1C. Groundwater Quality — Chloride

Target: Drinking Water below the Maximum Contaminant Level (MCL)

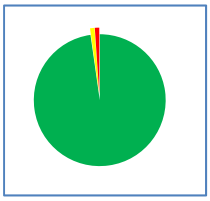
About this indicator: Chloride is one of three parameters selected as an indicator of groundwater quality because it can affect potability and may act as a conservative tracer of human activities. The secondary standard for chloride is over 250 mg/L (mg/L).

Influencing factors: Pumping wells in aquifers that are hydraulically connected to the Puget Sound can cause salt water intrusion into the aquifer. Chloride is also concentrated in animal urine and concentrations of animals (human or otherwise) have the potential to elevate the chloride levels in groundwater.

2010 Target: Groundwater quality meets drinking water quality standards (test results are below the MCL).

2010 Finding:

1 sites above MCL is no longer being used for drinking water



2010 Status: One of the 90 sites had results above the drinking water standard (MCL of 250 mg/L). One additional site has a result value between 100 to 250 mg/L or half of the MCL up to the MCL. The remaining 88 locations had results values below 100 mg/L. Chloride data from 90 locations (55 public water sources and 35 long-term monitoring sites) was accessed and the maximum result values from 1990 to 2010 are presented in Figure 1.

Other Drinking Water Standards: The United States Environmental Protection Agency sets drinking water standards and MCL's for over 95 parameters including microorganisms, disinfectants & their byproducts, inorganic chemicals, organic chemicals and radionuclide's.

Review of the public drinking water source data for Group A water systems available from the Washington Department of Health Drinking Water Program from 2008 to 2010 found no value above the MCL for the other 92 regulated parameters.

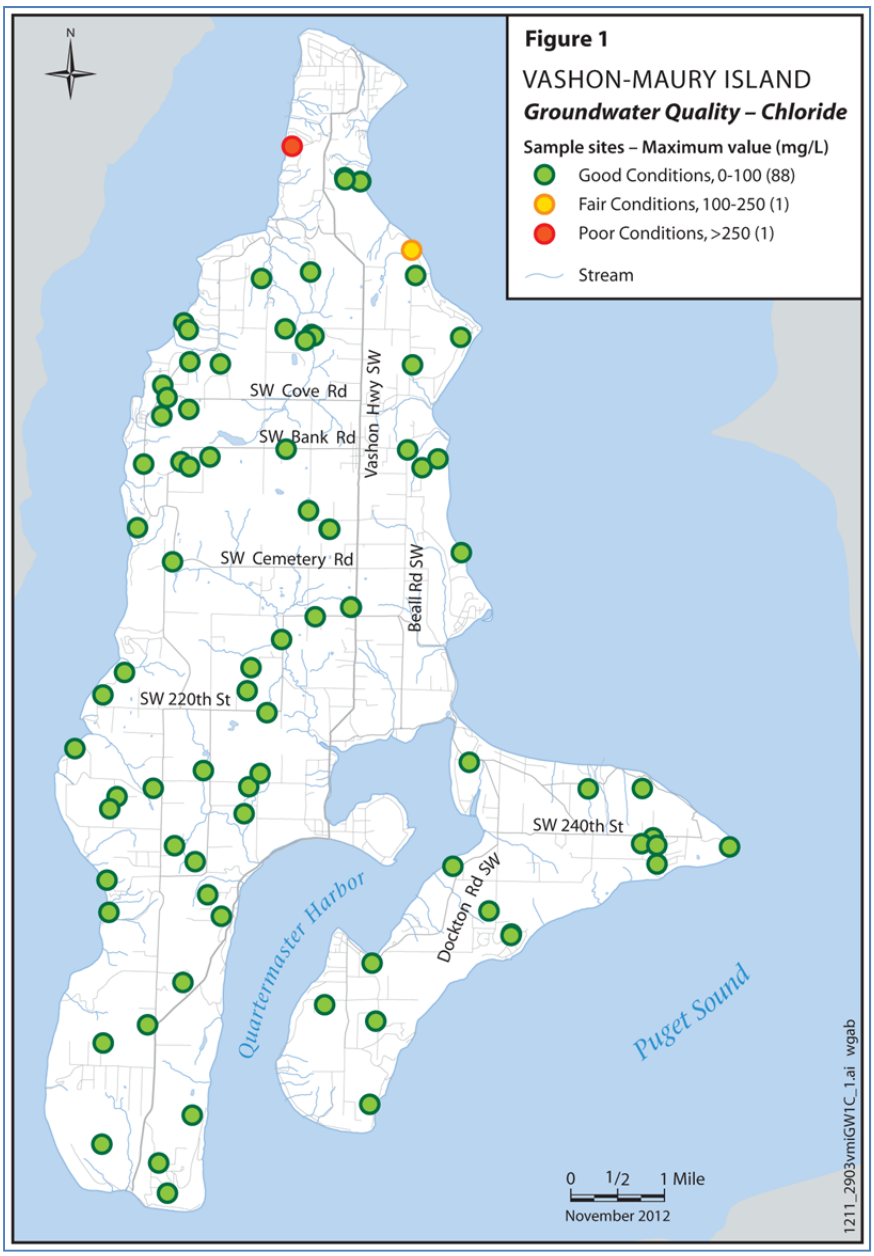


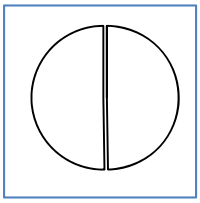
Figure 1. Maximum chloride results from 1990 to 2010 for 90 locations. One site had sample results are above the MCL of 250 mg/L. This location is no longer active. One additional result is between 100 – 250 mg/L while the remaining 88 sites have result values below 100 mg/L.

Trend Target: For locations with more than 10 years of water quality samples, new data will be compared to the baseline period to evaluate changes through time. Water quality changes that would trigger further evaluation were defined in the Vashon-Maury Island Ground Water Management Plan management strategies as:

1. Any increase in the sampled contaminates level greater than 10% over the baseline for two or more years;
2. Any trend that increases from zero to one quarter of the MCL or reaches one half the MCL limit.

Trend Finding:

Reported data has too short a period of record to complete an analysis;



Trend Status: Baseline assessment was not done due to insufficient data. No site has more than 10 years of chloride data. Fifteen sites have 10 years and two additional sites have eight years of data.

Recent Status: No apparent recent change in concentration in sites monitored on a regular basis, Figure 3.

Technical Notes: Chloride in Groundwater

Data source: The data for this indicator comes from multiple sources including VMI water purveyors, King County WLRD Groundwater Protection Program, Public Health - Seattle & King County Drinking Water Program, and Washington State Department of Health Office of Drinking Water.

Collection frequency: King County has been monitoring chloride concentrations annually on Vashon-Maury Island since 2001 and has monitoring data from 35 locations. Department of Health – local and state require chloride testing of public water system sources. Department of Health reported chloride data from 55 public water sources.

Methods for analysis: Each result is compared to the drinking water standard. Baseline assessment was not done due to insufficient data. No site has more than 10 years of chloride data. Fifteen sites have 10 years of data and Figure 3 shows the results for some of these sites.

Data Reliability and Quality: The data quality of this indicator is high based on SAP/SOP of sample collection. The reliability is fair to good. Data reliability from the sources can and does vary. King County has monitored 35 locations for chloride which is represents about 4% of the over 1000 wells on VMI. Department of Health reported chloride data from 55 public water sources which are 28% of the island's 200 public water sources.

Data Gaps: Collection of historic monitoring data directly from the public water purveyors might expand the data set sufficiently to permit extended trend analysis for many of the 71 public water sources.

Data Reference:

King County - Water Resources Evaluation Project – Data Report 2005-2009.
http://www.kingcounty.gov/environment/waterandland/groundwater/management-areas/vashon-maury-island-gwma/vashon-island.aspx

Washington State Department of Health – Sentry - database of public water systems (1990-2010).
https://fortress.wa.gov/doh/eh/portal/odw/si/Intro.aspx

Washington Administrative Code (WAC) — 173-200 Water quality standards for groundwater

Nitrate (1A) and Arsenic (1B) were selected for the other groundwater quality indicator parameters.

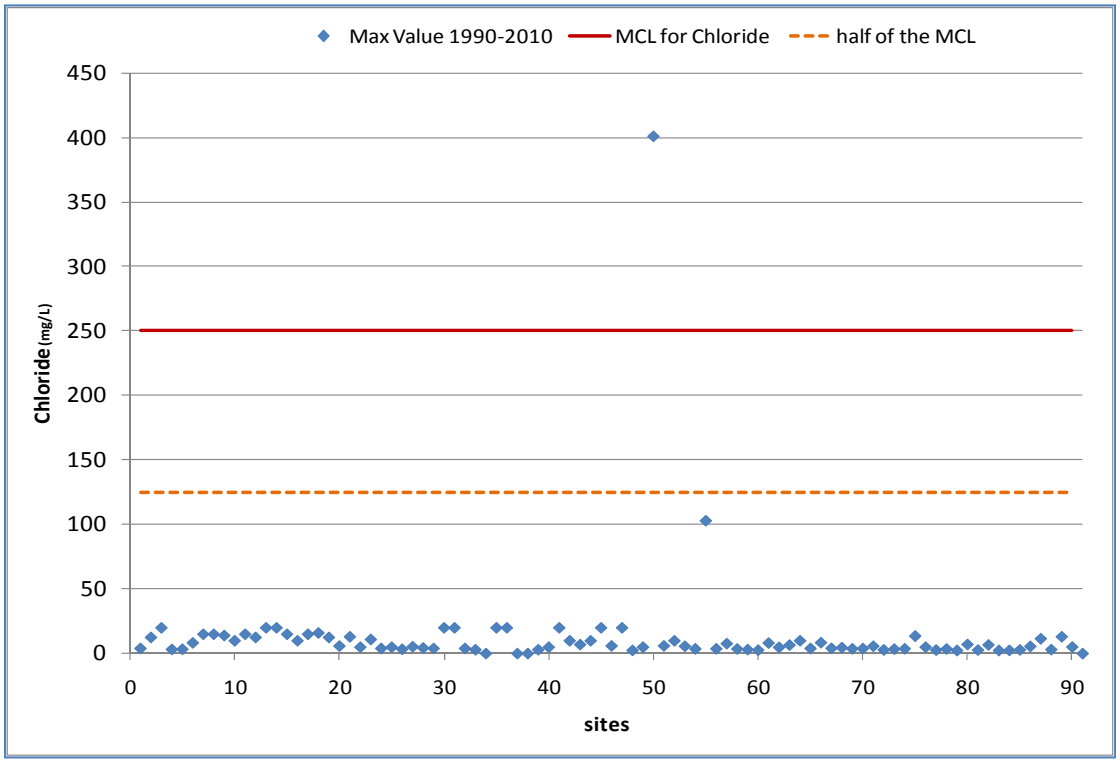


Figure 2. Maximum chloride concentration for each site from 1990 to 2010. The maximum contaminant level (MCL) for chloride is 250 mg/L. The one site with exceedance is a public water system source that is no longer being used for drinking water purposes.

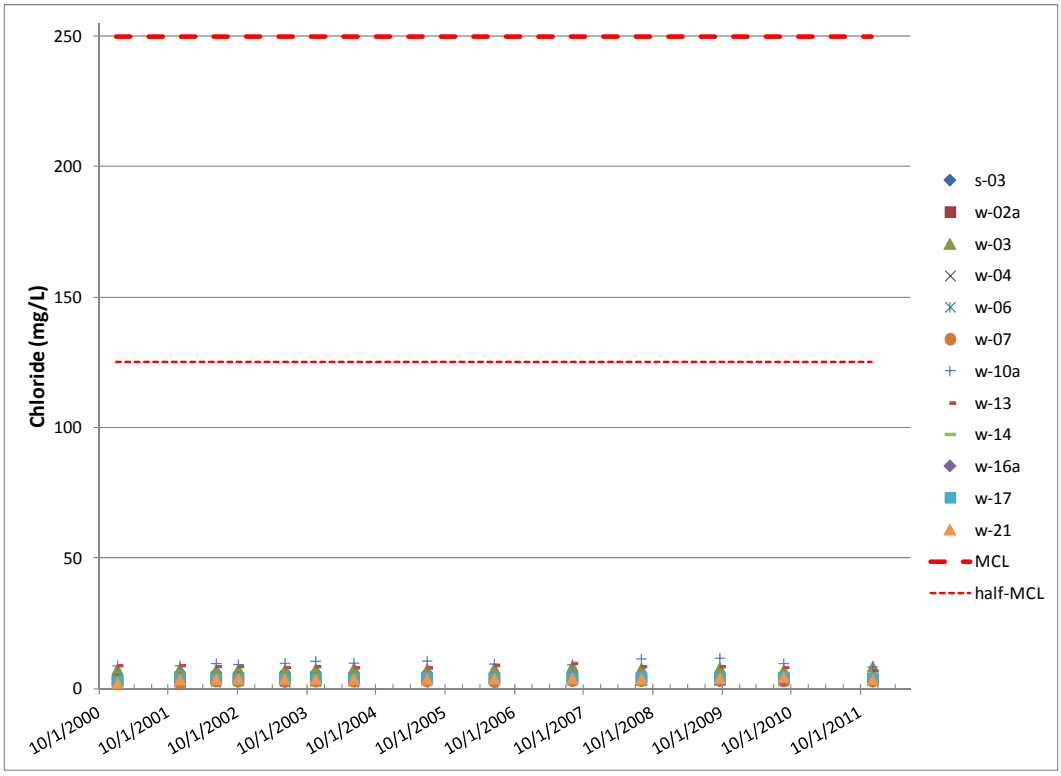


Figure 3. Chloride concentration for 12 sites that will have baseline assessments done in near future after additional data is collected.

Legend

2010 Finding

Poor Conditions: Reported data are above Maximum Contaminant Level (MCL) and/or fails to meet the state standard or criteria for a given indicator; needs improvement.

Fair Conditions: On average, data fell between the standard or criteria for "poor" and "good" and may be variable.

Good Conditions: Reported data are below MCL and/or meet the state standard or criteria for a given indicator.

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No Annual Assessment

2001-2010 Status

Downward Trajectory: 2001-2010 data shows decreasing or worsening conditions

No Change: 2001-2010 data shows no change with time.

Upward Trajectory: 2001-2010 data indicate increasing or improving conditions

Insufficient Data: reported data has too few data points and/or too short a period