

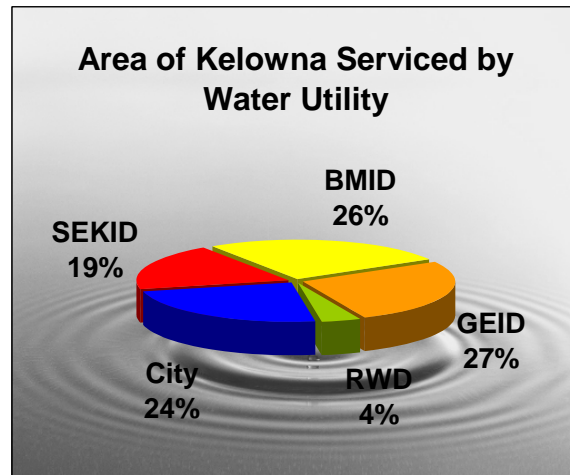
Drinking Water Quality

Why is it Important?

Water management issues center on the recognition that water is a precious resource relied upon by both people and nature. Okanagan Lake is the primary source of water for most activities in the valley.

The City water utility supplies drinking water to over 53,000 people from Okanagan Lake. Water is pumped from four pump houses, with Poplar Point supplying the largest percentage of water used. Other water purveyors servicing the rest of the City's population include the South East Kelowna Irrigation District, Black Mountain Irrigation District, Glenmore Ellison Improvement District and Rutland Water District; those sources include groundwater, watercourses, and upper watershed reservoirs.

To ensure water safety, the City of Kelowna water utility regularly tests the drinking water supplied to its customers. Water supplied by the City Water Utility complies with both the Provincial Drinking Water Regulations and Canadian Drinking Water Guidelines.

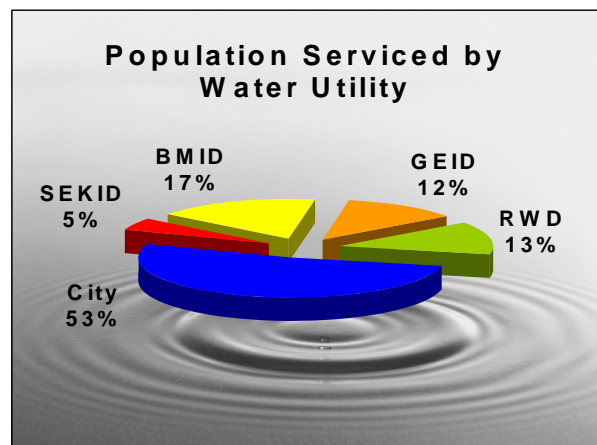


What is Being Done?

Drinking Water Monitoring

In 1991, the City implemented a drinking water quality program for its service area. This ensures the city complies with provincial and federal drinking water regulations and guidelines.

Provincial Drinking Water Protection Act: The focus of the program is to comply with the *Safe Drinking Water Regulation* amendment of the *Health Act*. This regulation requires that potable water be monitored monthly from one site per 1,000 capita (Health Act, 1992).



Water analysis includes: Total Coliform and E. Coli bacteria, free chlorine, total chlorine, taste, odour, UV-absorbency, colour, temperature and turbidity. City employees collect and analyze samples from over 75 locations within the distribution system. The number of sample sites varies according to seasonal operations of the water system.

Federal Health Guidelines:

Federal Health Guidelines for potable water state..."In general, drinking water should be sampled semi-annually for all chemical substances for which maximum acceptable concentrations have been set. If particular substances are consistently absent from a water supply, the frequency may be reduced, subject to the approval of the control agency." The guidelines also state; "If there is a reason to believe the presence of certain substances in a water supply, these substances should be sampled more frequently to ensure that their concentrations are below the acceptable limits."

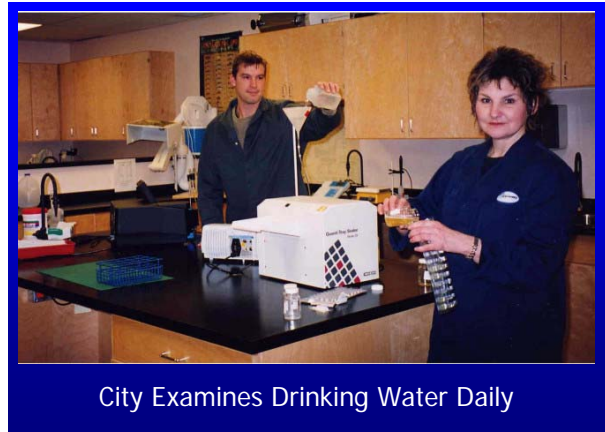
Drinking water sample sites include all four of the pump house intakes, as well as, reservoirs, booster stations, and selected sites within the distribution system.

General Water Analysis

Treated drinking water is examined for a variety of parameters. Nutrient analysis, conducted once per year for potable water, includes total nitrogen, total phosphorus, ammonia, nitrate, and nitrite. Ammonia analysis is performed daily, as a water quality indicator. General water chemistry includes free and total chlorine, taste, odour, colour, temperature, turbidity, hardness, pH, and UV-absorbency.

In addition to the general water analysis and nutrient tests, the City also sends drinking water samples to private certified labs to test:

- ◆ Dissolved and heavy metals (annually)
- ◆ Trihalomethanes (THM) and Halocetic Acids (HAA) (quarterly)
- ◆ Pesticides and herbicides (every three years).
- ◆ E.Coli and Total Coliform (20-30 samples/month)
- ◆ Radiological constituents (annually)



Microbiological Sampling

Daily microbiological testing occurs at the primary pumphouses on both raw and treated water. The results help to determine the amount of chlorine necessary for disinfection. Microbiological testing is also performed monthly in the reservoirs, booster stations and sampling sites throughout the system.

Treated Water

The Health Guidelines for treated waters sets limits for several microbiological parameters.

- ◆ Cryptosporidium <10 to 30 viable oocysts per 100L and Giardia <3 – 5 viable cysts per 100 L
- ◆ Coliform bacteria limit is <10 CFU/100 ml and none of which should be fecal
- ◆ E. coli bacteria limit is 0 CFU/100 ml

WHAT ARE COLIFORMS?

The term **total coliform** includes bacteria naturally found in soil and decaying vegetation, as well as fecal coliforms.

E. coli is one of the main species of bacteria that live in the lower intestines of warm blooded animals. Its presence in water is a common indicator of fecal contamination.

Analysis of treated water indicates that the City of Kelowna's potable water complies with the microbiological parameters set by the Health Guidelines.

Raw Water

Analysis of the deep raw water intakes has been available since September 1999, with physical parameters showing improved water quality over the shallower intakes. Continued monitoring will indicate general trends for microbiological parameters and the effect of the lake's seasonal mixing.

Sample Collection

On-line monitoring equipment installed at the Poplar Point, Eldorado, Cedar Creek and the Swick Road pump houses provides continuous raw water data for turbidity, pH, and temperature.

City employees collect additional samples from raw and treated water. Analysis includes tests on raw lines and on the treated lines several times a week. This data compares the online monitoring equipment with lab results to insure that disinfection has occurred. City staff adjusts the frequency of sampling to reflect seasonal operation changes.

Results and Trends

Physical and Chemical

Temperature

Seasonal changes to temperature in the water column can affect lake behaviour and influence water quality. Warm water is less dense than cold water and warm water will rise above the colder layers. This effect can lead to the establishment of a seasonal thermocline which acts as an impediment to the exchange of water from top to bottom. In other words, mixing throughout the water column is reduced, currents may become restricted to the layers above and below the thermocline, and water quality may be adversely affected by the lack of turbulent exchange.

WHAT IS A THERMOCLINE?

Thermocline is a rapid change in the temperature of water as you move from the surface to deeper levels within a body of water.

Each sample sites are represented by a monthly average of approximately 6500 data points per site per month obtained by the on-line monitoring system. The data establishes two clear trends in temperature behaviour:

1. Seasonal temperature changes affect water temperatures.
2. Deeper water intakes experience less seasonal change in water temperature (deep water intake samples were not taken after 2001)

Treated water temperature varies with the changes in seasonal ambient temperatures. The temperature of distribution systems water has remained below the Canadian Drinking Water Guidelines; however, in July and August of 2004 and 2005, temperatures did exceed 15°C. Water samples are collected from multiple sites throughout the distribution system by City staff, including pump stations, lake intakes, sample stations, booster stations, and reservoirs. The number of sample sites collected varies according to seasonal operation of the water system but the minimum number of sites is sixty.

Turbidity

Turbidity of water is an effective determinant of the condition and productivity of a water system. Suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, and plankton or other microscopic organisms can cause turbidity in water.

Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample.

Measuring turbidity is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions; the higher the intensity of scattered light, the higher the turbidity. Turbidity has improved through increased maintenance, reservoir cleaning, disinfecting, flushing of water mains, and installation of a new intake at Cedar Creek.

There are three clear trends in turbidity:

1. The water sources are consistently well below the Canadian maximum acceptable turbidity limit of 5.0 NTU for raw (untreated) water.
2. There is a seasonal increase in turbidity, likely resulting from spring run-off and increased productivity in the shallow zones during warmer seasons.
3. Deeper water intakes experience less seasonal change in water turbidity; likely due to the temperature stratification noted above.

On-line monitoring of the deep intake raw water turbidity no longer takes place. The City continues to monitor raw water to each of the pump stations and this information will continue to provide information on turbidity changes in the lake. Seasonal mixing and other annual trends, such as the apparent seasonal 'turn-over' of lake water during December through April also occurs.

The *Cryptosporidium parvum* and *Giardia lamblia* sampling is triggered by deviations in raw water turbidity at intake locations.

Treated water turbidity varies slightly and demonstrates consistent compliance with the Interior Health Authority's requirements as well as the Canadian Drinking Water Guidelines. Water samples collected from numerous sites randomly selected throughout the distribution system, including pump stations, lake intakes, sampling stations, booster stations, and reservoirs, provide a greater degree of statistical confidence. The number of sample sites collected varies according to seasonal operation of the water system but the minimum number is sixty.

Dissolved and Heavy Metals

Health Canada metals scans indicate that the City of Kelowna meets and exceeds the Health Canada Guidelines.



FACT:
The peak concentration of cryptosporidium was found in October 1996 at Okaview #1 with 335 oocysts/100 litres.

Pesticide Scans

None of the sixty-seven pesticide parameters monitored have been detected in any of the samples collected from Okanagan Lake in 2005. These results are consistent with data collected from previous years. Detailed numerical data are available in the monthly *City of Kelowna--Water Quality Reports*.

Note: Detectable limits range between 0.05 and 0.25 parts per billion.

Trihalomethanes

Chlorination of water may produce disinfection by-products, with one of them being Trihalomethanes (THM). A stringent limit of 100 µg/L (parts per billion) for total THM in drinking water is set because of carcinogenicity in laboratory animals. This maximum contaminant level considers both the risk from a lifetime of exposure and the status of current technology to meet the standard without unreasonable cost. Consequently, the standard balances public health considerations with the feasibility of meeting the approval limit in public water systems. Trihalomethane scans indicate that the City of Kelowna's potable water is well below the limit of 100 parts per billion, set in the Federal Health Guidelines.

Haloacetic Acids

Haloacetic acids (HAA's) are another disinfection by-product that the City of Kelowna monitors for in drinking water. Currently the guidelines for HAA's are in the consultation stage. Analysis for HAA's began in 2004 and the levels of HAA's in the drinking water are well below the proposed guidelines.

Water Quality Deviation Response Procedure

The Kelowna Joint Water Committee (KJWC), in co-operation with the Interior Health Authority (IHA), has developed a *Water Quality Response Guide* for adoption by all water purveyors in the City of Kelowna. This guide includes response and communication plans used by all water purveyors when water quality results deviate from the acceptable levels defined by the IHA. Each of the water purveyors will employ specific response procedures to varying degrees of water quality degradation.

For more information about the City of Kelowna's Water Division, the Water Utility, or the *Operations Water Quality Deviation Response Procedure*, call the Wastewater Treatment Facility at (250)469-8502.

WHAT IS CRYPTOSPORIDIUM?

Cryptosporidium is an infectious, hardy **ooocyst** that causes Cryptosporidiosis—an illness characterised by diarrhoea and cramping. A **cyst** is a protective, dormant structure formed by some microorganisms called protozoa. The **ooocyst** is the sexual stage of many protozoa, especially Sporozoa (Butler & Mayfield, 1996).