Salinity in Drinking Water on Kansas State University Manhattan Campus

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Why is Salinity Important?

Salinity—the concentration of dissolved salts such as chloride and sodium—fundamentally shapes freshwater quality and the health and resilience of the systems that rely on it[1]. Elevated salinity harms aquatic biota, reduces crop yields, and accelerates corrosion of water-delivery systems infrastructure, costs that exceed US $5 billion each year in the States[2, 3, 4]. In the Midwest, decades of heavy road salt application, intensive agriculture, and climate-driven shifts in precipitation has pushed chloride concentrations in many urban and agricultural streams well above natural baselines[1, 4, 5]. These elevated levels translate into health concerns for communities that rely on the affected water supplies[2,3]. Because salinity often rises in concert with other important water-quality indicators—higher total dissolved solids, pH shifts, and changes in oxidation–reduction potential—it serves as an early-warning signal of broader water-quality degradation[1]. Tracking its sources and dynamics is therefore important for protecting ecosystems, safeguarding human health, and ensuring that freshwater resources remain fit for their many uses now and in the future.

Question 1:

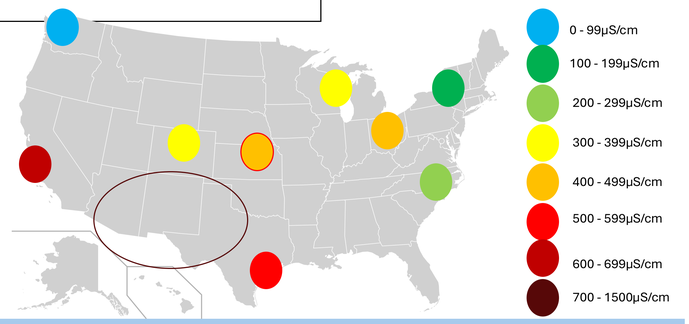
Does distance from an entry point within a water distribution system effect salinity concentration?

Question 2:

Does salinity concentration correlate to differences in pH, temperature, TDS, and ORP?

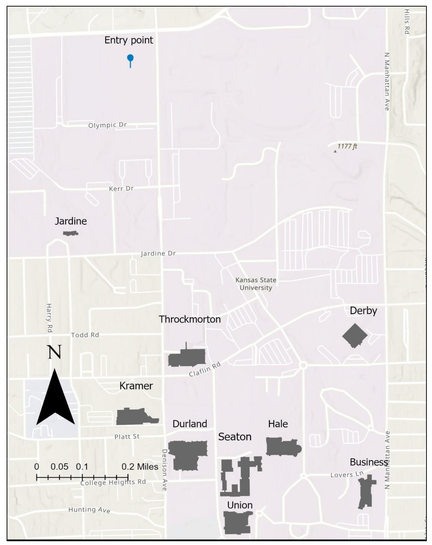
Question 3:

What are possible causes for salinity in K-States water distribution system?



Approach

Study Location



- Samples collected and analyzed within 24 hr, stored in a refrigerator at 4°C.
- analyzed using a YSI MultiLab 4010 2W with ion selective electrode probes.

Predictions

- We hypothesize that with increasing distance, water salinity will increase due to interaction with pipes.
- We predict that salinity (µS/cm) correlation to water quality parameters will be as follows:
  - ↑salinity = ↑pH
  - ↑salinity = ↑temperature
  - ↑salinity = ↑TDS
  - ↑salinity = ↓ ORP

Study Standards

Salinity concentration is limited by the EPA at 3 g/L. Our study uses this concentration as a MCL standard[6].

Results

Salinity varied across campus below EPA Salinity limit, but no significant correlation between salinity and distance

1

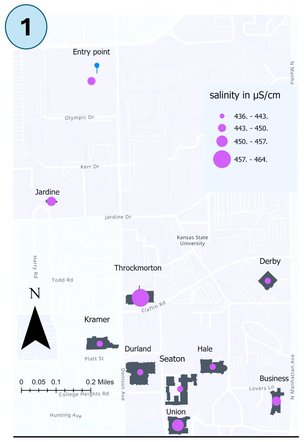


Figure 1: Salinity concentration (µS/cm) on Kansas State University Manhattan Campus. The map shows several buildings, including Jardine, Throckmorton, Kramer, Durland, Seaton, Hale, Union, and Derby, each marked with a purple circle representing the salinity level at that location.

2

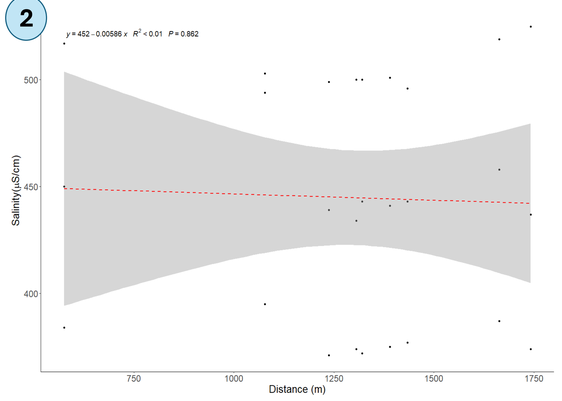


Figure 2: Linear relation of distance on salinity on K-State's water distribution system. This linear regression looks at the relationship between distance from the entry point and salinity (µS/cm). The gray area is standard error. There is a weak negative correlation between distance and salinity, but it is not significant.

3

Water Parameter Correlations

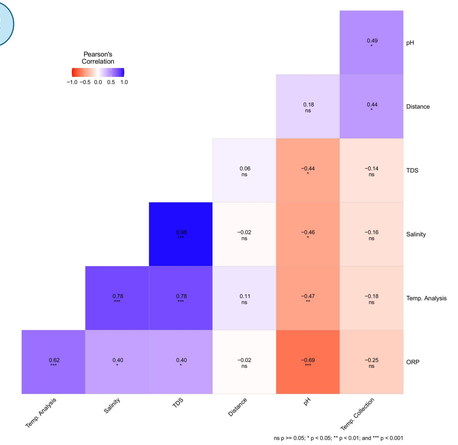


Figure 3: Pearson correlation table for water testing parameters. This figure shows Pearson correlation coefficients between pH, ORP, temperature at sample collection, temperature at sample analysis, salinity, and TDS.

Conclusions

Study Summary:
This research assessed the variability of salinity in tap water across Kansas State University's main campus. While minor differences in salinity were detected among buildings, all levels remained safely below the EPA's limit of 3 g/L, confirming that the water is safe for daily use.

Main Findings:
- No consistent pattern was observed between salinity and building distance from the water entry point.
- Strong correlation was found between salinity and TDS, while pH, temperature, and ORP had minimal influence.
- Highest salinity readings were found in older buildings located on the east side of campus.

Actionable Solutions:
- Prioritize replacement of aging infrastructure linked to elevated salinity.
- Explore less corrosive, potassium-based de-icing products to reduce runoff impact.
- Implement campus-wide salinity monitoring protocols and public outreach on salt-conscious practices.

Future Reseach Directions

We recognize that seasonality plays a role in water salinity concentration. A long-term research project using our procedure could give better insight on seasonal changes as well as yearly changes to drinking water salinity at K-State main campus.

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