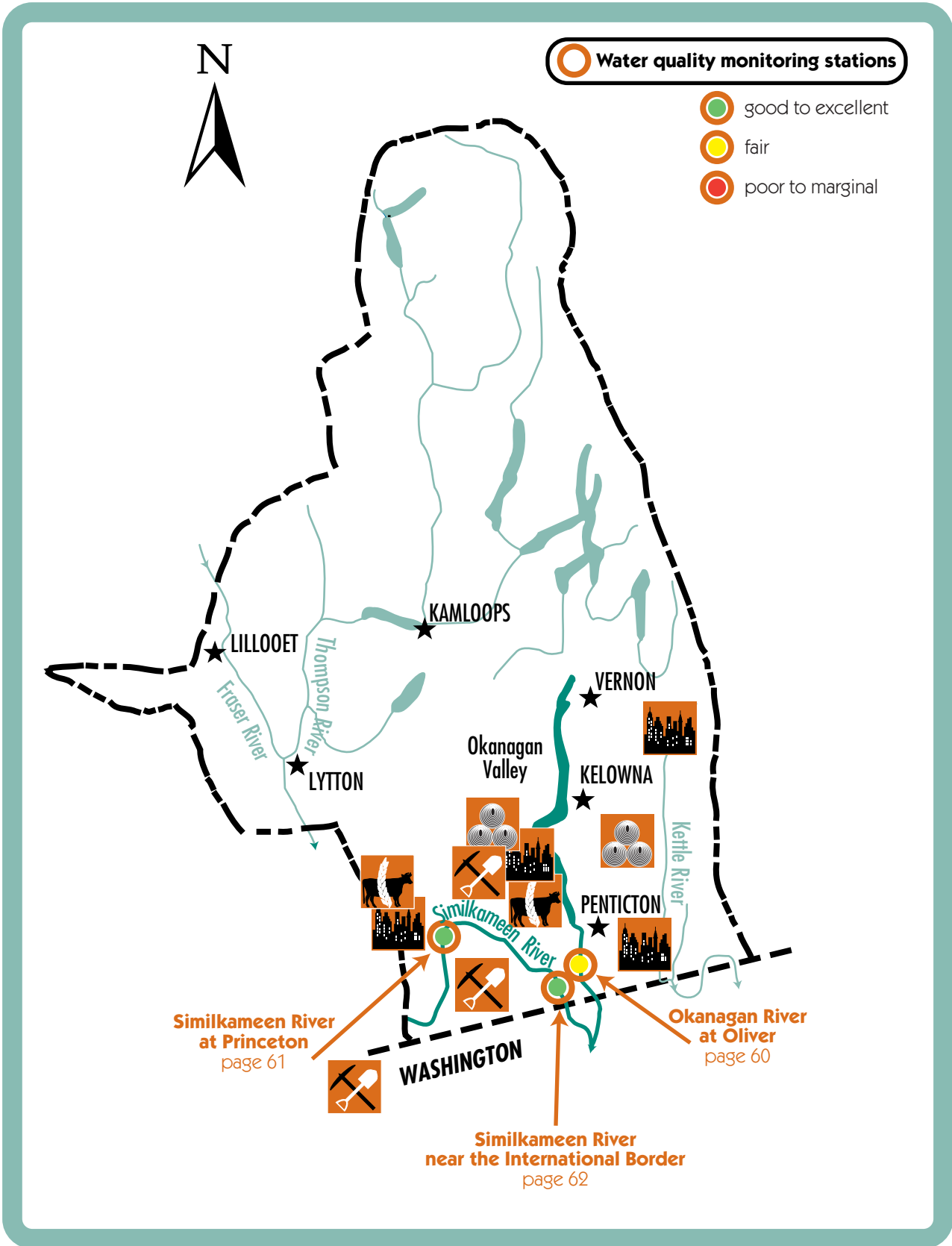
or

Andrea Ryan, Environment Canada

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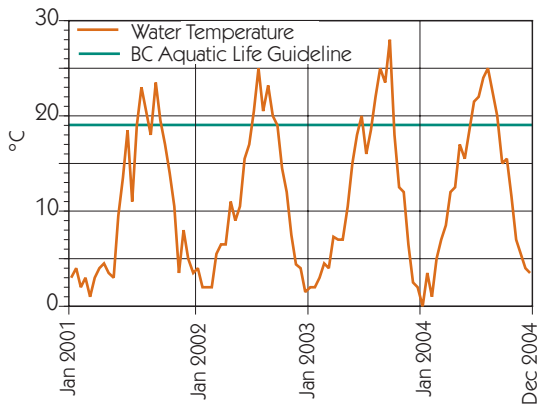
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Okanagan – Similkameen River Basin Summary

FIGURE 9
Water Temperature
in the Okanagan River at Oliver



Index 71.0 in 2001–2003; 70.8 in 2002–2004

Main Attributes

The Okanagan River drains about 8,000 km² into Washington State near Osoyoos. The Okanagan River and its chain of lakes is used for drinking water, irrigation, livestock watering, recreation such as swimming and supports significant aquatic life and wildlife populations.

Main Influences

The main influences on water quality include agriculture, municipal wastewater and stormwater discharges, septic tanks and tile fields, as well as forestry.

Site-Specific Guidelines

Site-specific guidelines were developed for cadmium, chloride, total dissolved nitrogen, total phosphorus, pH and temperature. Total phosphorus and water temperature often exceed site-specific guidelines while cadmium also exceeds site-specific guidelines on several occasions. Agriculture is the most likely source of these elevated levels. Flow regulation, channelization and removal of stream bank shade trees likely affect water temperatures. Higher water temperatures may limit use of the river by fish during the summer months, while elevated levels of phosphorus could contribute to the eutrophication of downstream Osoyoos Lake.

Other Water Quality Concerns

None at this time. No environmentally significant trends have been identified in the data collected from 1979–2002.



Monitoring by Environment Canada and BC Ministry of Environment will continue in the Okanagan River at Oliver, including air and water temperature measurements, to track any changes in the quality of the water flowing into Osoyoos Lake and Washington State.



Index 87.5 in 2001–2003 and 83.2 in 2002–2004

Main Attributes

The drainage area of the Similkameen River at Princeton is about 1,850 km². The river has its headwaters in Manning Park and is relatively undeveloped until just upstream of Princeton where an inactive copper mine is located.

Main Influences

The main influences on water quality include agriculture (such as cattle ranching), forestry and historic metal mining near Princeton.

Site-Specific Guidelines

Site-specific guidelines were developed for arsenic, chromium, copper, cyanide, iron, lead, manganese, molybdenum, nickel, zinc, total dissolved nitrogen, pH and temperature. Total copper and iron exceed site-specific guidelines on occasion during high flow/high turbidity periods (spring runoff/snowmelt), while water temperature exceeds the site-specific guideline once. Elevated turbidity levels are likely natural, although they may be increased by past and present upstream activities (including limited agriculture, ranching and historic mining). The high water temperature value occurred during a very hot period in the area.

The Similkameen River supports healthy populations of salmonids and other fish species. It is unlikely that they would be impacted by these short-term turbidity-driven metal exceedances.

Other Water Quality Concerns

Water quality data were assessed from 1966–2000 and no significant trends were noted. The 1996 BC Water Quality Status Report evaluated the water quality in the river to be Good.



Environment Canada and BC Ministry of Environment will continue to monitor the Similkameen River at Princeton to track trends in water quality.



Index 83.1 in 2001–2003; 82.7 in 2002–2004

Main Attributes

The Similkameen River drains about 9,200 km² of the Cascade Mountains and the Interior Plateau in British Columbia to the Okanogan River in Washington State, just downstream from Osoyoos Lake. The river is used for drinking, irrigation, livestock, industrial water supply and recreation. The Similkameen River also supports healthy populations of salmonids and a variety of other fish species.

Main Influences

Main influences on water quality include agriculture (both fruit farming and cattle ranching), metal mining near Princeton and Hedley, forestry and treated municipal waste water from Princeton and Keremeos.

Site-Specific Guidelines

Site-specific guidelines were developed for temperature and total dissolved nitrogen. In addition to these two guidelines, site-specific objectives had already been established by BC Ministry of Environment for arsenic, chromium, copper, cyanide, iron, lead, manganese, molybdenum, nickel, zinc and pH. Total copper, iron and manganese exceed site-specific objectives on occasion during high flow/high turbidity periods (spring runoff/snowmelt), while water temperatures exceed the site-specific guideline once. The metals values that exceed the objectives are primarily turbidity-related. Although elevated turbidity is natural in the river, it is likely exacerbated at this site by upstream activities such as mining (both historic and current), agriculture and ranching.

The Similkameen River supports healthy populations of salmonids and other fish species. It is unlikely that they would be impacted by these short-term turbidity-driven values in excess of site-specific objectives or guidelines.

Other Water Quality Concerns

None at this time that affect aquatic life. Water quality data were assessed from 1976–2000 and no significant trends were noted. The 1996 BC Water Quality Status Report evaluated the river as Good.



Environment Canada and BC Ministry of Environment will continue to monitor water quality in the Similkameen River near the International Boundary to determine whether there is need for remedial measures related to land use practices.

VANCOUVER ISLAND SUMMARY

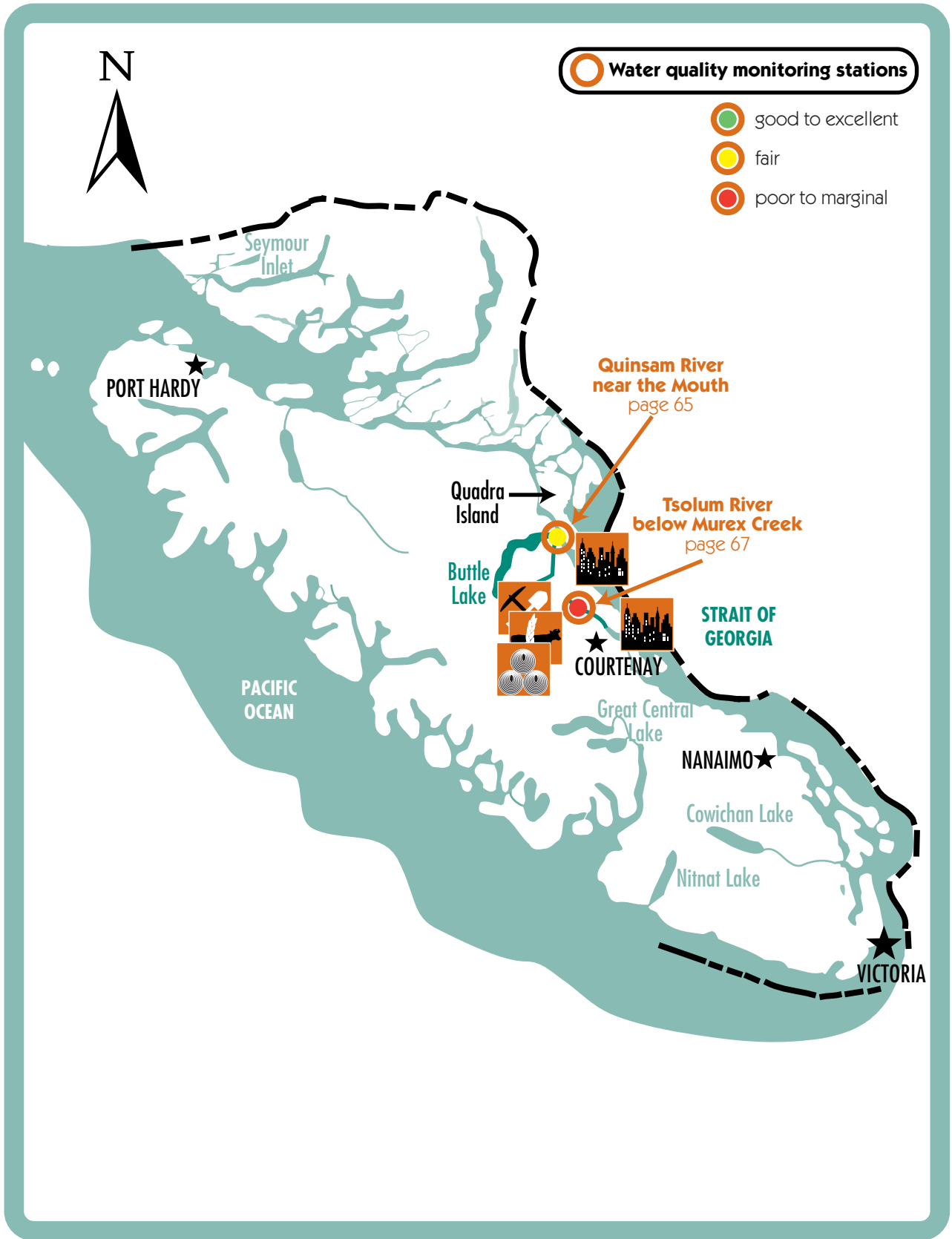
The **Vancouver Island Basin** area includes all of the watersheds on the island. Assessments of two rivers on the eastern side of the island are included in this report: the **Quinsam** and **Tsolum** rivers. The Quinsam River is assessed as Marginal to Fair and the Tsolum River is ranked as Marginal.

The main BC Ministry of Environment Regional Office is located in Nanaimo. If you have any questions on this Water Quality Report or want more information on other waterbodies in the region, please contact:

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Vancouver Island Summary



Index 64.4 in 2002–2003; 65.3 in 2002–2004

Main Attributes

The Quinsam River drains 280 km² of the east coast of Vancouver Island to the Campbell River, 3 km upstream from the Strait of Georgia. The Quinsam River is used for irrigation, recreation and as a water supply for a fish hatchery. The river supports a wide variety of wild salmonids, as well as salmonids raised at the Quinsam Fish Hatchery.

Main Influences

Influences on water quality include coal mining, a hydro-electrical dam, a fish hatchery and forestry.

Site-Specific Guidelines

Site-specific guidelines were developed for alkalinity, arsenic, copper, iron, lead, zinc, total dissolved nitrogen, total dissolved phosphorus, pH and temperature. Copper exceeds the site-specific guidelines only during turbid events while alkalinity, dissolved nitrogen and phosphorus exceed site-specific guidelines on occasion. Metals, nitrogen and phosphorus may be elevated due to upstream coal mining activities, although nutrients (nitrogen and phosphorus) may also be affected by the upstream fish hatchery or other residential or municipal activities in the lower watershed. Alkalinity is historically low in the watershed but may also be affected by coal mining (via acid-rock drainage), although the mine effluent is neutralized before release.

Metals that exceed site-specific guidelines are primarily turbidity-related, which can be natural or may be exacerbated by upstream coal mining. It is unlikely that there are impacts on aquatic life due to these short-term events. However, the elevated phosphorus and nitrogen levels could lead to nutrient enrichment of the river, contributing to plant growth and potentially affecting local aquatic life populations. Benthic macroinvertebrate assessments carried out at the site in 2001 and 2003 indicate that the community is severely stressed. The benthic macroinvertebrate community strongly deviated from what would be found at a less impacted site. More recent assessments indicate that the benthic macroinvertebrate community is improving from previous years. The benthic macroinvertebrate community in these assessments displays some characteristics of nutrient enrichment, indicating that the elevated nutrient levels in the river may be affecting aquatic life.

Other Water Quality Concerns

There are increasing trends in magnesium, sodium, sulphate, alkalinity and calcium at this site. These increases are likely indications of neutralized acid drainage, originating from the Quinsam coal mine.



The increasing concentrations in water quality variables at the mouth of the Quinsam River are well within the safe levels for all water uses. The sulphate levels upstream near the coal mine are much higher and may pose a risk to aquatic life, although no effects on aquatic life have been observed. There is no evidence to date of acidification of the waters near the mine. The 1996 BC Water Quality Status Report rated the water quality of Middle Quinsam Lake as Excellent and the Quinsam River as Good, using monitoring results collected to 1993.



Monitoring is continuing by Environment Canada and BC Ministry of Environment near the mine and at the mouth of the Quinsam River to track the trends in water quality.



Index 49.1 for 2001–2003

Main Attributes

The Tsolum River drains 258 km² of the east coast of Vancouver Island, joining the Puntledge River to form the Courtenay River, 1.5 km upstream from Comox Harbour on the Strait of Georgia. The river is used for irrigation, recreation and drinking water. The river has supported large populations of steelhead, rainbow and cutthroat trout as well as coho, pink and chum salmon in the past. However, there are virtually no escapements at present. Pink salmon are raised at the Tsolum River Hatchery on Headquarters Creek.

Main Influences

A number of human activities influence water quality in the Tsolum River basin to varying degrees. They include logging in the headwaters and upper watershed, road development, irrigation withdrawals and agriculture. The most significant impact on water quality is an abandoned mine on Mt. Washington. Copper is leaching from the mine via Pyrrhotite and Murex creeks, causing copper concentrations in the Tsolum River to exceed the site-specific objective developed by BC Ministry of Environment for the protection of aquatic life.

Site-Specific Guidelines

Site-specific guidelines were developed for aluminum, cadmium, copper, lead, pH, selenium, sulphate and zinc. There are frequent high copper values in excess of the site-specific guideline, aluminum values are regularly above the guideline and there are occasional high exceedances of cadmium. The stressor responsible is acid mine drainage from the abandoned copper mine on Mount Washington. The 2000 Water Quality Trends report identified a declining trend in copper levels in Pyrrhotite Creek at Branch 126. This trend was not detected at the stations farther downstream in Murex Creek and the Tsolum River, probably due to gaps in the copper data. In 1998, there was about a 50% decrease in copper loadings relative to the late 1980's. The provincial government spent \$1.5 million during the 1988–91 period to control acid mine drainage, by capping portions of the mine waste and diverting some of the surface water away from the mine.

Where guidelines are exceeded, there is a risk of adverse effects to aquatic life. However, the duration of exposure, which also determines the level of risk, was not determined. The high concentrations of copper have been shown to be toxic to fish and in the past had virtually eliminated the fish population throughout the river. Studies have shown that re-establishment of fisheries in the Tsolum River would require greater than a 95% decrease in copper loadings from the mine.

Other Water Quality Concerns

While the main water quality concern is copper, other concerns include low summer flows and elevated suspended solids during high flows.

The community-based Tsolum River Task Force was formed in 1997 to bring together various government and non-government organizations to increase community involvement in finding solutions to the Tsolum's water quality problems. This approach has resulted in a number of initiatives, including increased monitoring of flows and copper concentrations throughout the watershed. The Department of Fisheries and Oceans Canada has funded habitat restoration in the lower watershed. The Spectacle Wetland diversion in the upper watershed was constructed in 2003. This diversion will temporarily reduce copper levels in the lower watershed. Recent anecdotal reports of frog and fish observations indicate that efforts to restore the Tsolum may be showing positive results. Funding for major mine reclamation is not yet in place and continues to be pursued.



Environment Canada and BC Ministry of Environment in partnership with the Department of Fisheries and Oceans Canada will continue to monitor the Tsolum River below Murex Creek to track changes in water quality.

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