# What's in your Water: Chemical Compositions of Surface Waters in the Schenectady County Watershed


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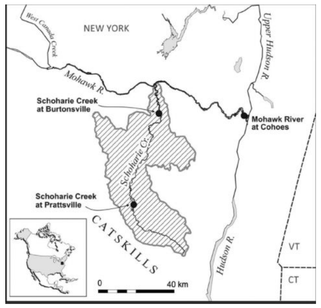
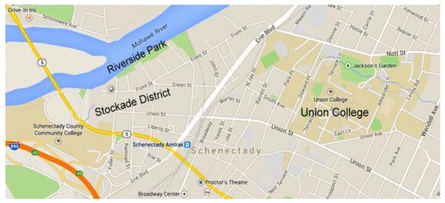
## BACKGROUND

The Schoharie River and Hans Groot's Kill are both tributaries into the Mohawk River. Thus, it is likely that they all have similar chemical compositions. One-third of the volume of the Mohawk River is contributed by the Schoharie River, while Hans Groot's Kill also feeds into the Mohawk River after passing through the residential homes of the "GE Plot" and Union College. Some chemicals are naturally occuring while others are introduced to the bodies of water via anthropogenic products.




Highlighted are the three bodies of water: the Bowman Creek of the Schoharie River, Hans Groot's Kill and the Mohawk River which are being analyzed.




Map of the Schoharie River in relation to the Mohawk (1)

Hans Groot's Kill in comparison to the Mohawk River (2)

## INTRODUCTION

**Goals:**

- To compare chemical species such as: $Cl^-$, $Na^+$, $Ca^{2+}$, and $F^-$ to determine if their concentrations in each body of water are significantly different
- To determine the pH and total alkalinity of each sample
- To attempt to explain chemical compositions of samples through correlations
- To compare methods of analysis of certain chemical species

Initially, observed differences can be due to differences in volume (most easily measured as surface area) and flow rates of each body of water as followed:

Mohawk River volume: 3,412 square miles (3)

Bowman Creek of the Schoharie River volume: 120 square miles (4)

Hans Groot's Kill volume: No known volume or path due to flow under plots of land

## LOCATIONS

Bowman Creek (5)

Hans Groot's Kill

Mohawk River (6)

## RESULTS AND DISCUSSION

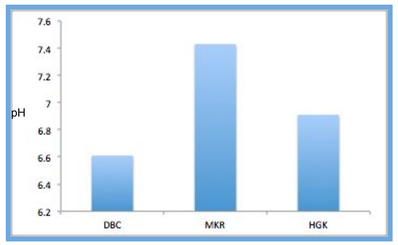



**Figure 1: Measured pH of DBC, MKR, and HGK using an ionic strength adjuster (2.0 M KNO3).**
DBC had the most acidic pH and MKR the most basic, possibly due to dilution of the $H^+$ concentration in the Mohawk. It is interesting that the DBC and MKR are different by almost one whole pH unit.

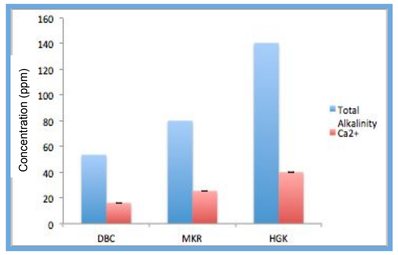



**Figure 2: Comparison of total alkalinity and calcium concentration (collected from AAS).**
As alkalinity increased, so did calcium ion concentration. It is interesting that HGK had a lower pH than MKR, but a higher alkalinity. This may be due to the volume of the Mohawk compared to HGK and DBC. Alkalinity likely depends on the rock composition the river flows on.

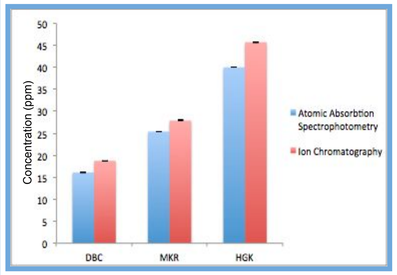



**Figure 3: Comparison of calcium concentration using Ion Chromatography and Atomic Absorption Spectroscopy.**
External standards were used to measure the concentrations of calcium in AAS versus ion chromatography samples ran by Geology. The ion chromatography method can be deemed more accurate analyses at high concentrations when AAS is usually less accurate.

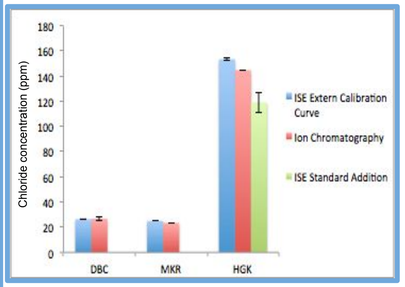



**Figure 4: Comparing concentrations of chloride using Ion Chromatography and Ion Selective Electrode.**
Hans Groot's Kill has a much higher concentration of chloride than DBC and MKR. IC produced slightly lower concentrations of chloride than ISE in each sample. The chloride concentration of HGK was further analyzed using standard addition methods due to high ion concentrations. Standard addition accounts for the other ions detected, not confusing them with chloride.

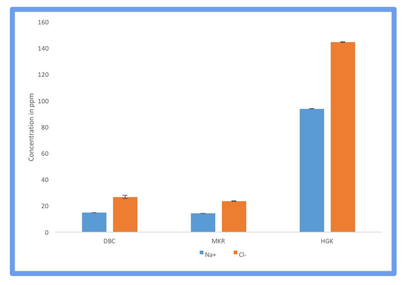



**Figure 5: Correlation of $Na^+$ and $Cl^-$ concentrations, measured in ppm.**
$Na^+$ and $Cl^-$ are two common ions found in road salt. Direct correlation of both ions were detected in each water sample. However, accounting for molar mass they are not proportional in a 1.5:1 ratio, which may be due to $CaCl_2$ also being used as road salt.

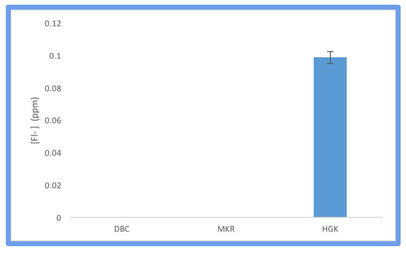



**Figure 6: Concentration of Fluorine (ppm) analyzed by Ion Chromatography**
Hans Groot's Kill is the only body of water tested that $Fl^-$ was detected using Ion Chromatography. This could be due to the residential areas Hans Groot's Kill runs through and the tap water which drains into it.

## EXPERIMENTAL

**Chloride Ion Selective Electrode (ISE)**

- Used external standards of 10, 50, and 100 ppm $Cl^-$ to generate calibration curve
- Measured voltages were used to calculate chloride concentration from the calibration curve; HGK was tested with standard addition due to high ion concentrations; 2.0 M $KNO_3$ ionic strength adjuster was applied to each sample
- The Accumet Chloride Ion Selective Electrode was used

**Atomic Absorption Spectroscopy (AAS)**

- Calcium ion standards of 1, 5, and 10 ppm were used to generate a calibration curve, which was used to calculate the concentration of calcium in samples
- Samples were diluted when needed based on IC data
- A Perkin-Elmer Model 3100 AAS was used

**Ion Chromatography (IC)**

- Using model Dionex DX-500 Ion Chromatograph, the Geology department carried out methods to yield concentrations of calcium, chloride, sodium, and fluorine

**Hydrogen Ion Selective Electrode**

- To measure pH of samples, this probe was calibrated with solutions of pH 4, 7, and 10; and 2.5 M $KNO_3$ Ionic Strength Adjuster was added to samples

**Alkalinity**

- Titrations of alkalinity were performed using methyl orange as an indicator and 0.02N sulfuric acid as the titrant. Endpoints at pale and deep orange allowed alkalinity ranges to be calculated

## CONCLUSIONS

The concentrations of many ions, of the data presented, in the Mohawk River are between those relative concentrations in the Schoharie River downstream of Bowman's Creek and Hans Groot's Kill. DBC tends to have lower ion concentrations than HGK likely due to its larger volume. This agrees with our hypothesis that since ions from low and high concentrations are flowing into the Mohawk, with a significantly larger volume, the ion concentration in most cases is somewhere in the middle. The basic pH of MKR may be due to dilution of $H^+$ ions from both tributaries. The concentrations of Hans Groot's Kill were most striking, yet consistent, probably because it is a small body of water flowing mainly through residential areas, leaving it with unusually high ion concentrations. Some of the chemical species of these bodies of water can be explained. For example, the correlation of sodium and chloride is likely due to road salt, the correlation between alkalinity and calcium is likely due to flow over rocks, and fluorine concentration in HGK is most probably due to tap water runoff which the other samples experience less.

## REFERENCES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