Tsulquate River Community Watershed
Water Quality Objectives Attainment Report

Environmental Quality Section
Environmental Protection Division
West Coast Region

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Report Prepared by: Clayton Smith.

Approved by _____

Date Approved _____

Executive Summary

Water Quality Objectives (WQOs) were approved for the Tsulquate River in 2009 (Epps and Phippen, 2009) based on data collected between June 2002 and May 2005. The Tsulquate River is the source of drinking water for the community of Port Hardy. WQO attainment monitoring occurred during summer low flow and fall flush periods in 2009. Grab samples were also collected in September 2006 as part of the MOE's benthic invertebrate sampling program. Water quality data from 2005 to 2009, along with changes that have occurred in the watershed between 2005 and 2012, are presented in this report. Data showed that the water quality objectives for fecal coliform bacteria, *Escherichia coli,* and total suspended solids were exceeded during the summer sampling event; with no exceedances observed in the fall sampling period. The higher summer values coincided with a first flush rainfall event on September 9, 2009. In order to get the best representation of summer low flow and first flush events in future monitoring, it is recommended that summer sampling be completed by mid-August, and that the start of fall sampling be determined by assessing the long-range weather forecast in order to choose the first period where significant persistent rain is predicted.

Introduction

As part of the Province of British Columbia MOE's mandate to manage water bodies, water quality objective reports have been created for a number of lakes, rivers and marine surface waters. These reports provide a list of objectives to protect water quality that are tailored to the specific water body for which they have been created, taking into account natural local water quality, water uses, water movement, and waste discharges. While the water quality objectives currently have no legal standing, they can direct resource managers aiming to protect the water body in question and are used as a standard against which to measure the water quality of that water body. Once objectives have been developed, periodic monitoring (every three to five years) is undertaken to determine whether they are being met (attainment monitoring).

The Tsulquate River watershed (Figure 1) is the source of drinking water for the community of Port Hardy, British Columbia, located on the north east side of Vancouver Island. Objectives were approved for the Tsulquate River in 2009, based on data that were collected between 2002 and 2005. Some data collection occurred between 2005 and 2007, and attainment monitoring occurred from August to November 2009. This report summarizes these data.

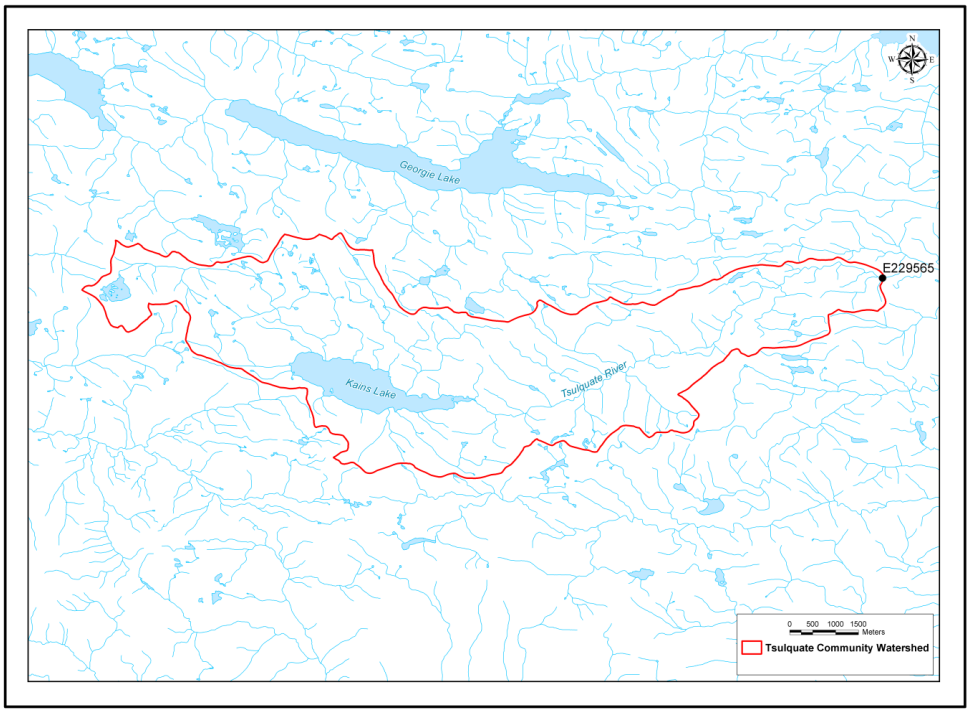

Figure 1. Map of the Tsulquate watershed indicating sample site E229565.

Changes in the Watershed since Objectives Development

The following notable activities have occurred in the watershed since 2005.

- Phase I of the Cape Scott Wind Farm project was approved (March 2012). This project will increase traffic on the road to Holberg, which passes through the Tsulquate watershed. In preparation for the increased road traffic, two undersized culverts were replaced on the road in early 2011 (Dugas, pers comm. 2012). A transmission line between Port Hardy and the Cape Scott Wind Farm, which will cross the Tsulquate River, is also being built. The line will be installed below the drinking water intake and thus will not have an effect on drinking water quality.
- Timber harvesting occurred in the south east corner of the watershed in 2011. Due to the distance of the harvesting from the main stem of the river no foreseeable impacts to water quality are expected (Dugas, pers comm. 2012).

Sampling and Analytical Methods

One water quality site was sampled from August through November 2009 following recommendations in the 2009 WQO report (Table 1). Benthic invertebrate sampling took place in September 2006 by MOE staff, as per Canadian Aquatic Biomonitoring Network protocols; however, only the water quality data (not benthic invertebrate data) from this sampling are

presented in this report. One grab sample that was collected in June 2005 was not included in the 2009 WQOs report; therefore, the sample is included in this WQO attainment report.

For the two attainment sampling periods, five weekly samples were collected over 30 days (5-in-30 sampling) to calculate 30-day averages and 90th percentiles. Summer low flow sampling occurred August 13 to September 9, 2009 and fall flush sampling occurred from October 7 to November 12, 2009. Samples were collected by EPCOR Port Hardy staff and sent for analysis at Maxxam Analytics Ltd. in Burnaby B.C, with the exception of bacteriological samples which were sent to Cantest Labs. The samples obtained during the September 9, 2009 sampling event were not shipped with ice, which may have affected the sample results on that date. All data are summarized in the Appendix.

Table 1. Water quality sampling program as recommended in the 2009 WQO report.

Site Name	EMS ID	Parameters measured	Description
Tsulquate River at Water Intake	E229565	Turbidity, pH, true colour, total suspended solids, total organic carbon, *E. coli*, fecal coliform, total and dissolved metals, hardness, chlorophyll a, specific conductivity, UV absorbance	Tsulquate River, upstream from the main water intake

Objectives Attainment

A list of the water quality objectives for Tsulquate River along with a summary of the exceedances observed from the attainment monitoring are presented in Table 2. Of the parameters measured, only those that exceed the Tsulquate River water quality objectives will be discussed in this report.

Table 2. Water quality objectives and attainment information. "Y" indicates objectives were met, "N" indicates objectives were not met.

Parameter	Objective	Tsulquate River Summer 2009	Tsulquate River Fall 2009
Fecal Coliform Bacteria	≤ 60 CFU/100 ml (90th percentile)	N	Y
Escherichia coli	≤ 60 CFU/100 ml (90th percentile)	N	Y
Turbidity	2 NTU (average)	Y	Y
	5 NTU (maximum)	Y	Y
pH	6.0-8.5 pH units	Y	Y
True Colour	≤ 108 TCU (average)	Y	Y
Total Suspended Solids	26 mg/L (maximum in a 24-hour period)	N	Y
	6 mg/L (average)	N	Y
Total Organic Carbon	≤ 12 mg/L (average)	Y	Y

*all calculations for 90th percentiles and averages are based on 5-in-30 sampling

Data showed that the water quality objectives for fecal coliform bacteria, *E. coli*, and total suspended solids were not met during the summer sampling event (Table 3). However, on the September 9, 2009 sample date, 33.8mm of rain fell; this was preceded by prolonged dry weather (Environment Canada, 2012) and could be considered the initial fall flush event, despite that it occurred in September. The 90th percentile value for both fecal coliforms and *E. coli* were exceeded during the summer sampling event (Table 3). With little to no human activity in the watershed when attainment monitoring took place, these results likely represent natural conditions. However, these results indicate the continued need for water purveyors to provide adequate treatment prior to consumption.

All objectives were met during the fall sampling period.

Table 3. Attainment monitoring grab sample results showing parameters in exceedence of Objectives for the Tsulquate River sample site. Shaded values indicate exceedences.

Sample Date	Fecal Coliform (CFU/100mL)	*E. Coli* (CFU/100mL)	Total Suspended Solids (mg/L)	Total Organic Carbon (mg/L)
Summer				
2009-08-13	9	5	< 1	4.4
2009-08-19	7	6	< 1	4.3
2009-08-26	30	14	< 1	4.2
2009-08-26	no duplicate	no duplicate	< 1	4.2
2009-09-02	16	8	< 1	2.7
2009-09-09	310	300	58	20.2
90th percentile	198	186		12.3
average	74	67	11	6.7
max	310	14	58	20.2
Fall				
2009-10-07	2	2	< 1	6.0
2009-10-21	7	6	< 1	7.4
2009-10-28	3	3	< 1	8.0
2009-11-04	6	5	< 1	6.8
2009-11-12	2	2	< 1	6.9
90th percentile	7	6		7.8
average	4	4	1	7.0
max	7	6	1	8.0

Summary and Recommendations

Attainment monitoring indicated that the water quality in the Tsulquate River is generally good. The exceedences observed were directly linked with a first flush precipitation event. Large persistent rain events often occur earlier in the late summer and early fall in northern regions of Vancouver Island compared with southern regions, as seen in the 2009 attainment monitoring period. These early rain storms can flush sediment and contaminants into the river, especially if they occur after an extended dry period. As such, it is recommended that the summer low-flow sampling be completed by mid-August, and that the start of the fall sampling be determined by analyzing the long-range weather forecast and choosing the first period where significant and persistent rain is predicted for that year. Also, it is recommended that water temperature data be collected during the next attainment monitoring period. In order to reduce the chances of vehicle accidents and spills in the watershed, it is suggested that speed limits be enforced and that road users be encouraged to use radio communication while driving on the Holberg road.

References

Dugas, D. 2012. Personal communication. Acting Site Manager. Epcor Water Services Inc. Port Hardy, B.C.

Epps, D. and Phippen, B. 2009. Water quality assessment and objectives for the Tsulquate River Community Watershed: technical report. British Columbia Ministry of Environment. Victoria, B.C. Available online at: http://www.env.gov.bc.ca/wat/wq/wq_objectives.html

Environment Canada. 2012. National Climate and Data Information Archive. http://www.climate.weatheroffice.gc.ca/Welcome_e.html. Accessed on October 17, 2012.

Appendix

Table 4. Summary statistics for grab samples taken at the Tsulquate River sample site from June 2005 to November 2009. Shaded cells indicate values below minimum detection limits.

Location Name	E229565 TSULQUATE RIVER AT WATER INTAKE				
Parameter	Min	Max	Average	Standard Deviation	Number of Samples
Ag-D (mg/L)	0.000005	0.000005	0.000005	0	3
Ag-T (mg/L)	0.000005	0.00002	0.000008	6.7082E-06	5
Al-D (mg/L)	0.0561	0.118	0.077666667	0.034957736	3
Al-T (mg/L)	0.0521	0.116	0.07184	0.025989479	5
As-D (mg/L)	0.00006	0.00006	0.00006	0	3
As-T (mg/L)	0.00002	0.0001	0.000056	3.04959E-05	5
B--D (mg/L)	0.05	0.05	0.05	8.49837E-18	3
B--T (mg/L)	0.05	0.05	0.05	0	4
Ba-D (mg/L)	0.00063	0.00068	0.00066	2.64575E-05	3
Ba-T (mg/L)	0.00055	0.00156	0.000856	0.000410037	5
Be-D (mg/L)	0.00001	0.00001	0.00001	0	3
Be-T (mg/L)	0.00001	0.00002	0.000012	4.47214E-06	5
Bi-D (mg/L)	0.000005	0.000005	0.000005	0	3
Bi-T (mg/L)	0.000005	0.00002	0.000008	6.7082E-06	5
Ca-D (mg/L)	1.99	2.74	2.406666667	0.381881308	3
Ca-T (mg/L)	1.93	2.61	2.243333333	0.343122913	3
Cd-D (mg/L)	0.000005	0.000005	0.000005	0	3
Cd-T (mg/L)	0.000005	0.00001	0.0000066	2.30217E-06	5
Co-D (mg/L)	0.000025	0.000035	2.83333E-05	5.7735E-06	3
Co-T (mg/L)	0.000027	0.000066	0.0000402	1.53525E-05	5
Cr-D (mg/L)	0.0001	0.0002	0.000133333	5.7735E-05	3
Cr-T (mg/L)	0.0001	0.0002	0.00014	5.47723E-05	5
Cu-D (mg/L)	0.00246	0.00334	0.002953333	0.000449592	3
Cu-T (mg/L)	0.00062	0.00416	0.002258	0.001453485	5
Li-D (mg/L)	0.0005	0.0005	0.0005	0	3
Li-T (mg/L)	0.00014	0.0005	0.000428	0.000160997	5
Mg-D (mg/L)	0.49	0.62	0.546666667	0.066583281	3
Mg-T (mg/L)	0.47	0.64	0.5525	0.085	4
Mn-D (mg/L)	0.00191	0.00416	0.003166667	0.001147882	3
Mn-T (mg/L)	0.00201	0.00515	0.00379	0.001314059	5
Mo-D (mg/L)	0.00005	0.00005	0.00005	0	3
Mo-T (mg/L)	0.00005	0.00005	0.00005	0	5
Ni-D (mg/L)	0.00011	0.00017	0.000143333	3.05505E-05	3
Ni-T (mg/L)	0.00012	0.00022	0.000178	4.86826E-05	5
P--T (mg/L)	0.002	0.009	0.0035	0.002738613	6

Location Name	E229565 TSULQUATE RIVER AT WATER INTAKE				
Parameter	Min	Max	Average	Standard Deviation	Number of Samples
Pb-D (mg/L)	0.00005	0.000128	9.43333E-05	4.00791E-05	3
Pb-T (mg/L)	0.00003	0.000371	0.0001532	0.000129533	5
Sb-D (mg/L)	0.00002	0.00002	0.00002	0	3
Sb-T (mg/L)	0.000005	0.00002	0.000017	6.7082E-06	5
Se-D (mg/L)	0.00004	0.00004	0.00004	0	3
Se-T (mg/L)	0.00004	0.0002	0.000072	7.15542E-05	5
Sn-D (mg/L)	0.00001	0.00001	0.00001	0	3
Sn-T (mg/L)	0.00001	0.00006	0.00002	2.23607E-05	5
Sr-D (mg/L)	0.00551	0.00718	0.006453333	0.000855823	3
Sr-T (mg/L)	0.00485	0.00831	0.006712	0.001462129	5
Tl-D (mg/L)	0.000002	0.000002	0.000002	0	3
Tl-T (mg/L)	0.000002	0.000002	0.000002	0	5
U--D (mg/L)	0.000002	0.000004	2.66667E-06	1.1547E-06	3
U--T (mg/L)	0.000002	0.000004	0.0000028	8.3666E-07	5
V--D (mg/L)	0.0002	0.0004	0.0003	0.0001	3
V--T (mg/L)	0.00019	0.0004	0.000278	8.61394E-05	5
Zn-D (mg/L)	0.0005	0.0014	0.000966667	0.000450925	3
Zn-T (mg/L)	0.0002	0.0026	0.00128	0.000962808	5
Ammonia Dissolved (mg/L)	0.005	0.005	0.005	0	2
Carbon Dissolved Organic (mg/L)	3	20	6.908333333	4.375023809	12
Carbon Total Organic (mg/L)	2.7	20.2	6.530769231	4.396093837	13
Chlorophyll A (mg/L)	0.001	0.001	0.001		1
Color True (Col.unit)	5	70	38.07692308	19.74192467	13
E. Coli (CFU/100mL)	1	300	32	88.95841725	11
Fecal Coliform (CFU/100mL)	2	310	35.90909091	91.27590541	11
Hardness Total (D) (mg/L)	7	9.4	8.266666667	1.205542755	3
Hardness Total (T) (mg/L)	6.8	9	7.766666667	1.12398102	3
Nitrate (NO3) Dissolved (mg/L)	0.002	0.04	0.012	0.015336232	6
Nitrate + Nitrite Diss. (mg/L)	0.003	0.04	0.012166667	0.014455679	6
Nitrogen (Kjel.) Tot Diss (mg/L)	0.1	0.1	0.1		1
Nitrogen - Nitrite Diss. (mg/L)	0.002	0.008	0.003	0.00244949	6
Nitrogen Organic-Total (mg/L)	0.08	0.1	0.09	0.014142136	2
Nitrogen Total (mg/L)	0.1	0.12	0.11	0.014142136	2
Nitrogen Total Dissolved (mg/L)	0.106	0.106	0.106		1

Location Name	E229565 TSULQUATE RIVER AT WATER INTAKE				
Parameter	Min	Max	Average	Standard Deviation	Number of Samples
N.Kjel:T (mg/L)	0.08	0.08	0.08		1
NO2+NO3 (mg/L)	0.04	0.04	0.04		1
Ortho-Phosphate Dissolved (mg/L)	0.001	0.001	0.001	0	2
pH (pH units)	6.1	7.6	7.021428571	0.394536869	14
Phosphorus Tot. Dissolved (mg/L)	0.002	0.002	0.002		1
Residue Total (mg/L)	27	27	27		1
Residue Filterable 1.0u (mg/L)	26	26	26		1
Residue Non-filterable (mg/L)	1	58	5.615384615	15.76144273	13
Specific Conductance (uS/cm)	18	27	23	4.582575695	3
Turbidity (NTU)	0.3	2.8	0.964285714	0.70011773	14
UV Absorbance 250nm (AU/cm)	0.27	0.27	0.27		1
UV Absorbance 254nm (AU/cm)	0.27	0.27	0.27		1
UV Absorbance 310nm (AU/cm)	0.13	0.13	0.13		1
UV Absorbance 340nm (AU/cm)	0.08	0.08	0.08		1
UV Absorbance 360nm (AU/cm)	0.06	0.06	0.06		1
UV Absorbance 365nm (AU/cm)	0.06	0.06	0.06		1