Waterfully Delightful

Hunter McGahan and Erica Engelhard
Geology 100

Whatcom COMMUNITY COLLEGE

Background & Research Question

According to the 2022 Water Quality Report by Mayor Seth Fleetwood, Bellingham "throughout City government, [is] leading the way locally, regionally, and nationally in advancing new ideas and initiatives." How do certain segments of this report compare to two separate tap water locations collected with our own equipment? We were thirsty to find out, and further analyze how this data compares to the 2023 City of Bellingham Common Water Quality Parameters. Finally, let's set it to a national scale, and see if Bellingham's data keeps up with the parameters of the National Drinking Water Regulations.

Results

Based on Table 1 and figure 4a-e, lab results differ compared to Quality Parameters with a lower pH. Labs also have higher ppm of iron and copper compared to both Quality Parameters and 2022 Quality Analysis. In 2022 there were signs of fecal coliform bacteria in July and August but returned to the negative results like our labs. Hardness is considered soft across all data points. Water still qualifies as safe according to the national regulations.

Figure 1. *Materials used in experiment: x2 Styrofoam cups; x2 glass beakers; Eutech PCTest35 Probe Oakton, serial no. 2309389; LABTECH H2O OK Drinking Water Analysis Test Kit; Distilled water; masking tape; 'Low-cost Water Monitoring' tablet, by LaMotte*

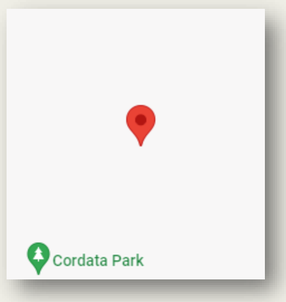


Figure 2a. *Map view of Cordata collection site* (48.8041770, -122.4945941)

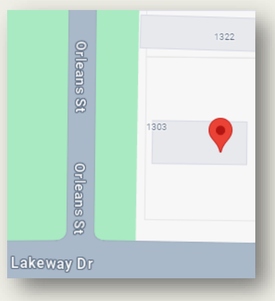


Figure 2b. *Map view of* Lakeway collection site (48.744960, -122.458460)

Methods and Lab Procedure

Materials fig 1 & Location fig 2a-b

- Kris Harrell, lab tech, calibrated probe instrument before lab. During lab, we labeled two Styrofoam cups: "Lakeway" and "Cordata", supported them with glass beakers, and poured respective water samples.
- We submerged probe for pH testing, documented results, then cleaned it with distilled water before switching samples. Repeat steps for hardness.
- We used the "Drinking Water Analysis Test Kit" labeling both copper and iron strips, then immersed copper strip, swirling ten times, and waited fifteen seconds before comparing with the provided coloring chart. Repeat steps for iron.
- We poured each sample their own vial, added one tablet for each of them from "Low-Cost Water Monitoring", and sealed off vials. On 4th day we recorded reaction of the tablets mixing with water.

Table 1. Tests for PH, Hardness, Fecal Coliform Bacteria, Iron, Copper. Units: pH scale and ppm-parts per million

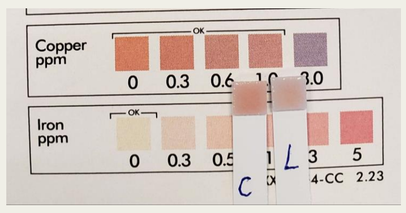
Water Quality Tests

	Cordata "C"	Lakeway "L"	Bellingham 2022 Water Quality Analysis Results	City of Bellingham Common Water Quality Parameters	National Primary and Secondary Drinking Water Regulations
pH	7.4	7.2	N/A	8.32	6.5-8.5
Hardness (ppm)	48.4	45.65	20.3	23.5	N/A
Fecal Coliform Bacteria (+/-)	Negative	Negative	2% positive July. 1% positive August. 0% positive all	Negative	No more than 5.0% tested per month can be positive
Iron (ppm)	.3	.3	N/A	.01	.3
Copper (ppm)	1.0	1.0	.002 to .118	N/A	1.3

Figure 4a. **(right) pH**
Probe submerged in sample waters. pH 7.4 and 7.2 for C and L, respectively. "pH is the measure of acidity in water. High acid water can cause damage to your plumbing system" (5).

Figure 4b. **(right) Hardness**
Probe submerged in sample waters. Hardness 83 and 88 for C and L, respectively. "the constituents that contribute to hardness (generally calcium and magnesium ions) are not toxic" (8).
Ref. *limitations* for conversion process

Figure 4c. **(right) Copper**
Test strip result 1.0 for both with coloring chart. Copper comes from "corrosion of household plumbing systems; erosion of natural deposits" (7).



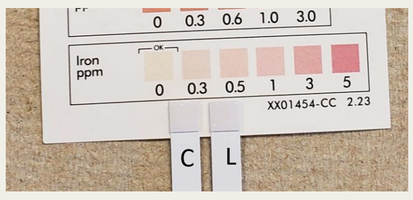
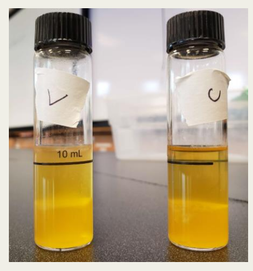


Figure 4d. **(Left) Iron**
Test strip result 0.3 for both with coloring chart. "Iron can leach from cast iron pipes in the water distribution system" (3).

Figure 4e. **(Below) Coliform Bacteria**
Result: negative, yellow with no gas bubbles. "Fecal coliform bacteria are naturally present in the human digestive tract but are rare"(6)



Discussion: Our study finds that despite claiming to nationally lead the way for drinkable water, Bellingham's pipe conditions will alter the quality of water as it runs to our households. This creates different variables to those at the City of Bellingham Common Water Quality Parameters and 2022 Water Quality Analysis Results not making them fully reliable (table 1).

Interpretation: Bellingham's drinking water comes from Lake Whatcom watershed. As water moves through these watersheds, hardness and dissolved sediments impacting the pH. This significant impact is adjusted according to the treatment labs "Bellingham's source water is so pure, it can be corrosive. We adjust the pH up with soda ash to reduce this corrosiveness" (3). These facilities are where staff collect data and set parameters.

As water moves to the household, copper, iron, and hardness are now altered from pipe runoff. These variables are separate from the treatment as they run through the houses. For example, older pipes have more corrosion, and the collection point at Lakeway had pipes constructed in 1955 according to the front desk at Landmark Real Estate Management.

Limitations: Cordata's collection point started "Phase 1 construction… in June of 2019" (2), however we speculate that this area connects with older pipes like Lakeway due to the similarities of the data; despite best efforts this cannot be confirmed. More samples and tests would provide more data to compare with the city's. The hardness conversion formula was limited since we used a formula to convert micro siemens to total dissolved solids on the premise of freshwater to drinking water.

However, hardness, "(EPA) has not set a legal limit or standard for hardness in water" (8). Since hardness is not toxic, "…there is a generally accepted division of water into categories" (8). Hence why the data shows all points as soft.

Implications: To avoid these pipe buildups, Kraft recommends running the water for 10 minutes to get the best quality. Nonetheless, this water is still safe to drink on a national scale, so cheers.

Resources

1. City of Bellingham. (2023, May 18). Lake Whatcom Water Quality. https://cob.org/services/environment/lake-whatcom/water-quality-lw
2. Cordata Park. City of Bellingham. (2023a, August 16). https://cob.org/services/recreation/parks-trails/parks-guide/cordata-park
3. Drinking water quality monitoring. City of Bellingham. (2023, April 28). https://cob.org/services/environment/lake-whatcom/water-quality-monitoring
4. EPA, (2023, January 9). National Primary Drinking Water Regulations | US EPA. United States Environmental Protection Agency. https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations
5. LabTech. (n.d.). LABTECH H2O OK drinking water analysis test kit LT5010-6. The Home Depot. https://www.homedepot.com/p/LABTECH-H2O-OK-Drinking-Water-Analysis-Test-Kit-LT5010-6/205540448https://www.homedepot.com/p/LABTECH-H2O-OK-Drinking-Water-Analysis-Test-Kit-LT5010-6/205540448
6. LaMotte, & Earth Force. (n.d.). 3-5886 low cost water monitoring Kit.pdf. Environmental Action Civics. https://drive.google.com/file/d/14FT1K3L89zCed6cQzEFze-9NLvWtXQ1V/view
7. Secondary drinking water standards: Guidance for Nuisance Chemicals. Environmental Protection Agency. (2023, February 14). https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals
8. USGS. (n.d.). Do you have information about water hardness in the United States?. Do you have information about water hardness in the United States? | U.S. Geological Survey. https://www.usgs.gov/faqs/do-you-have-information-about-water-hardness-united-states

Acknowledgements

Special thanks to Kaatje Kraft and Kris Harrell. Their help was foundational for this project, and helped sculpt it into what we see today. Small thanks to Landmark for pipe dates but still high rent.