

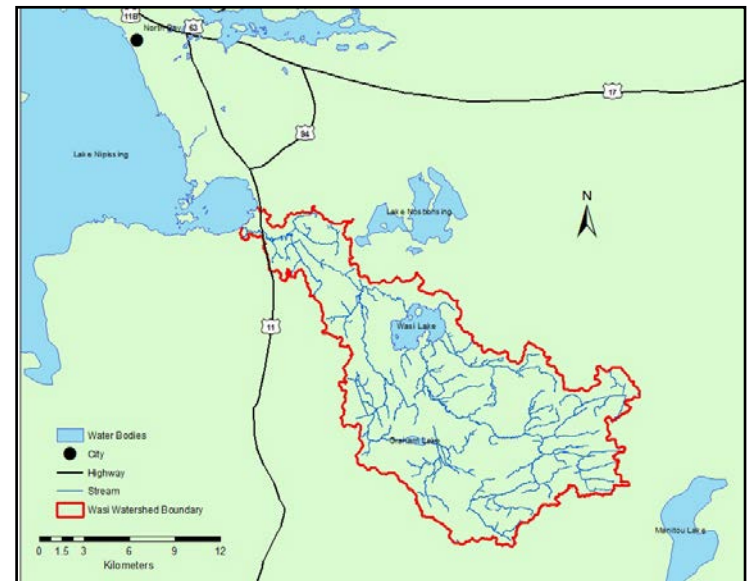
Understanding Sources of Streamflow in the Wasi Watershed using Water Isotopes

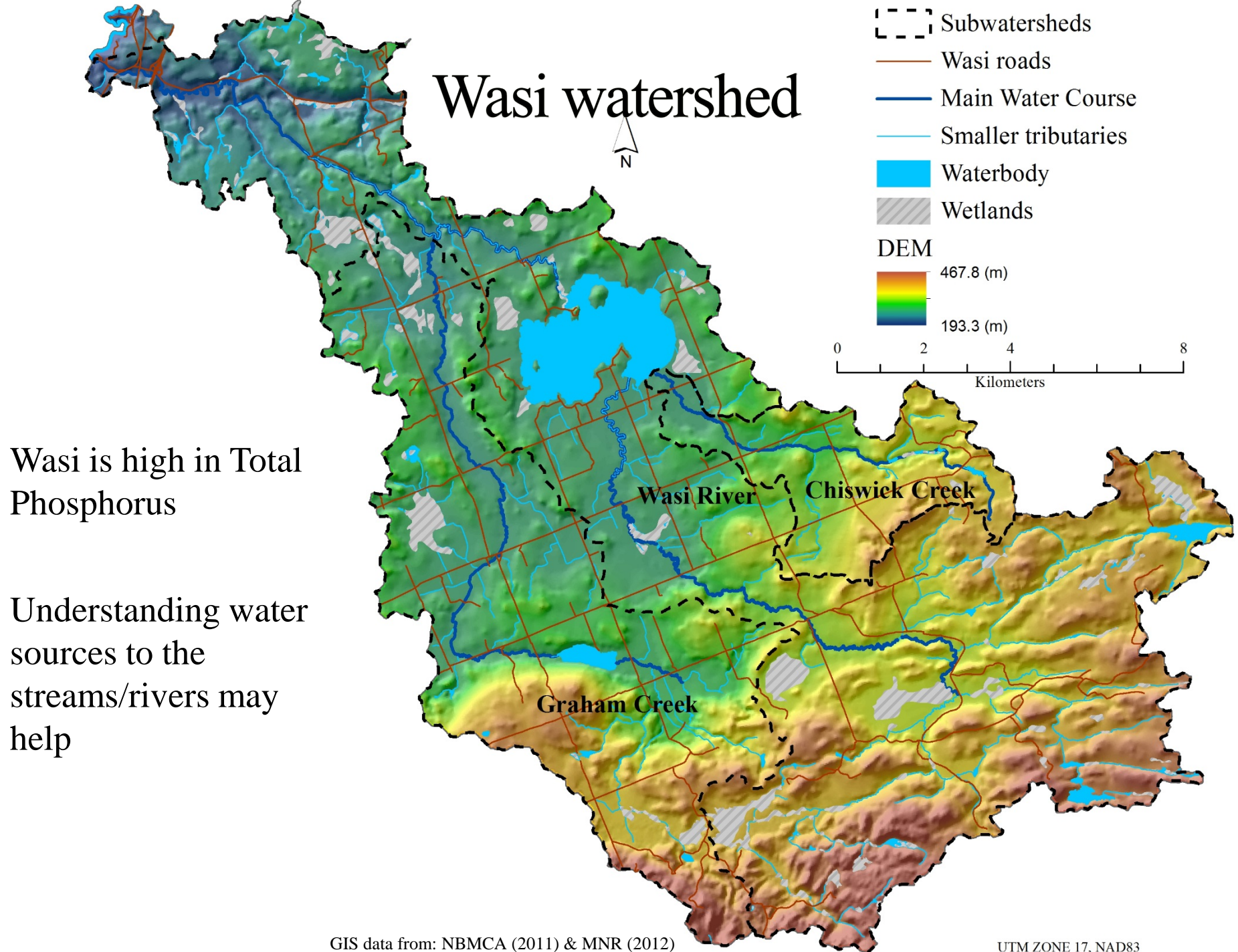
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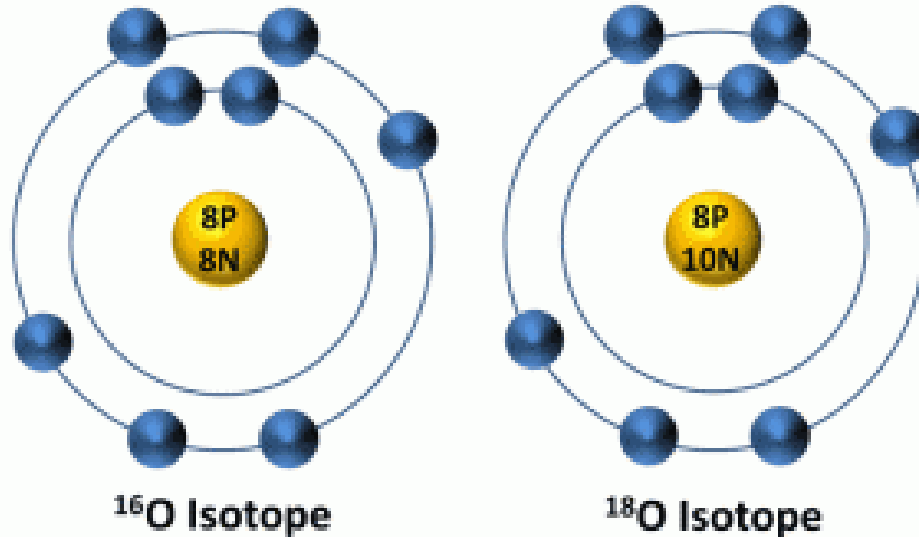
Research Questions

How do contributions of precipitation, groundwater, and lake water to streamflow change depending on where I am in the watershed and when?

Can we explain differences in temporal or spatial patterns of water isotopes using watershed characteristics (e.g. local geology)?

What are water isotopes?

Oxygen Isotopes



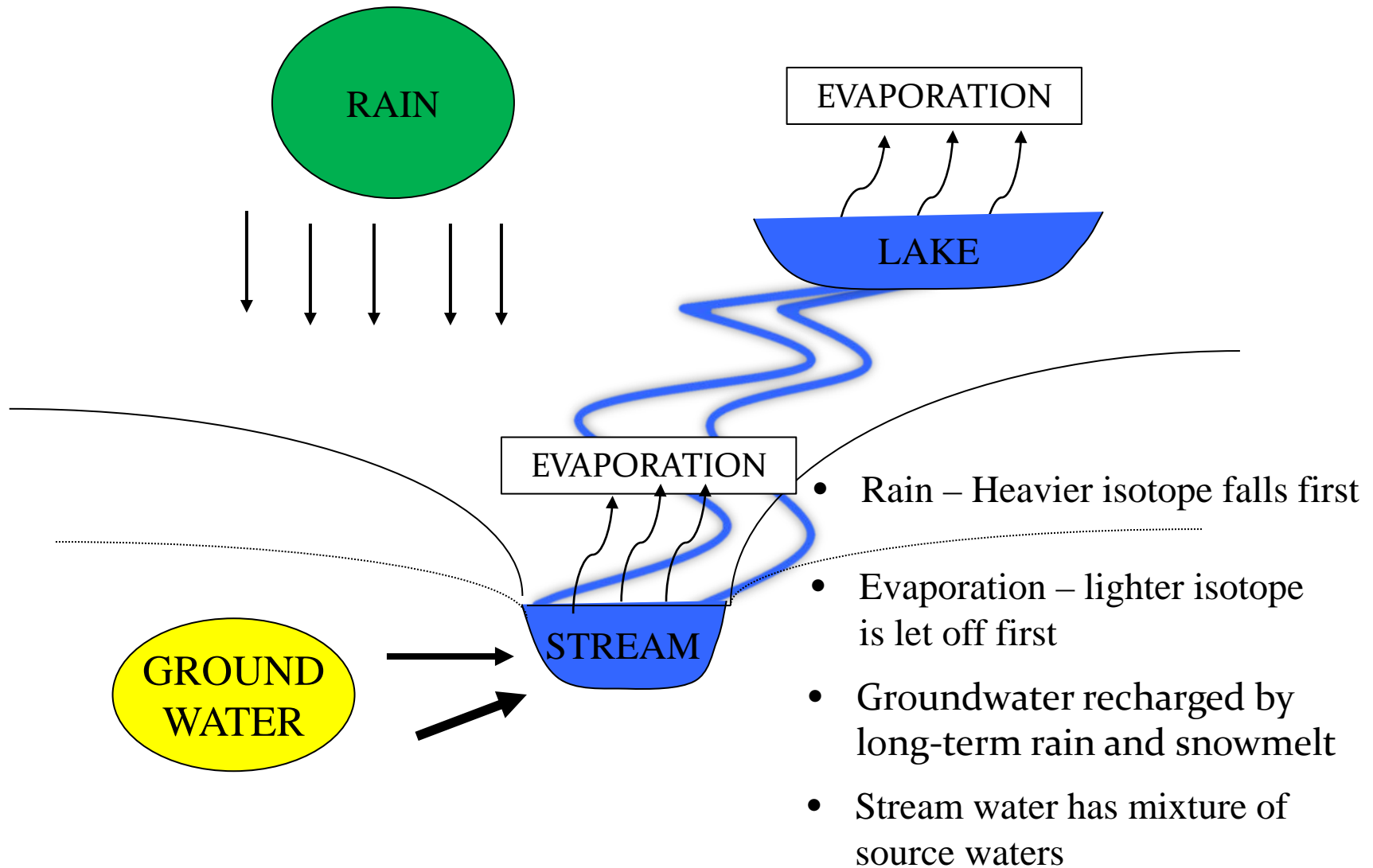
An isotope is the same element with different # of neutrons

We are interested in the ratio of ^{18}O to ^{16}O (e.g. $^{18}\text{O}/^{16}\text{O}$ & $^2\text{H}/^1\text{H}$)

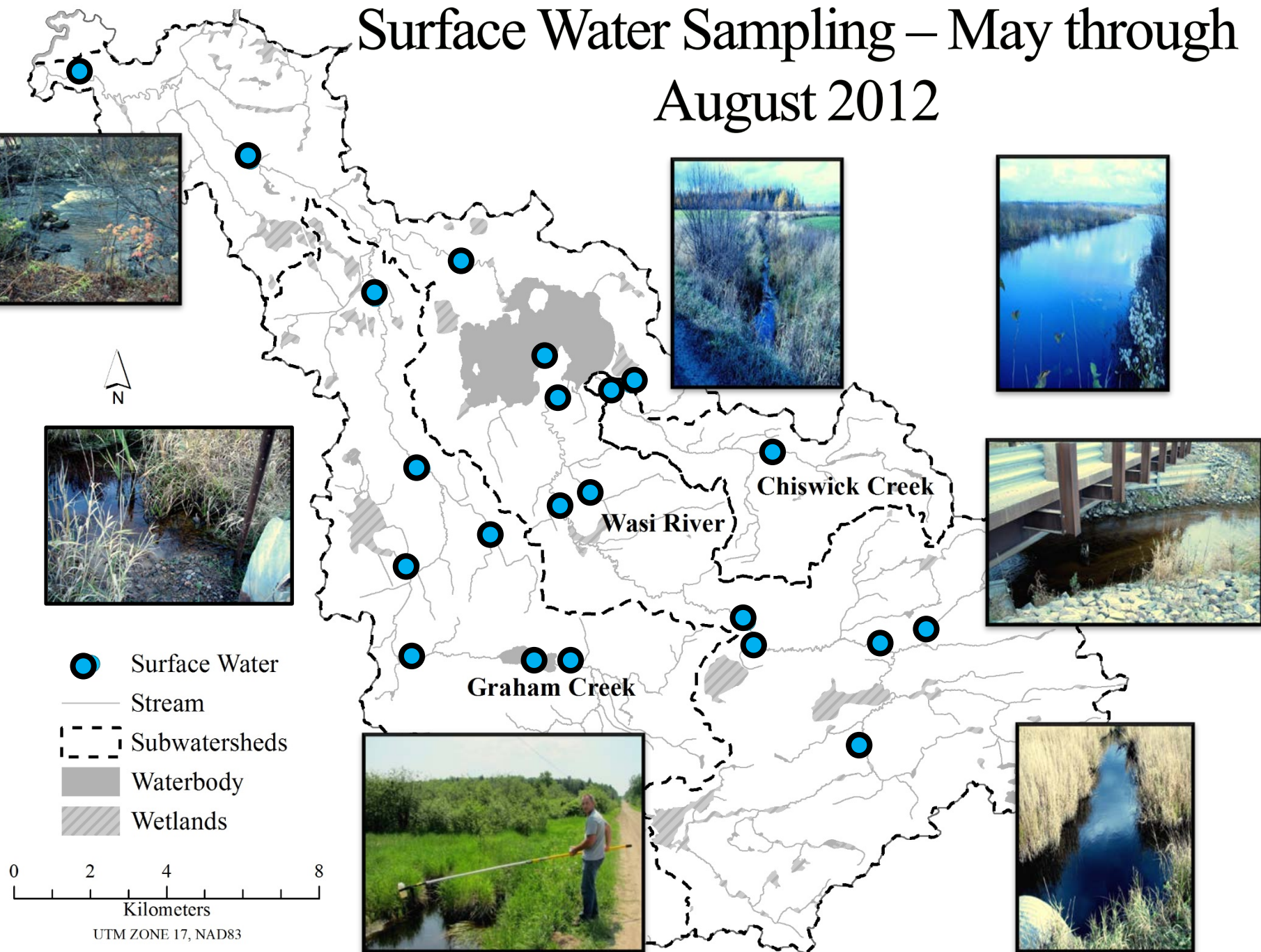
These ratios change depending on what is happening to water!

Image retrieved from: <http://www.ces.fau.edu/nasa/module-3/how-is-temperature-measured/isotopes.php>

What hydrological processes affect water isotope ratios?

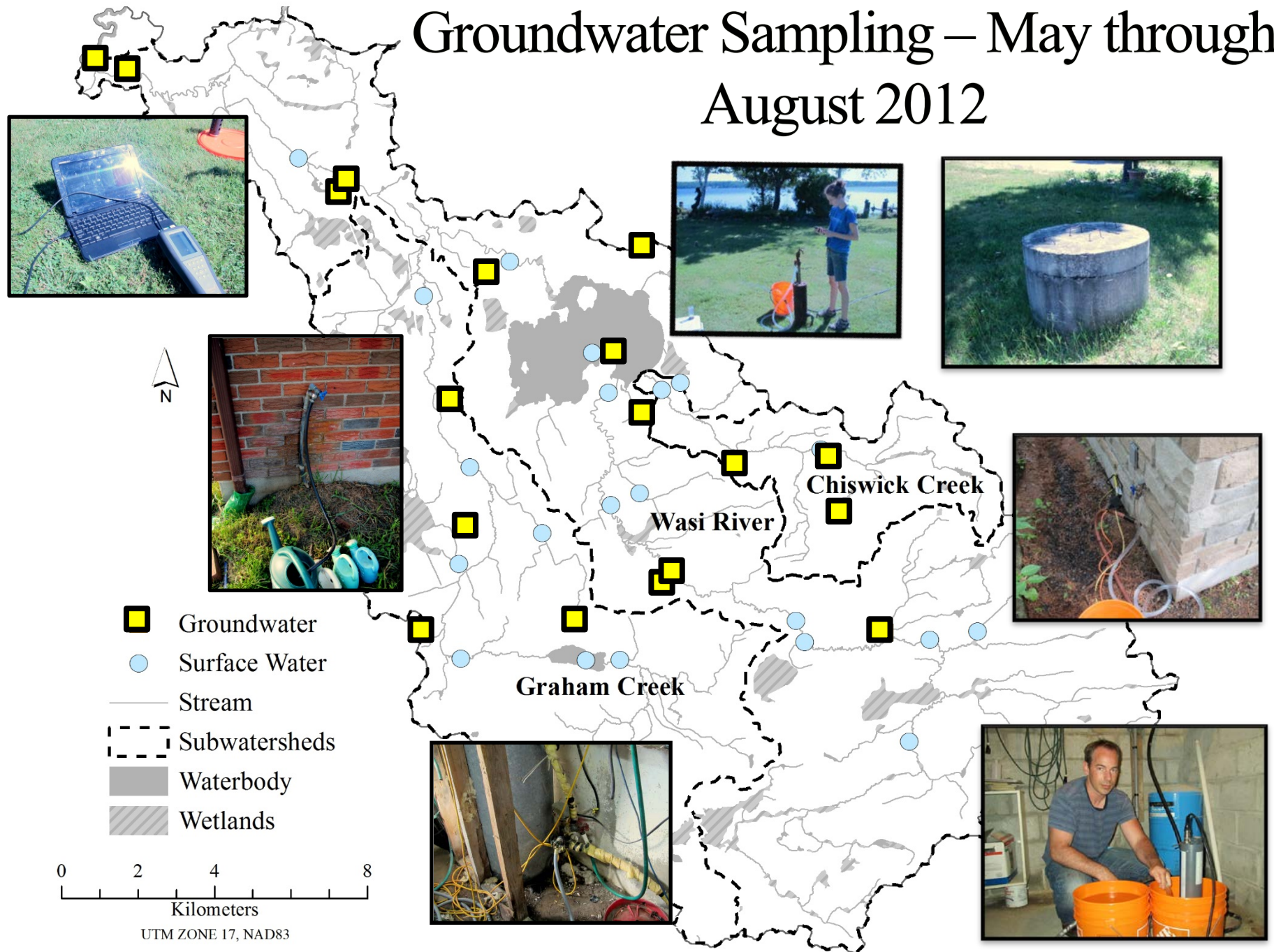


Surface Water Sampling – May through August 2012



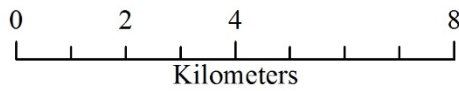
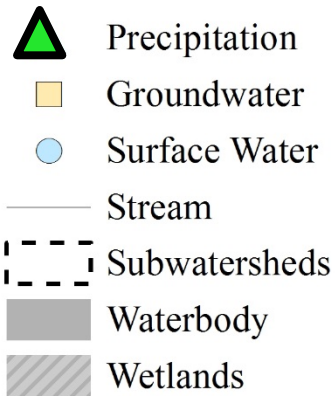
GIS data from: NBMCA (2011) & DMTI Spatial Inc. (2005)

Groundwater Sampling – May through August 2012

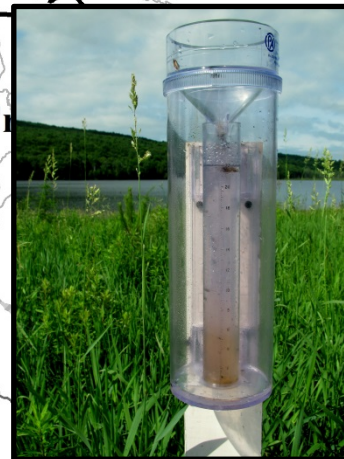
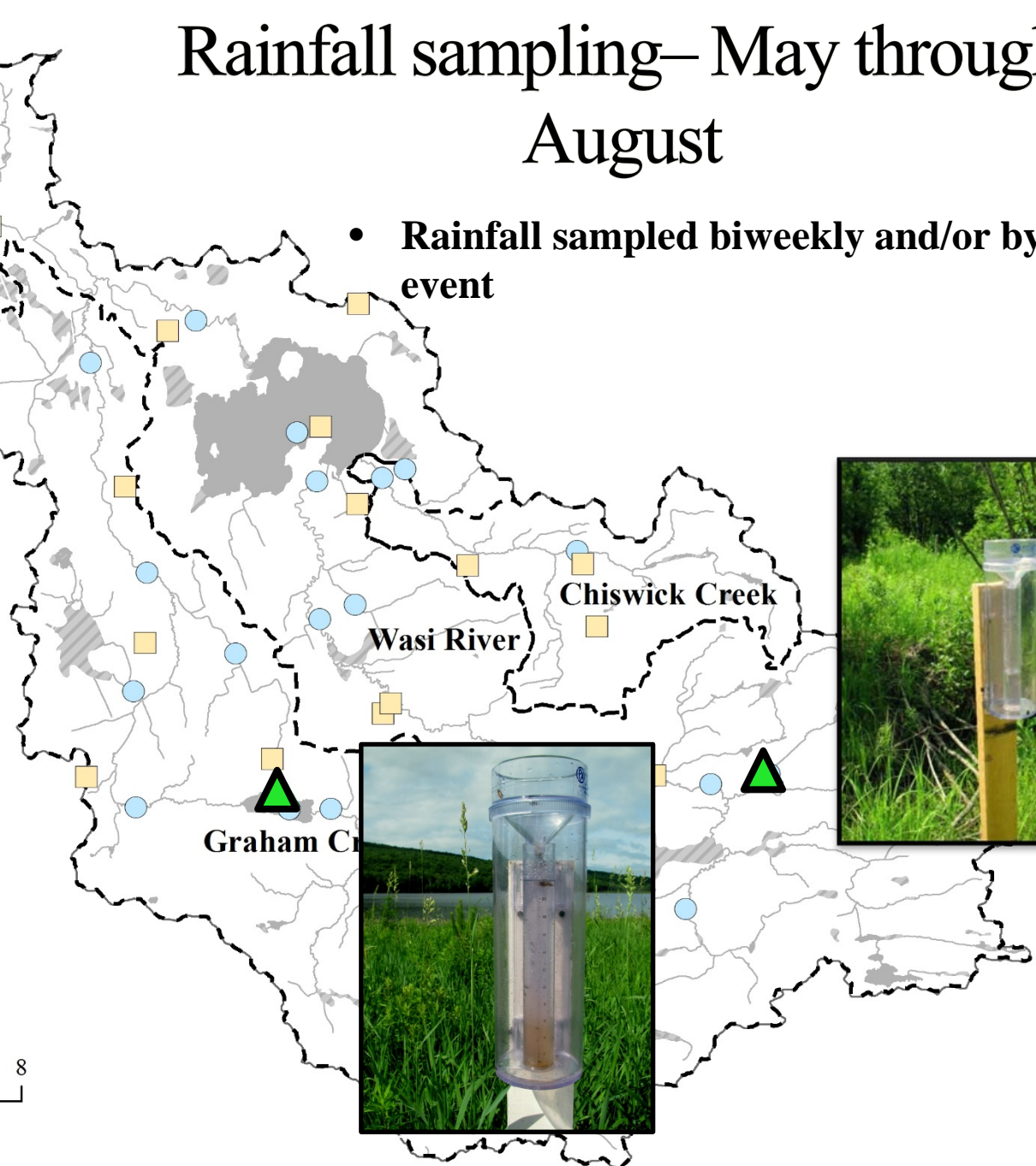


Rainfall sampling– May through August

- Rainfall sampled biweekly and/or by rain event

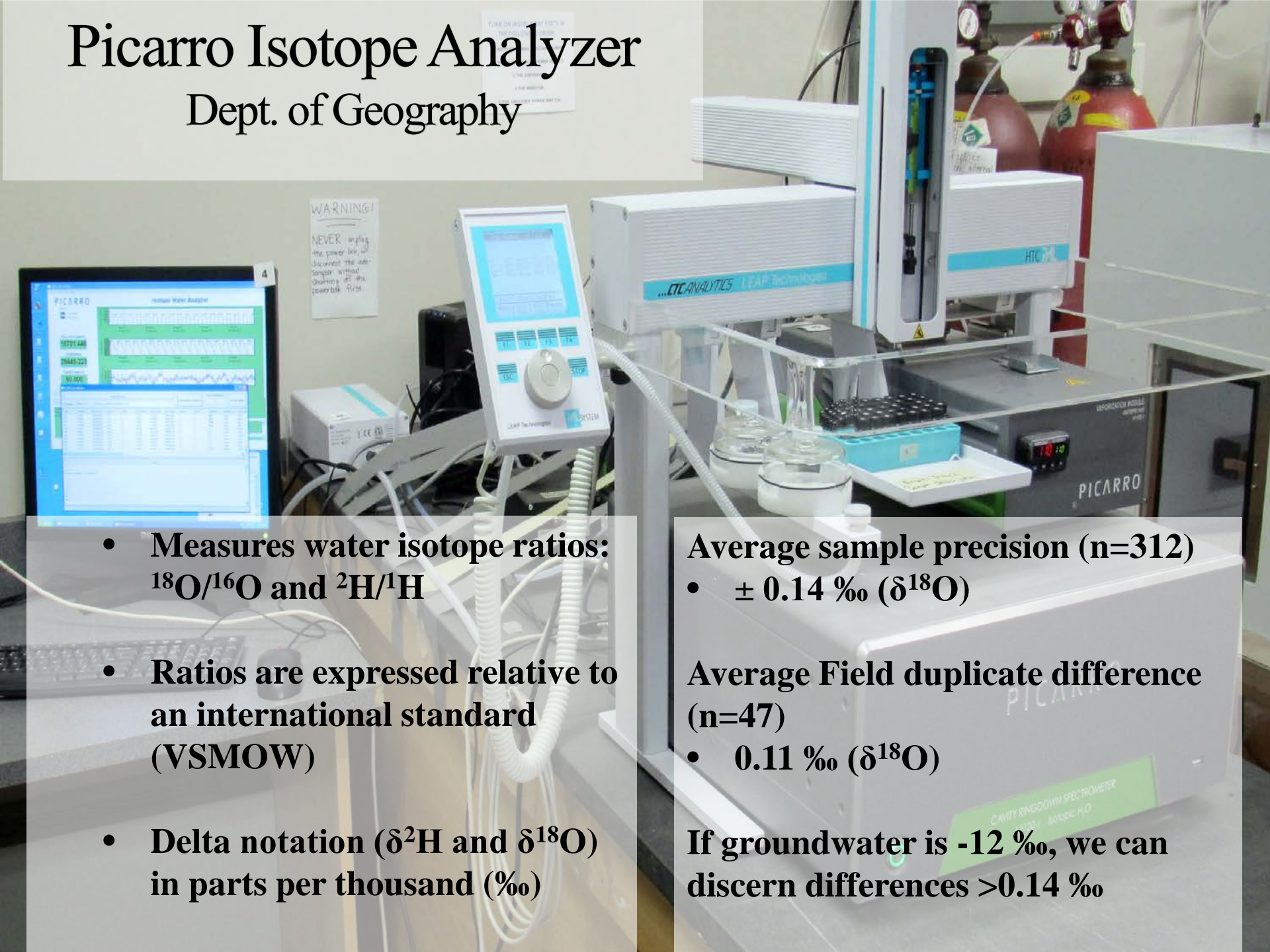


UTM ZONE 17, NAD83



Picarro Isotope Analyzer

Dept. of Geography

- 
- A photograph of a Picarro Isotope Analyzer in a laboratory setting. The machine is white with blue accents and has a control panel with a screen and buttons. A computer monitor to the left displays the software interface with various data plots and tables. A warning sign is visible on the wall behind the machine. The machine is connected to gas cylinders in the background.
- Measures water isotope ratios: $^{18}\text{O}/^{16}\text{O}$ and $^2\text{H}/^1\text{H}$
 - Ratios are expressed relative to an international standard (VSMOW)
 - Delta notation ($\delta^2\text{H}$ and $\delta^{18}\text{O}$) in parts per thousand (‰)

Average sample precision (n=312)

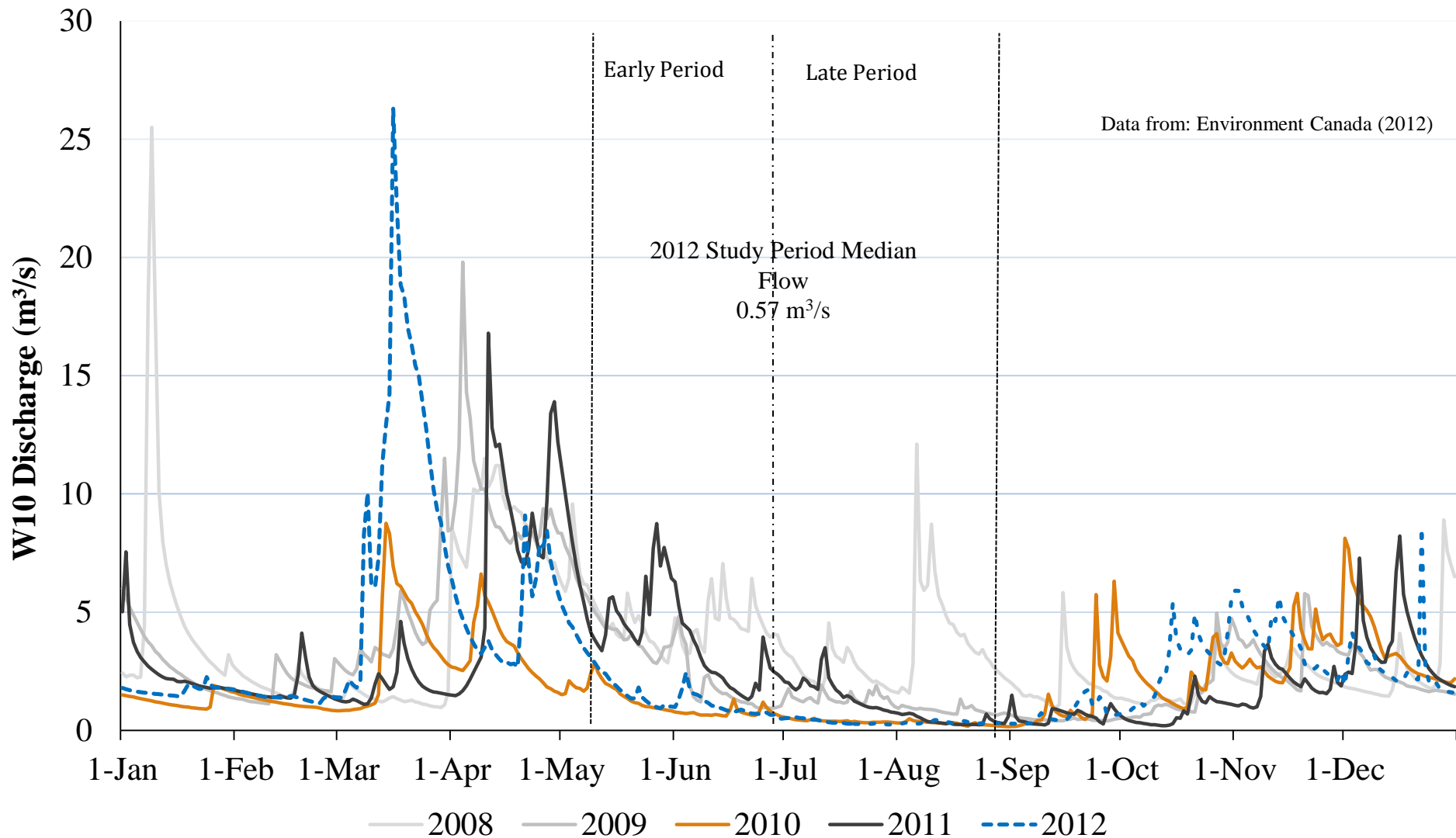
- $\pm 0.14 \text{ ‰} (\delta^{18}\text{O})$

Average Field duplicate difference (n=47)

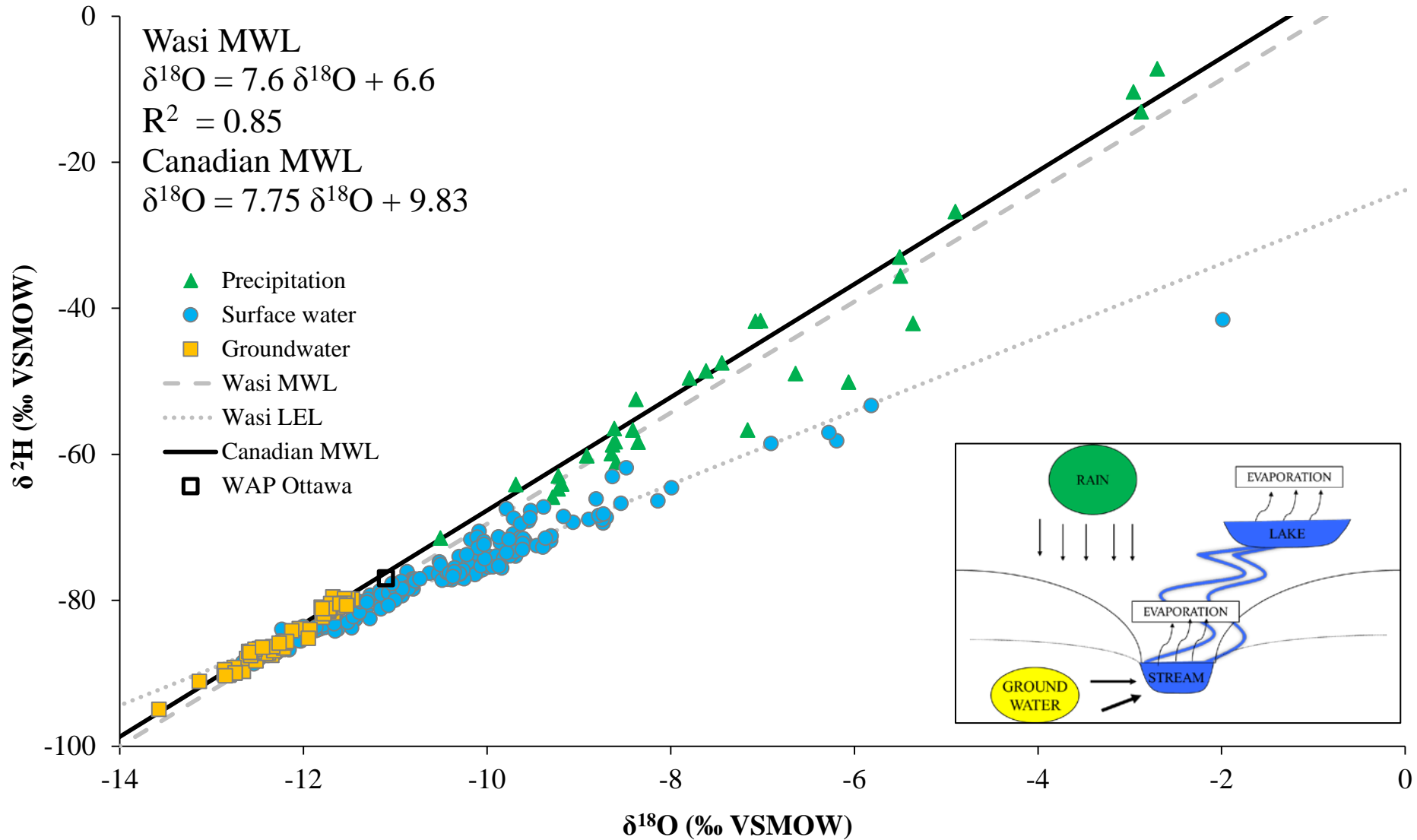
- $0.11 \text{ ‰} (\delta^{18}\text{O})$

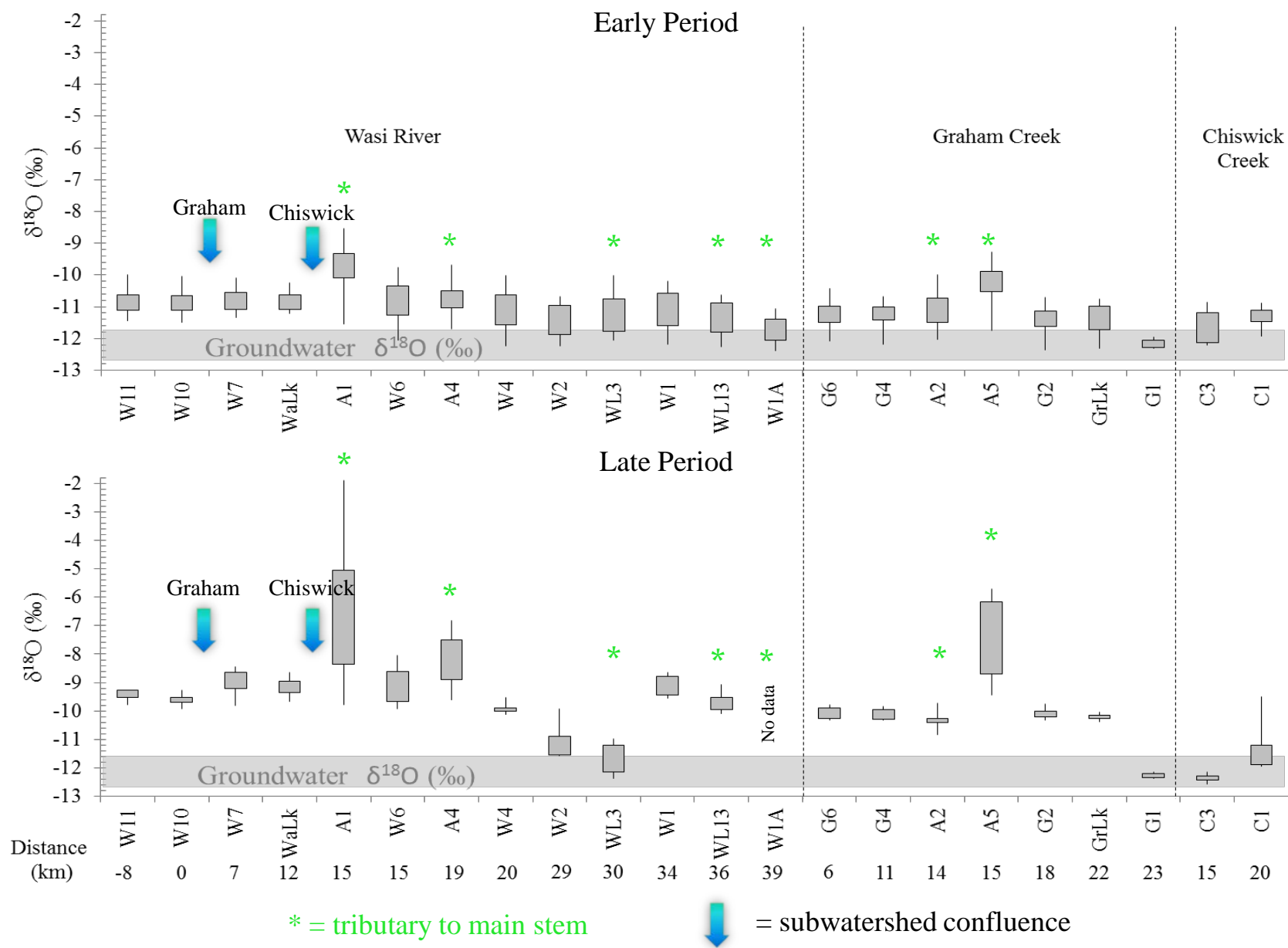
If groundwater is -12 ‰ , we can discern differences $>0.14 \text{ ‰}$

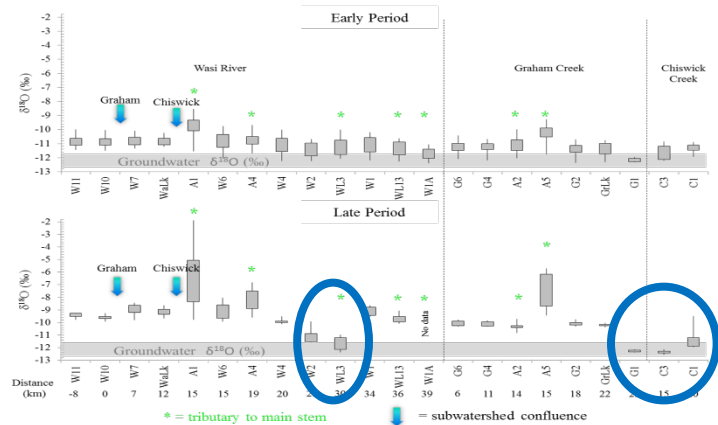
What did river flow look like during our sampling?



Isotope Results

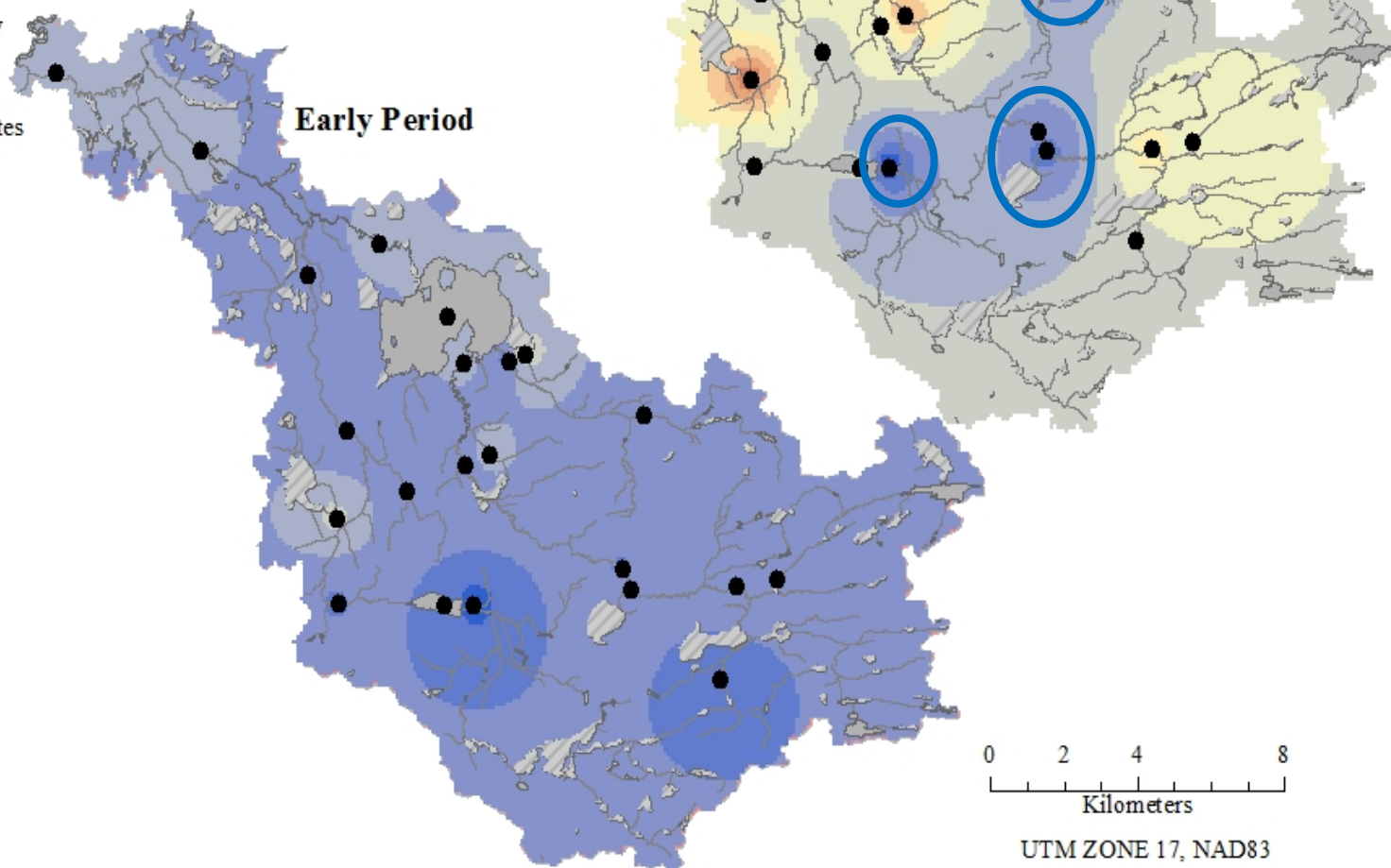
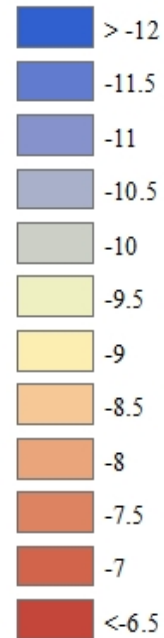


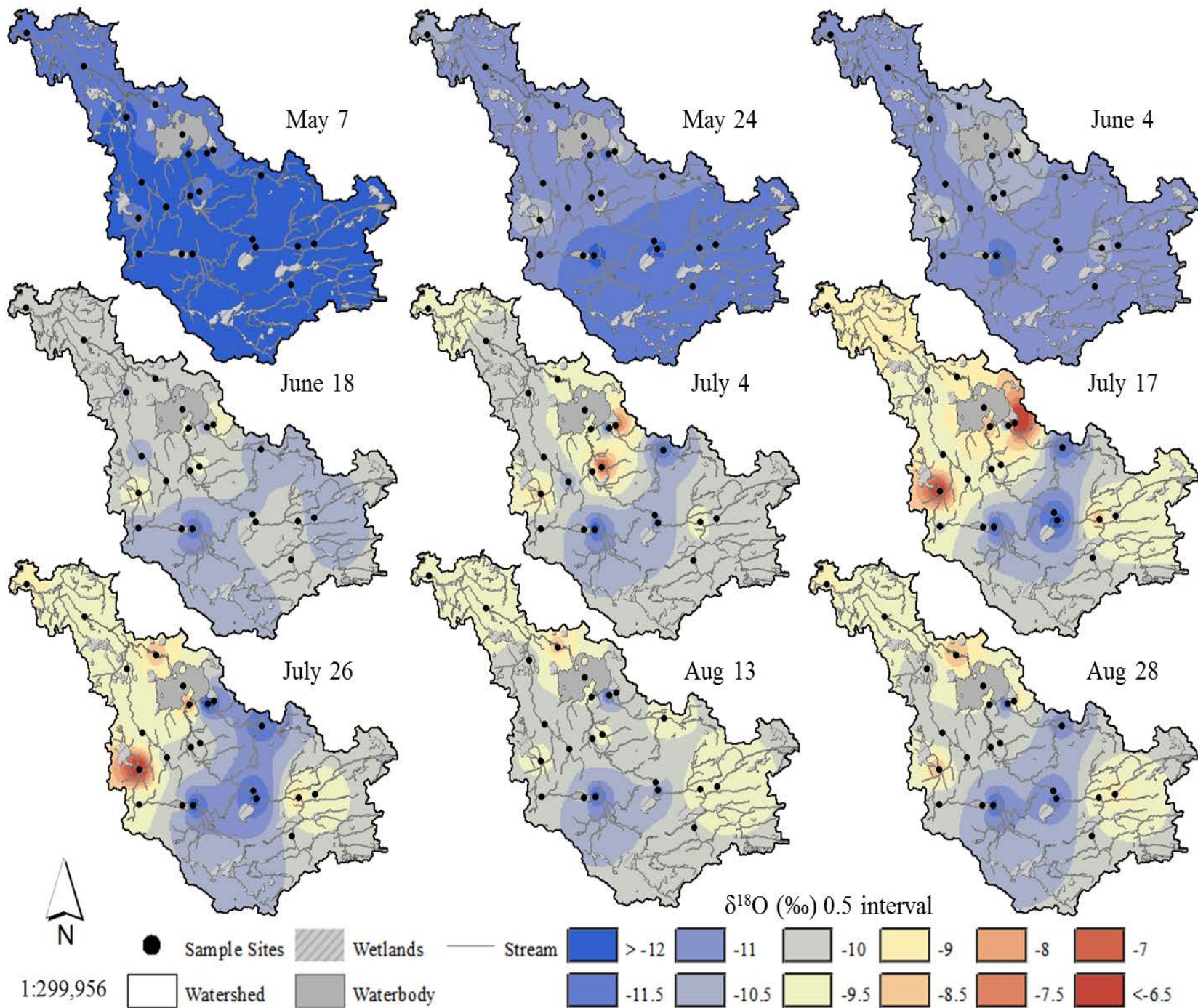




- Waterbody
- Wetlands
- Sample Sites
- Stream

$\delta^{18}\text{O}$ (‰)





Summary

First watershed isotope study in the Lake Nipissing watershed.

We selected the Wasi watershed to help inform how watersheds deliver water and from where.

We have started a local meteoric waterline.

We can see dynamic changes in water isotopes signatures

We see a consistent influence of groundwater aligned with the quaternary geology

Thank you and thanks to the team!

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Technical Advisor: Dr. Krys Chutko

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community

Kristin Cummings (field assistance)

Watershed Hydrology Lab members (moral support)

