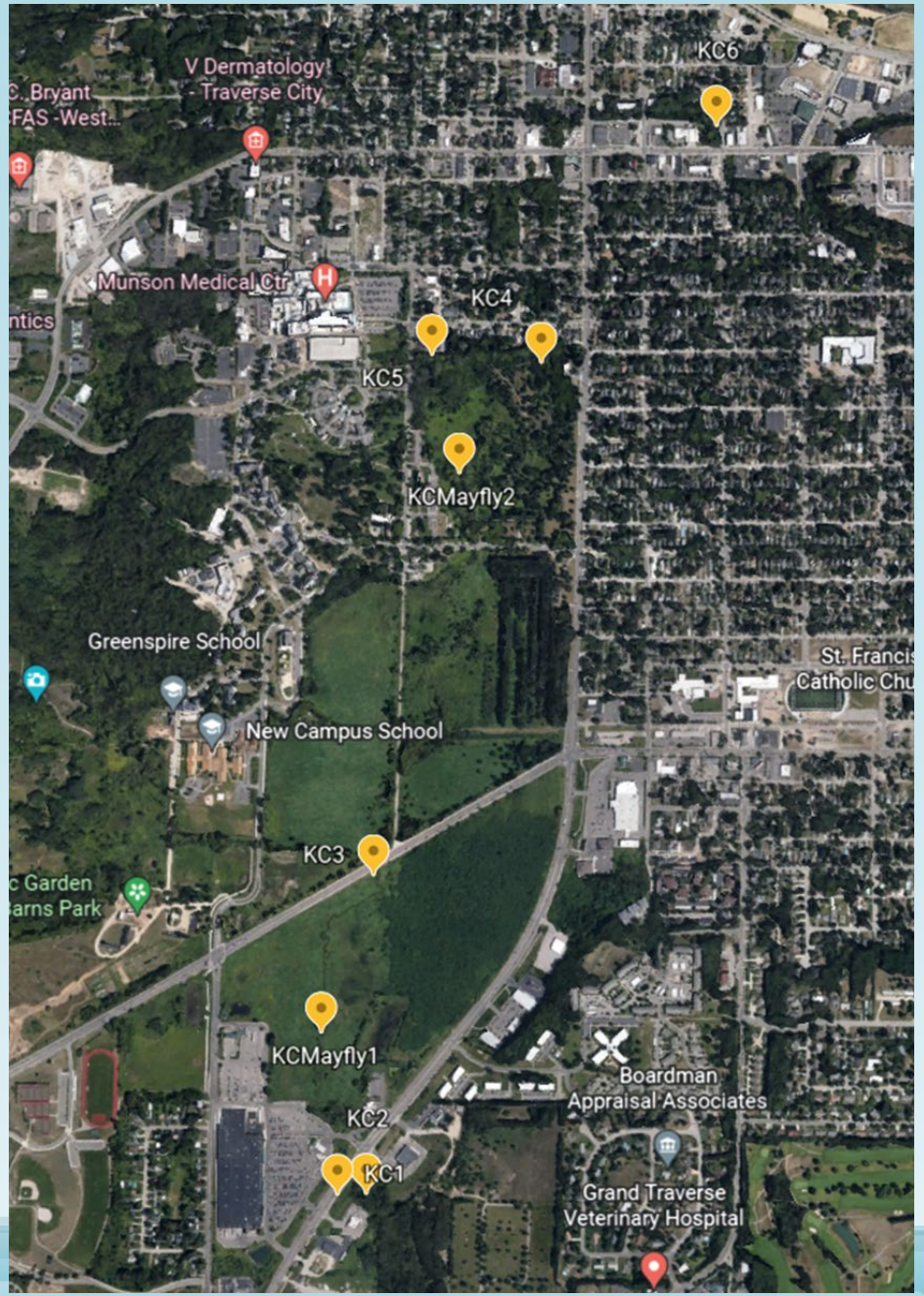
Development of Chloride- Conductivity Rating Curves

The project goal was to collect chloride and conductivity data concurrently in order to develop system-specific rating curves that would predict chloride concentrations from in situ measurements of conductivity.

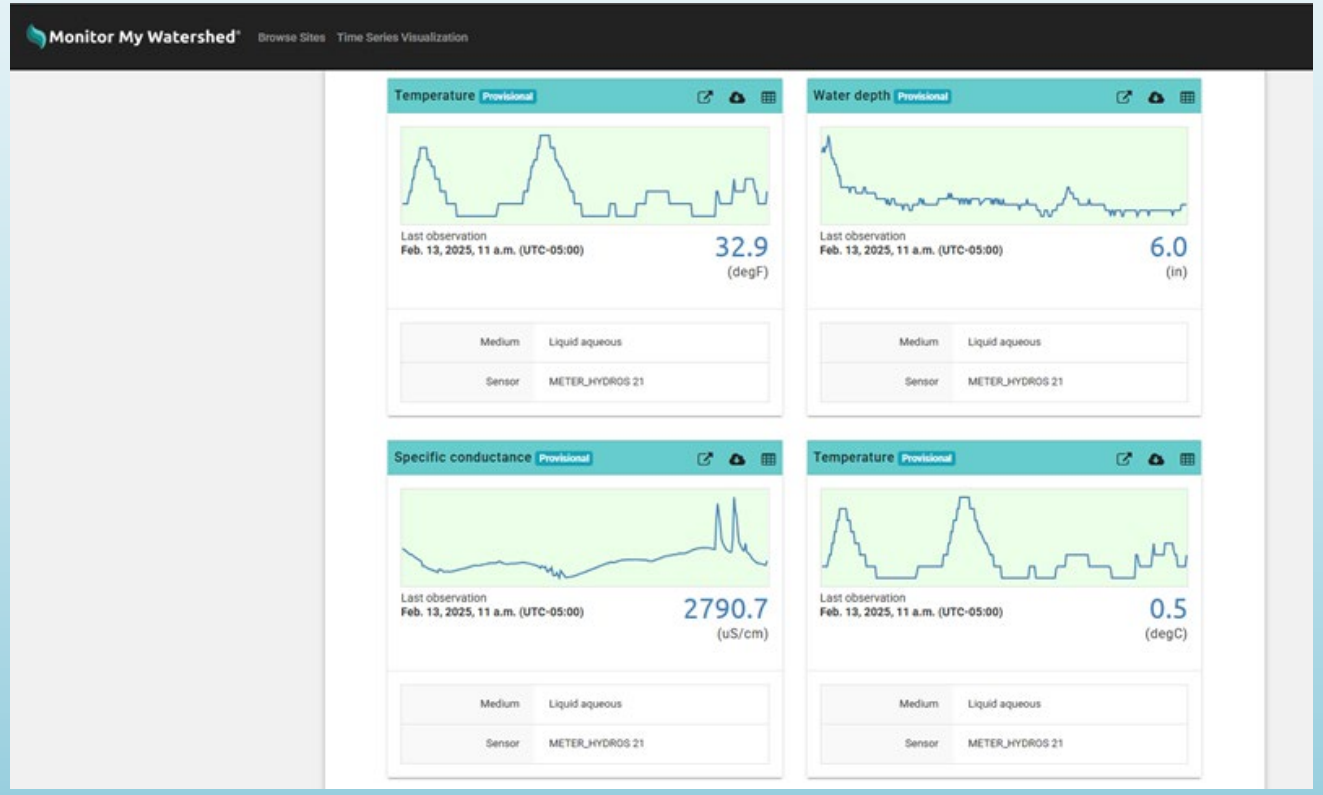
Chloride-Conductivity Monitoring

- 3 systems selected for monitoring: Kids Creek, Carrier Creek, and Plaster Creek
- Despite restoration activities, P51 scores have not improved.
- EGLE suspected high chloride concentrations during “off months” to be contributing factor



Methods

- October 2022 – March 2024
- In-situ measurements and Chloride samples
- Monthly and event-based
- Mayfly monitors – continuously monitored conductivity – know when to mobilize

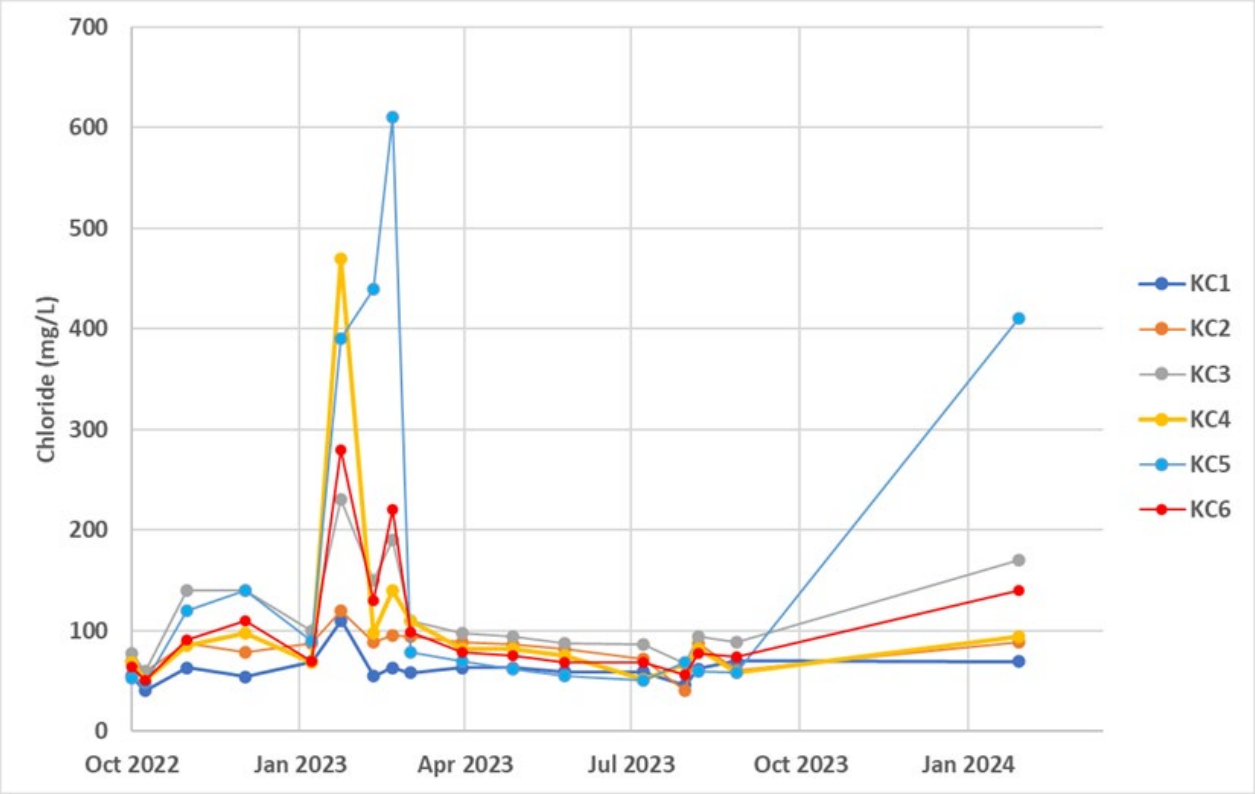


Mayfly Monitor

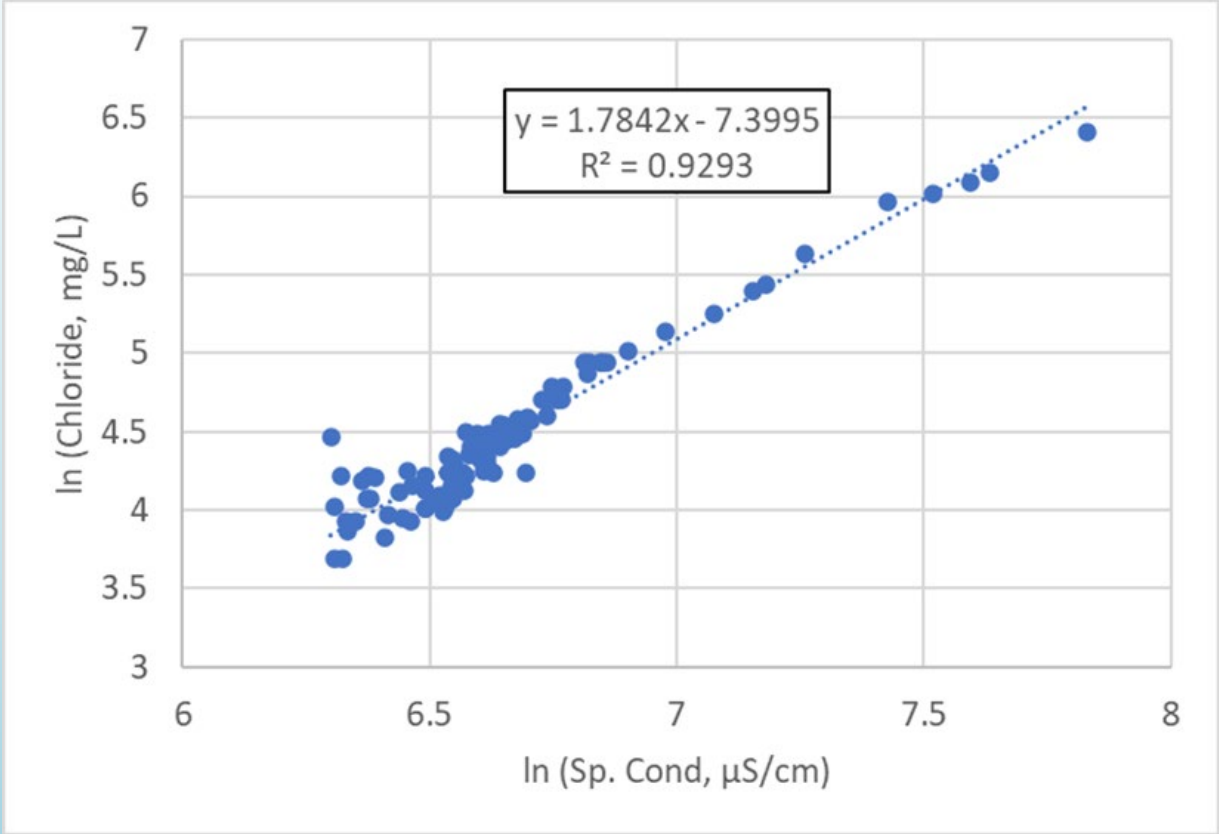
Results

- Higher Chloride measured in winter
- Rating curves between chloride concentration and conductivity developed for each system

Tributary	coefficient a	coefficient b	R^2
Carrier Creek*	0.0579	1.177	0.973
Kids Creek*	0.000612	1.784	0.929
Plaster Creek	0.00828	1.427	0.879



Kids Creek chloride concentration timeseries

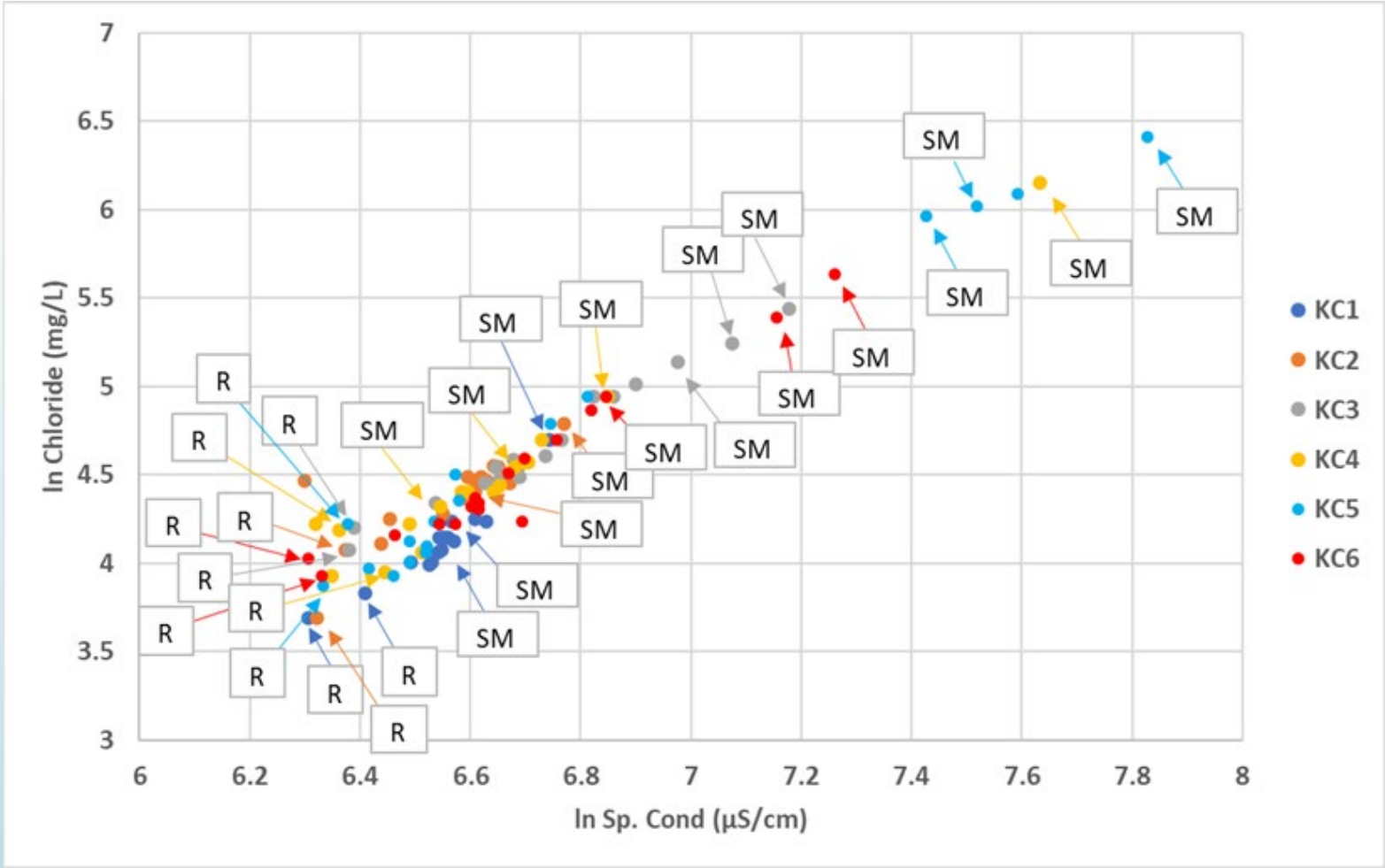


Rating curve for chloride vs. conductivity in Kids Creek

Results

- Inspection of the rating curves for Kids Creek and Plaster Creek revealed more variance and lack of fit at the lower end (rain events)

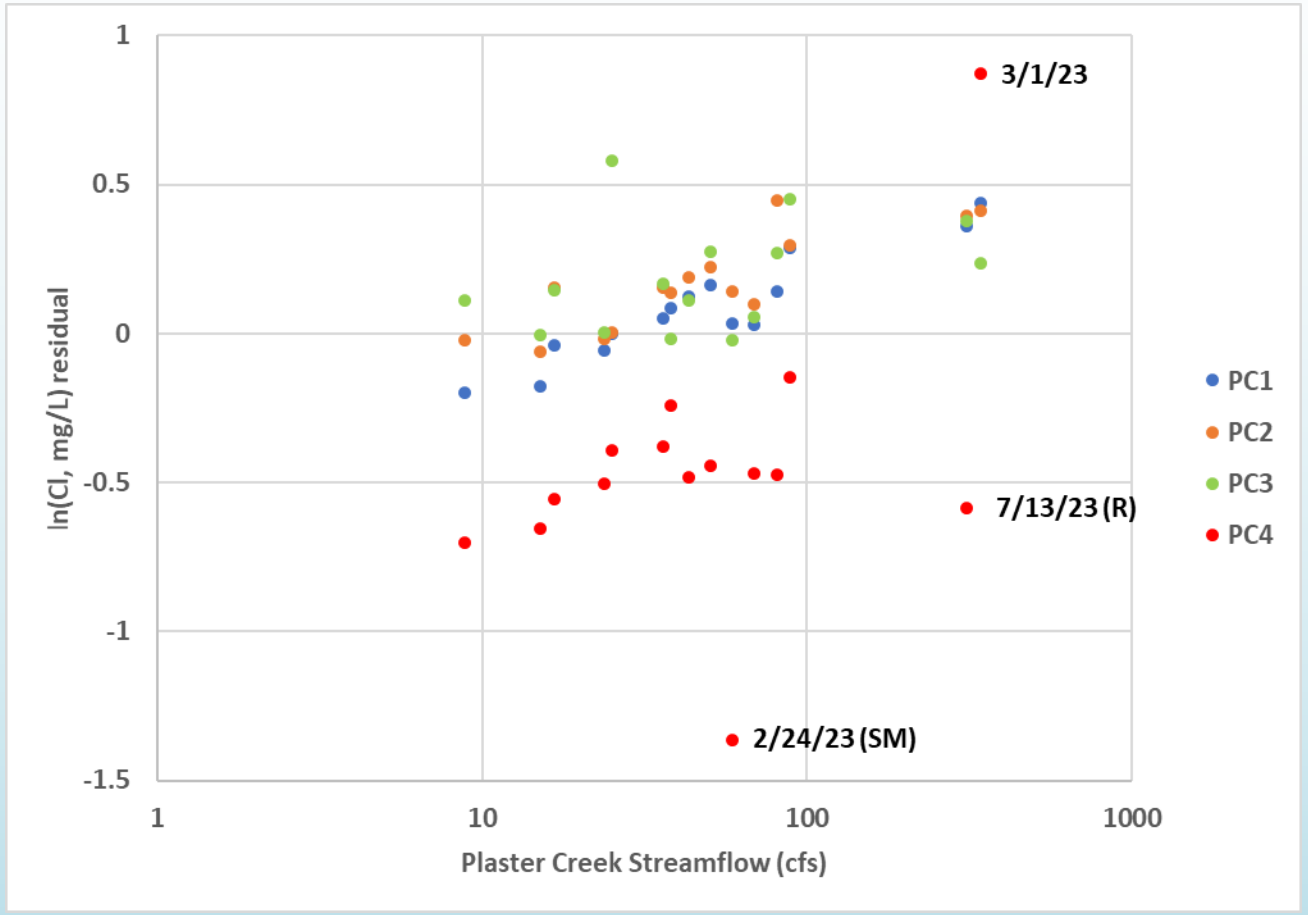
- Investigated stream flow and land use characteristics in each system to help explain the lack of fit



Lack of fit during rain events in Kids Creek

Results

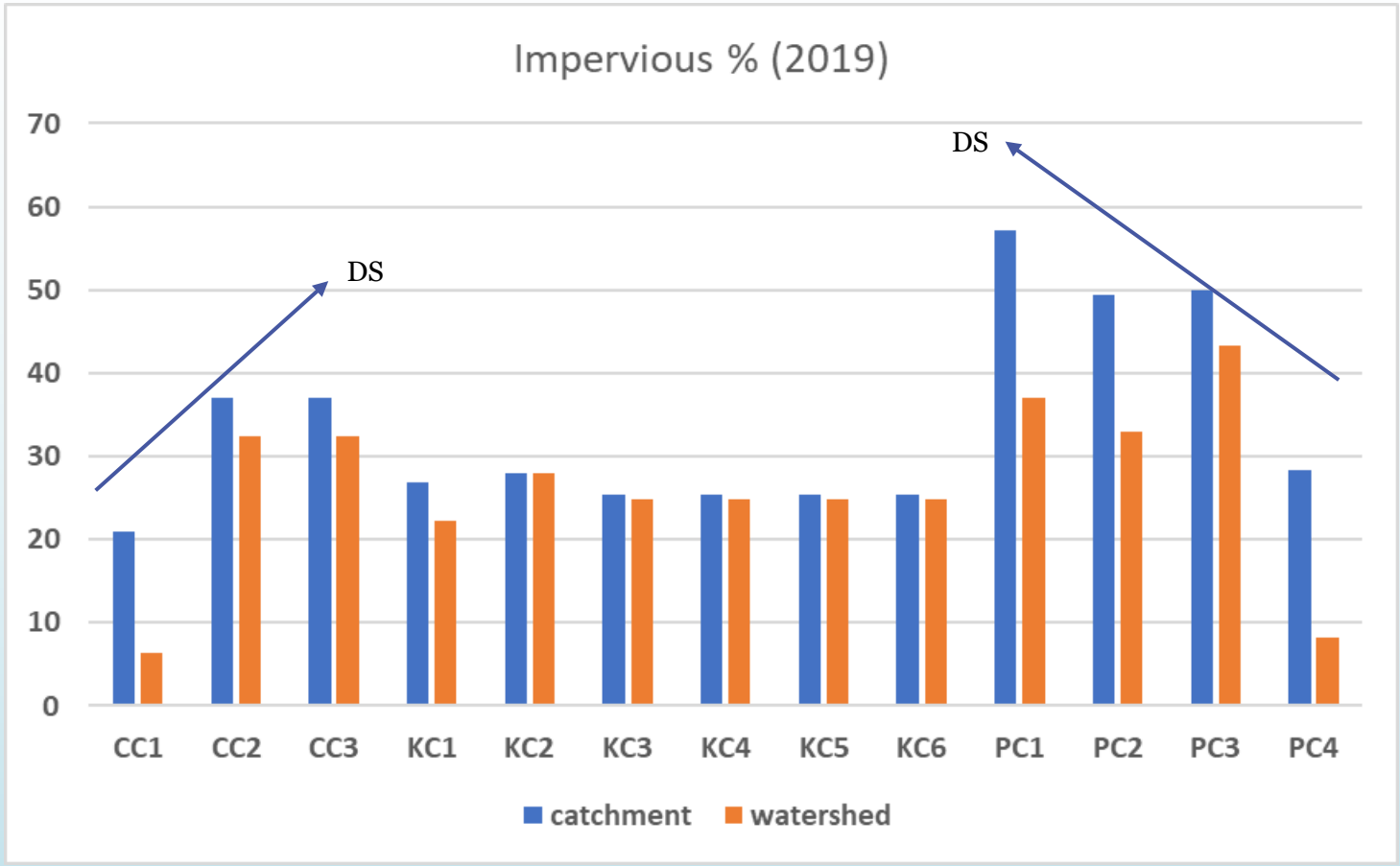
- Chloride vs. Streamflow: showed no particular relationship in Carrier or Kids Creeks.
- Plaster Creek – Chloride increases with streamflow. As streamflow increases, Cl ions make up an increasing proportion of ions that constitute conductivity
- PC4 unique – lead to an investigation of:
  - % impervious surface
  - Road density
  - Population density
  - Density of WWTPs



Plaster Creek – as streamflow increases, Cl residuals increase

Results

- Chloride vs. Land Use:
- Carrier Creek and Plaster Creek had notable gradient of landuse characteristics between upper and lower watershed sites
- PC4: less anthropogenic activity, fewer non-point source loadings of Chloride
  - This influences water quality and the rating curve.



CC and PC showed increasing impervious cover moving downstream

Summary: Chloride-Conductivity Monitoring

- Goal: To develop rating curves that would allow for a prediction of chloride concentration using an in-situ measurement of conductivity.
- A non-linear power relationship provided the best fit of the chloride-conductivity data.
- The Plaster Creek data was best fit by creating two different rating curves, one for PC4 and one for PC1-PC3

$$ln(Cl^{-}) = a + ln(b) \cdot \ln(cond)$$

Tributary	coefficient a	coefficient b	R^2
Carrier Creek*	0.0579	1.177	0.973
Kids Creek*	0.000612	1.784	0.929
Plaster Creek	0.00828	1.427	0.879

Tributary	coefficient a	coefficient b	R^2
PC1 – PC3*	0.02503	1.290	0.976
PC4	0.5651	0.6985	0.250
PC4 (2 data excluded)*	0.01255	1.290	0.867