

Electrokinetic Brine Spill Remediation Project

Presented by Matt Foreman

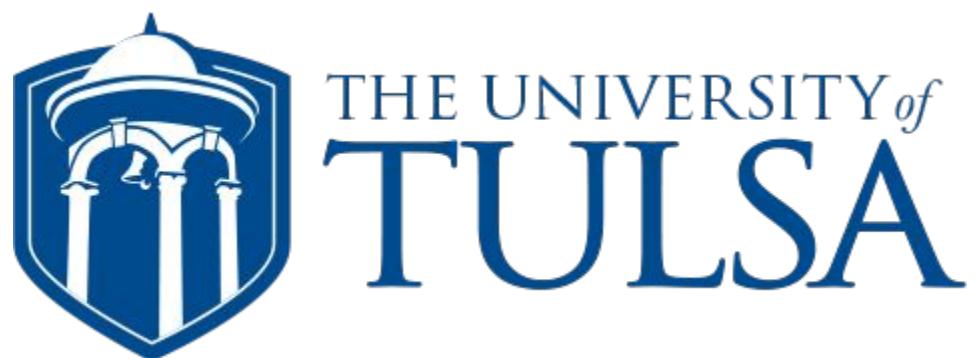


Acknowledgments

Advisor – Dr. Javen Weston

Undergraduate Student – Bethany Mally

REU Advisor – Dr. Laura Ford

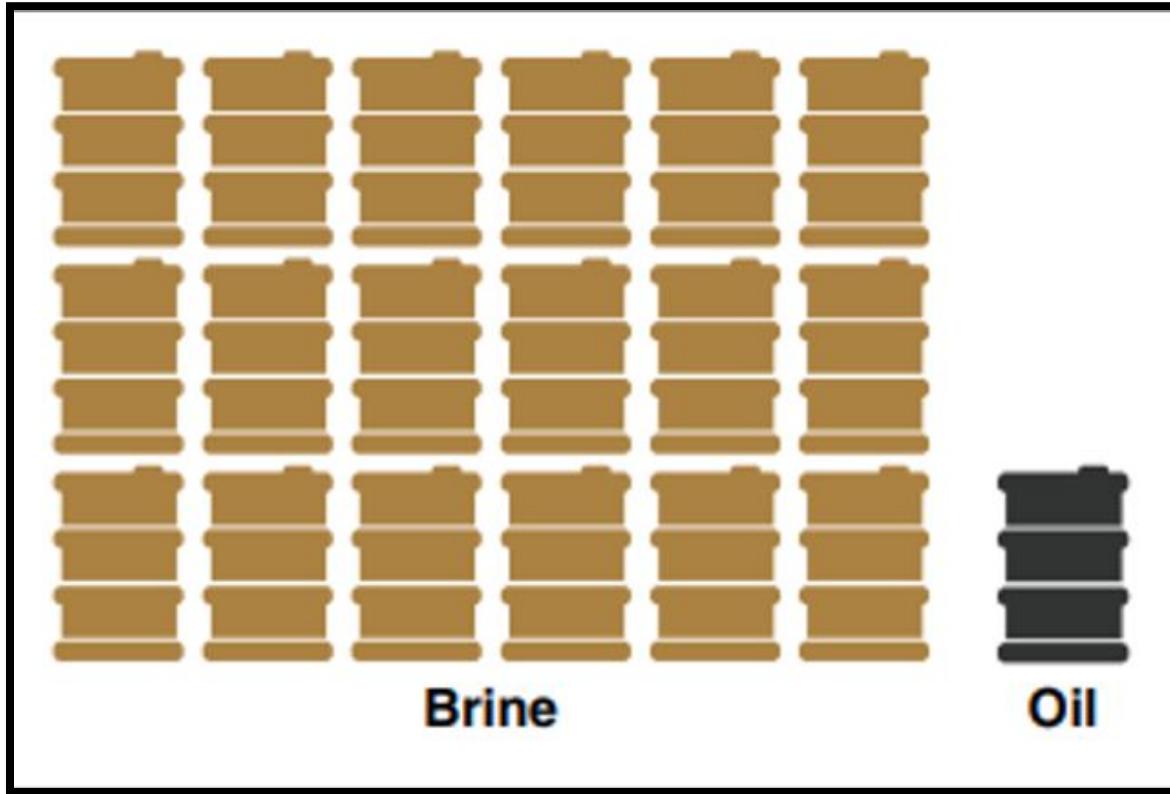


The oil production byproduct brine permanently damages soil when spilled



Photo by Bethany Mally

There is significantly more brine produced than oil
in the life of a well.



18:1

Soil damage increases over time after a brine spill

Initial Spill



1 week –
1 month



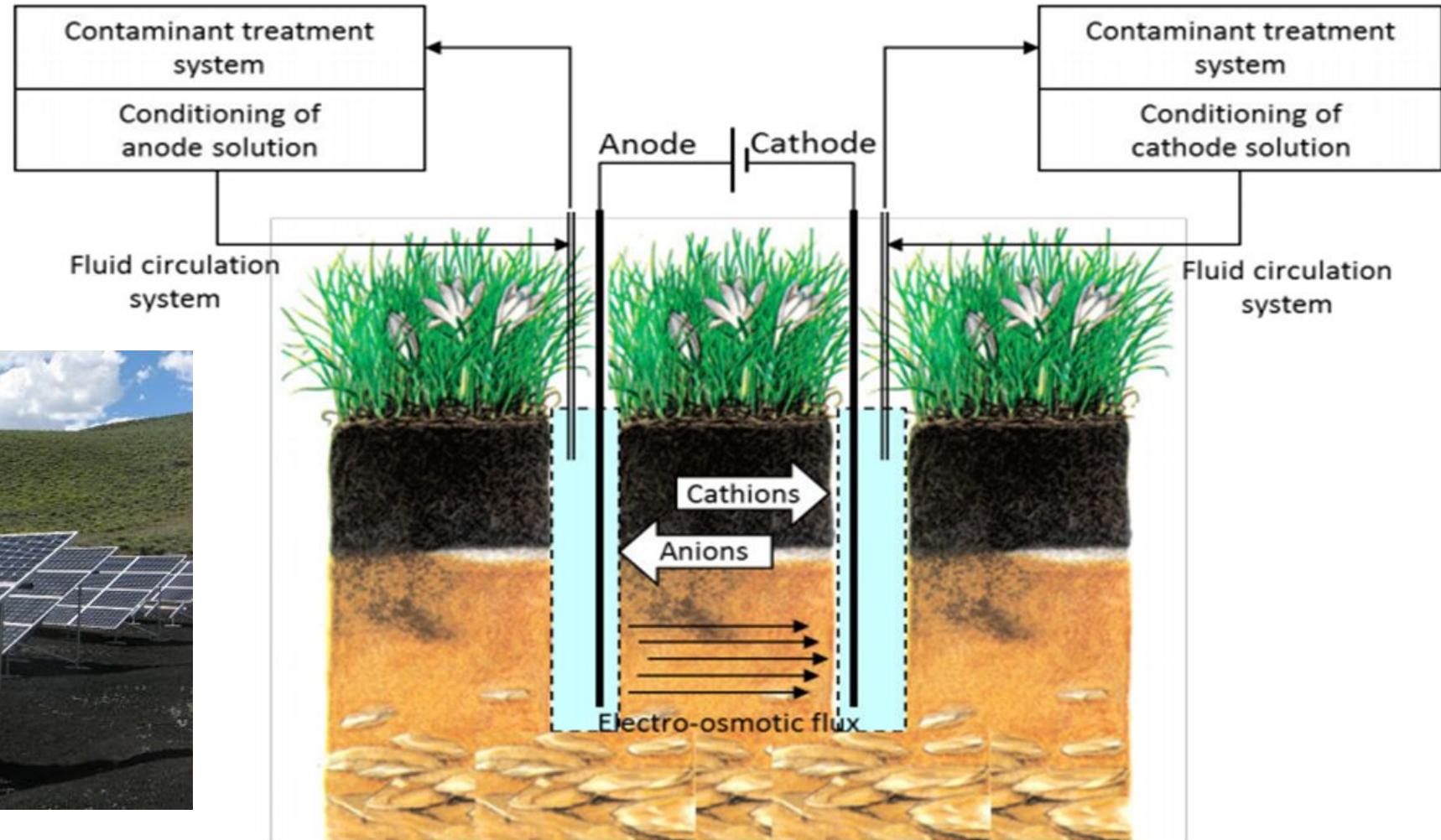
1-2 years

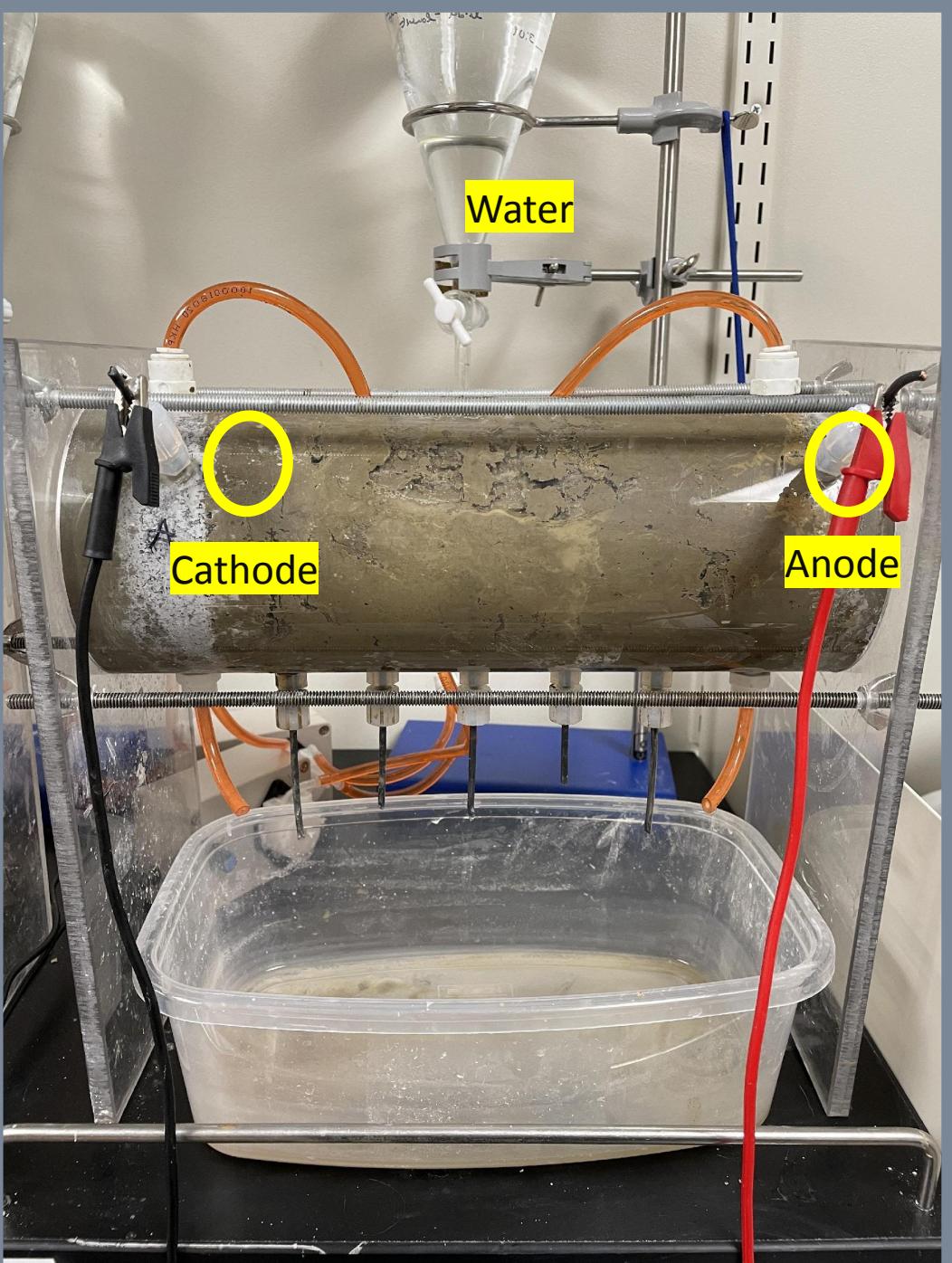


5+ years



In a field setting a device will be used for Electrokinetic remediation

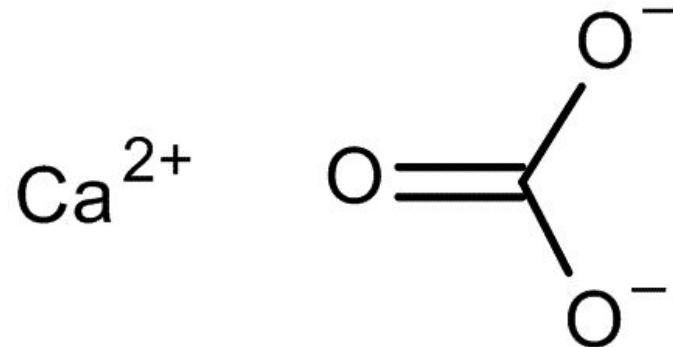




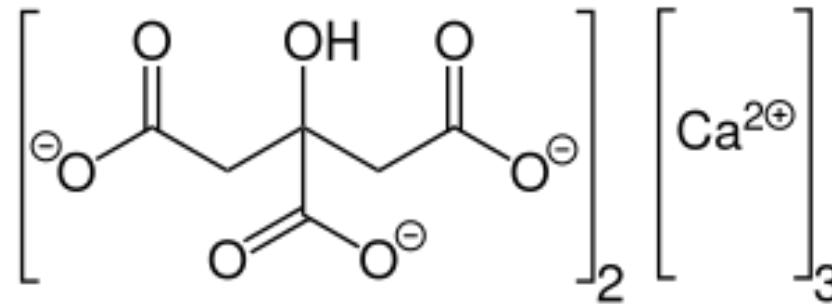
Electrokinetic remediation uses electricity to draw the sodium and chloride ions to electrodes

Different forms of calcium are added to determine their effects on remediation

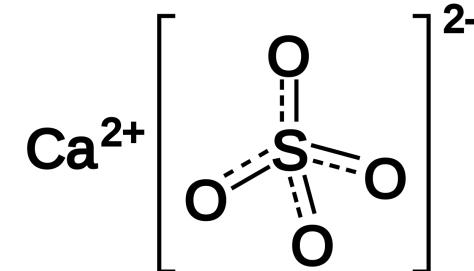
Calcium Carbonate (Lime)

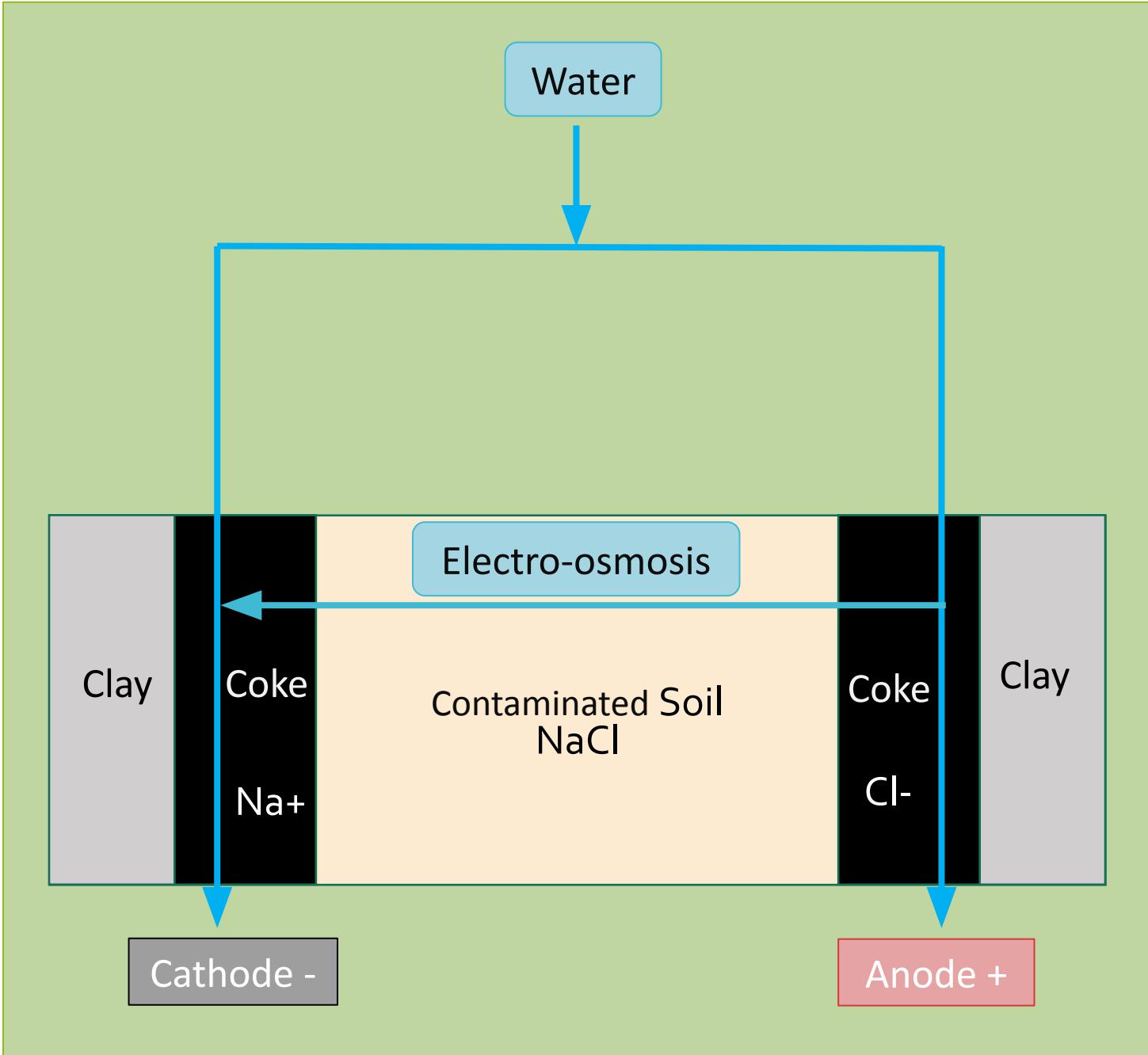


Calcium Citrate

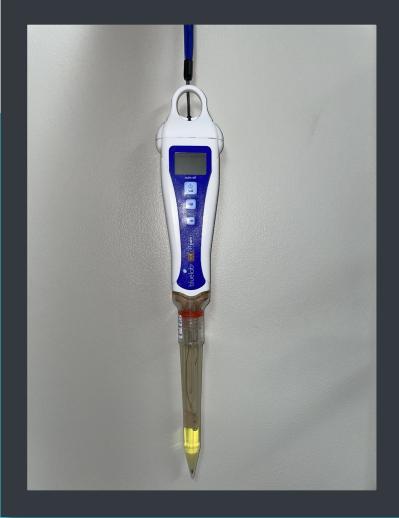


Calcium Sulfate (Gypsum)





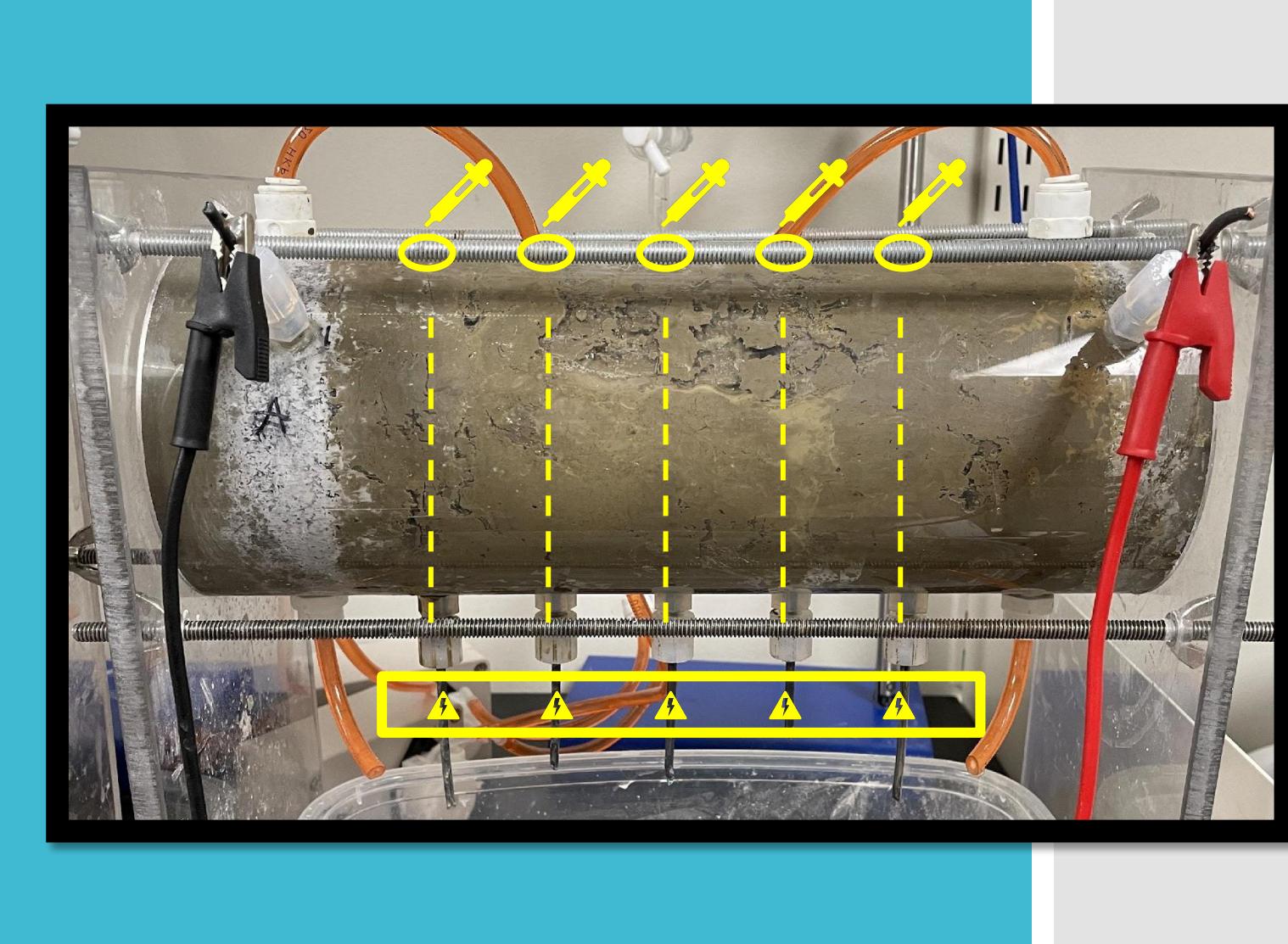
The calcium additives are introduced to the coke mixture. Water is pumped through the layers of coke to remove the chloride and sodium ions after they have been separated.

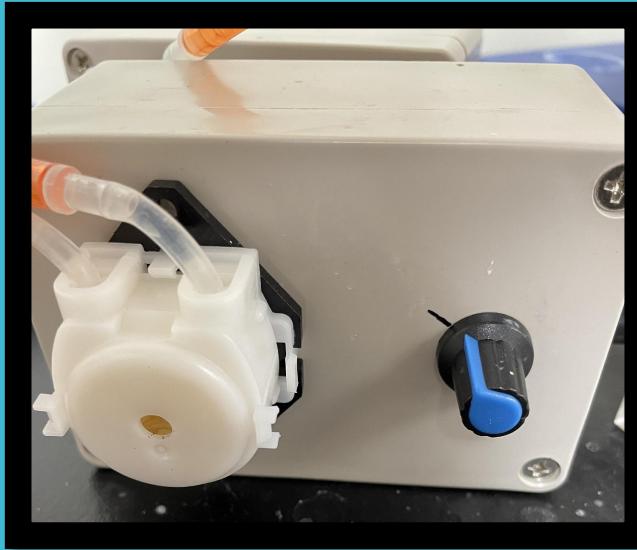


pH Meter



Voltage meter

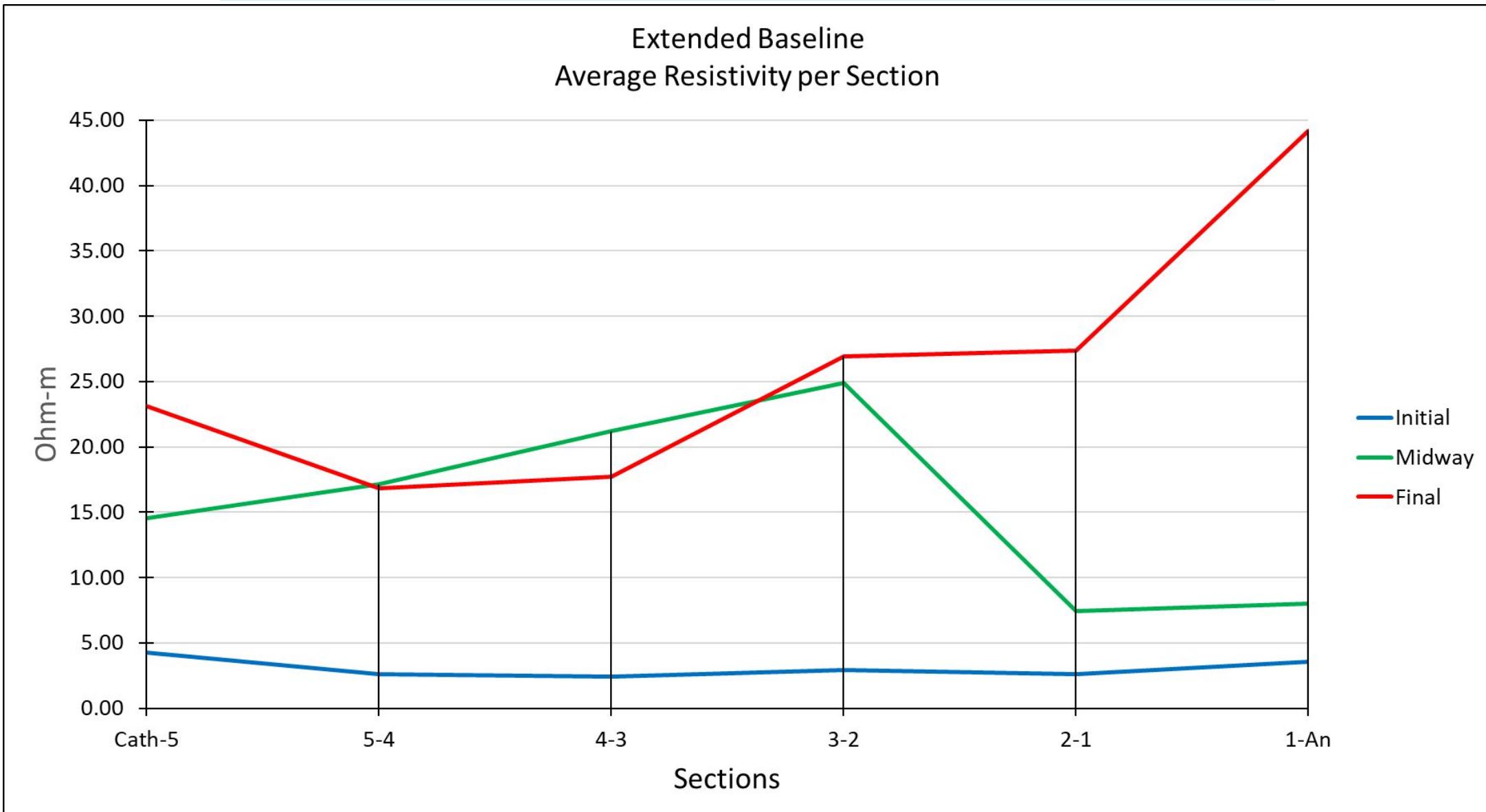




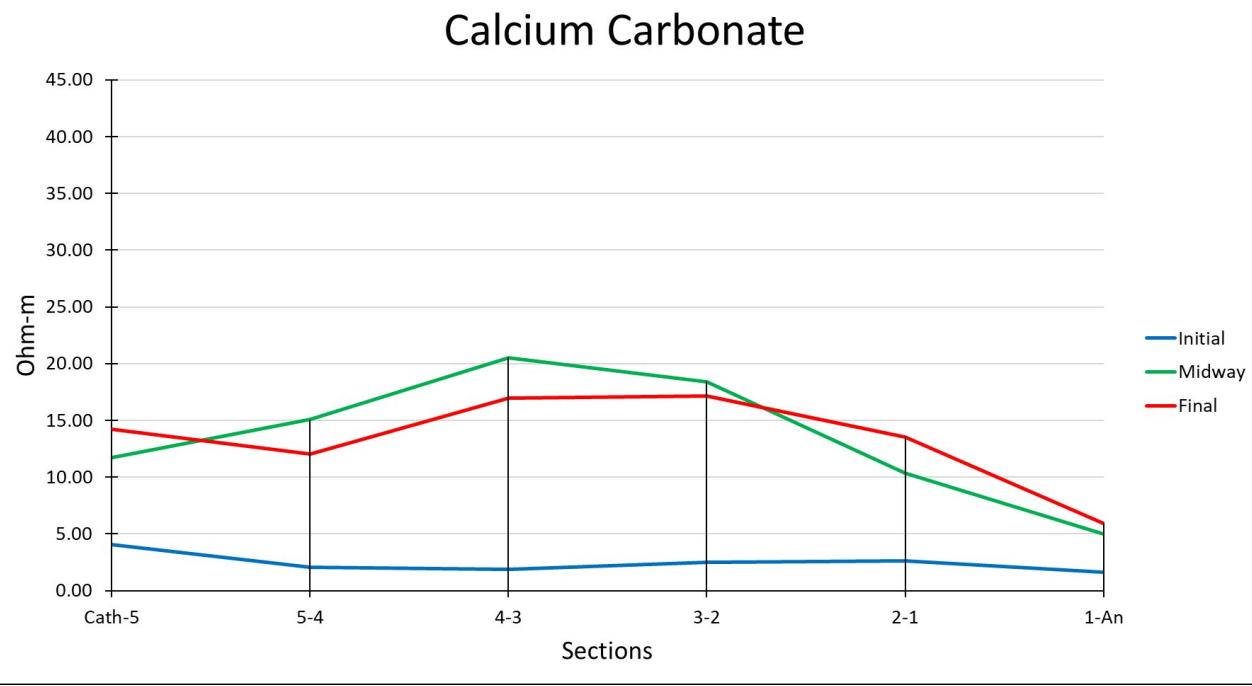
Peristaltic pumps have been added and connected to a timer.

Run at a rate of 30 seconds per hour to clean out the build up of ions.

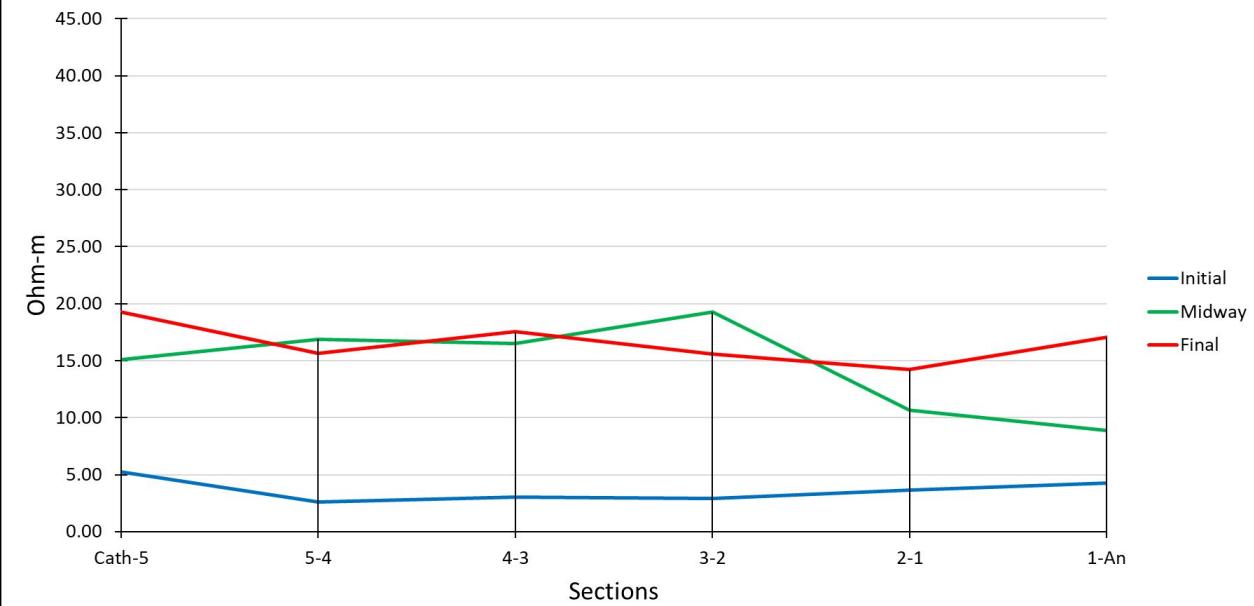
Resistance shows that ions are being removed from the soil



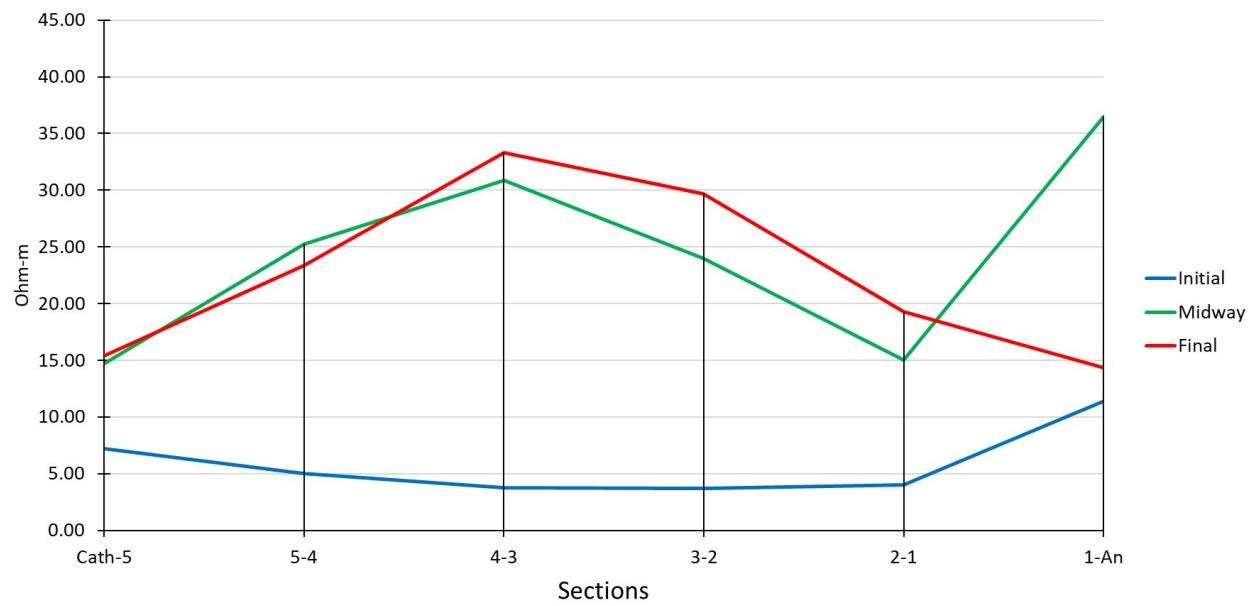
Resistivity follows similar trends across other calcium tests with some variations



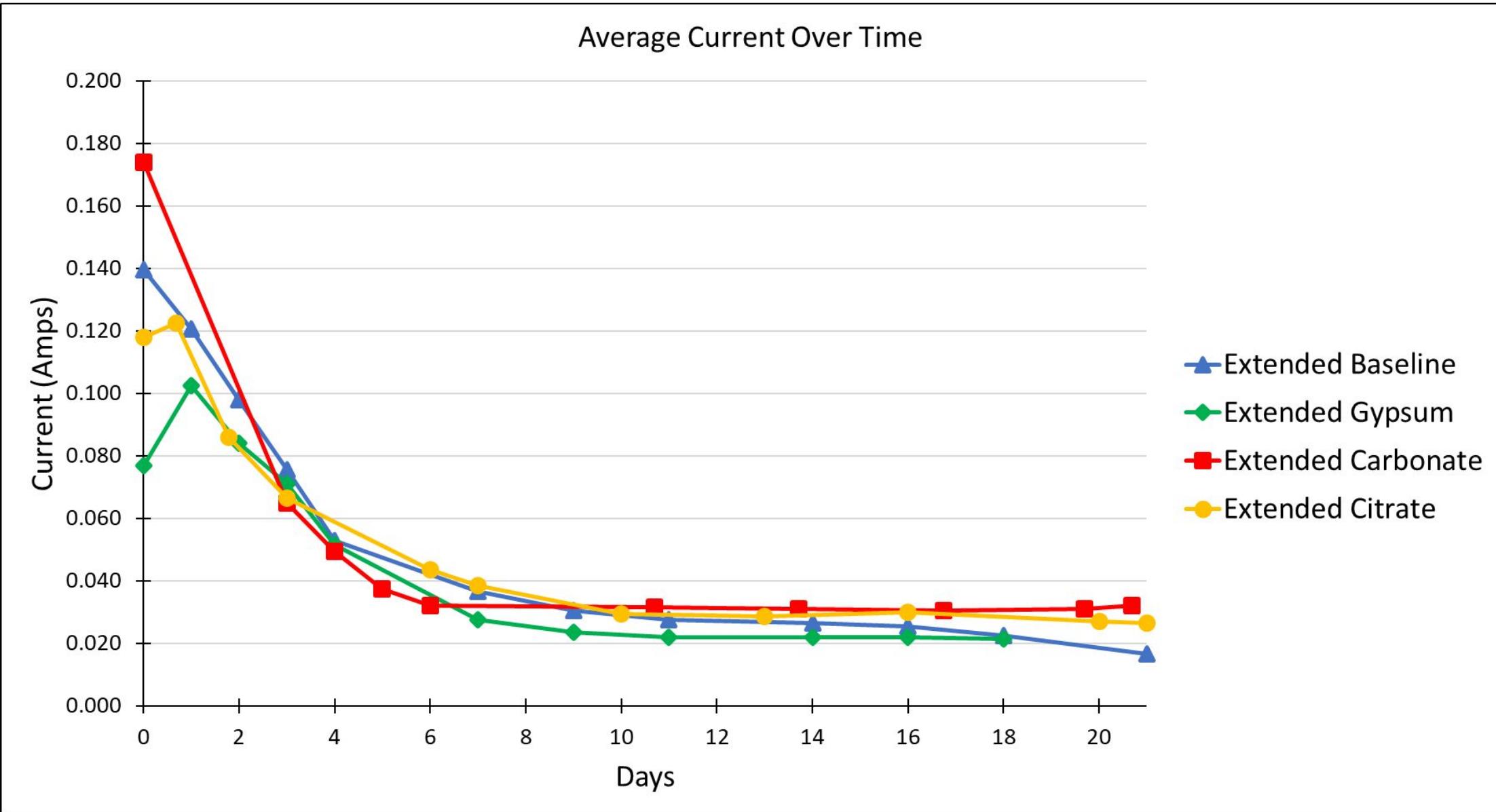
Calcium Citrate



Gypsum (Calcium Sulfate Dihydrate)

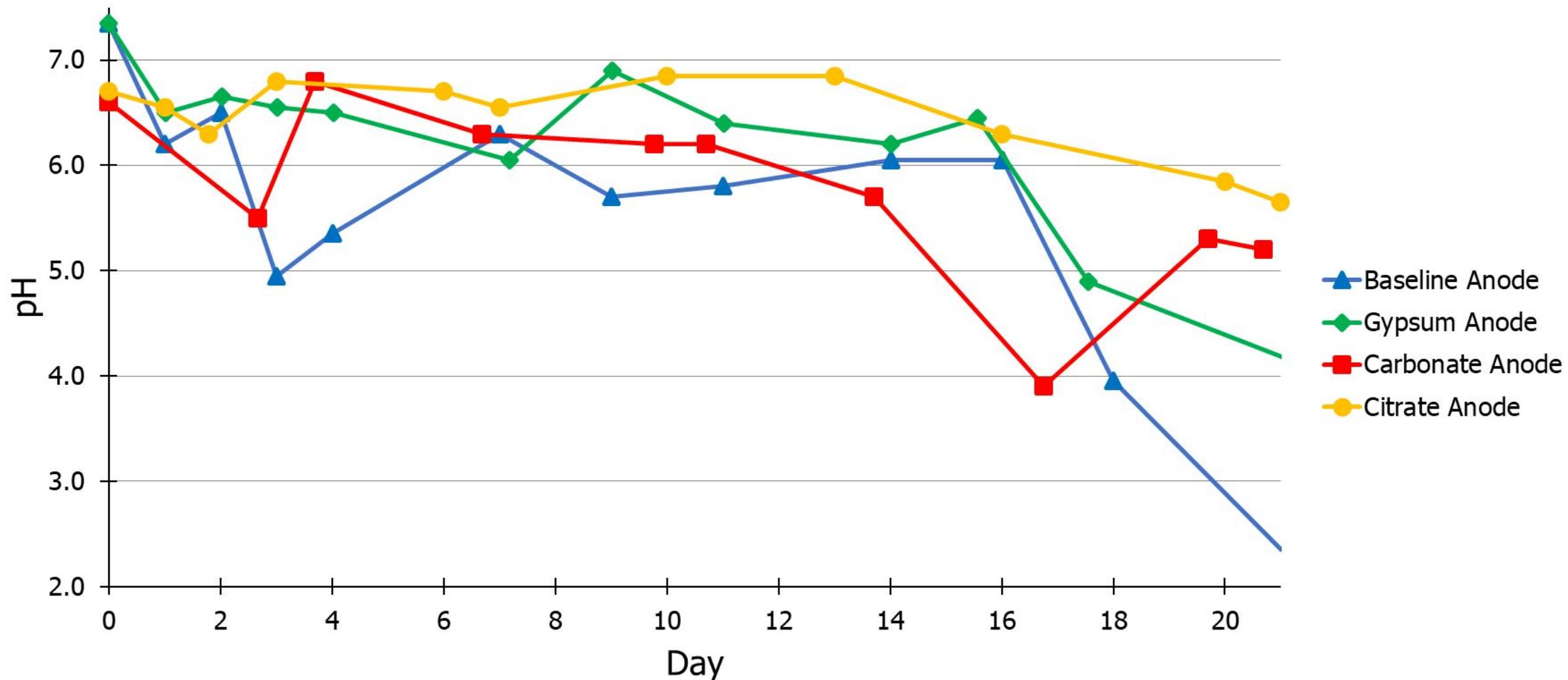


The current across all tests follow a consistent path even with separate starting currents

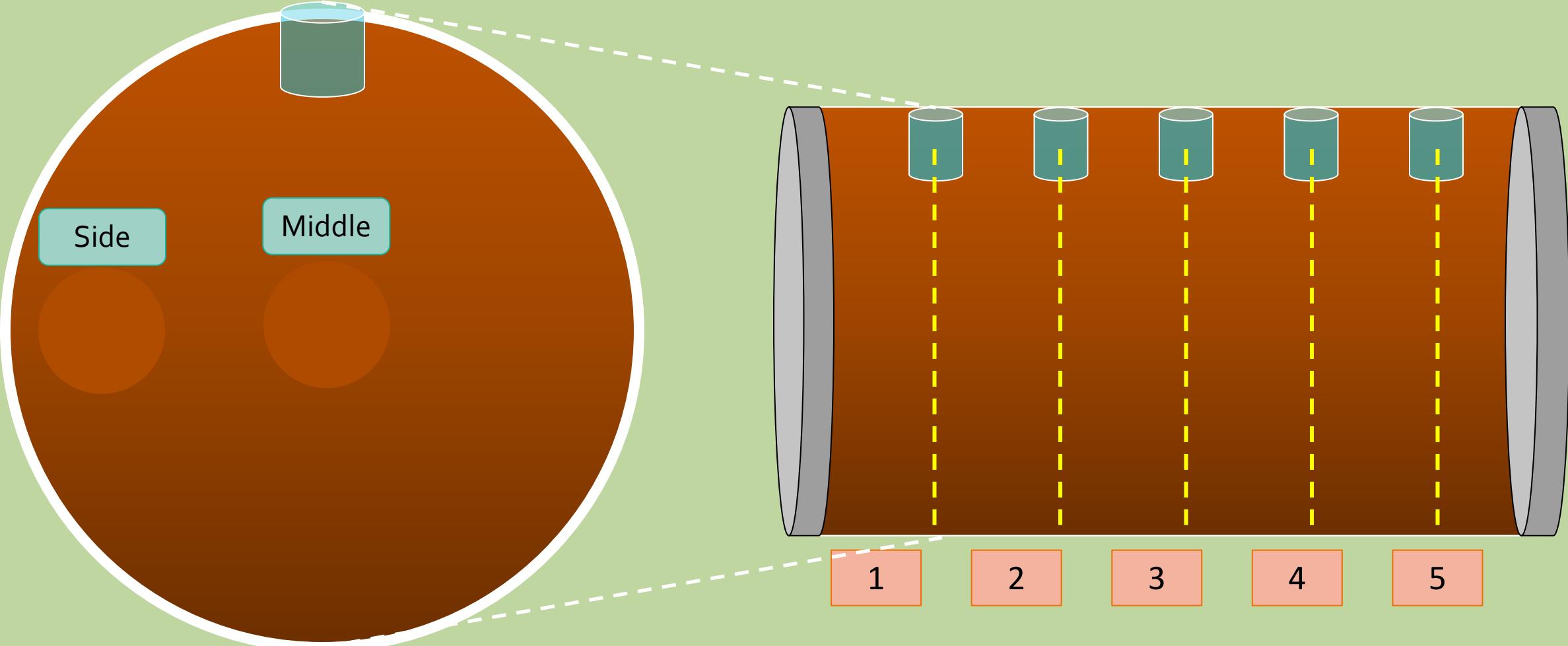


Calcium additives show similar trends near the cathode but alterations at the anode.

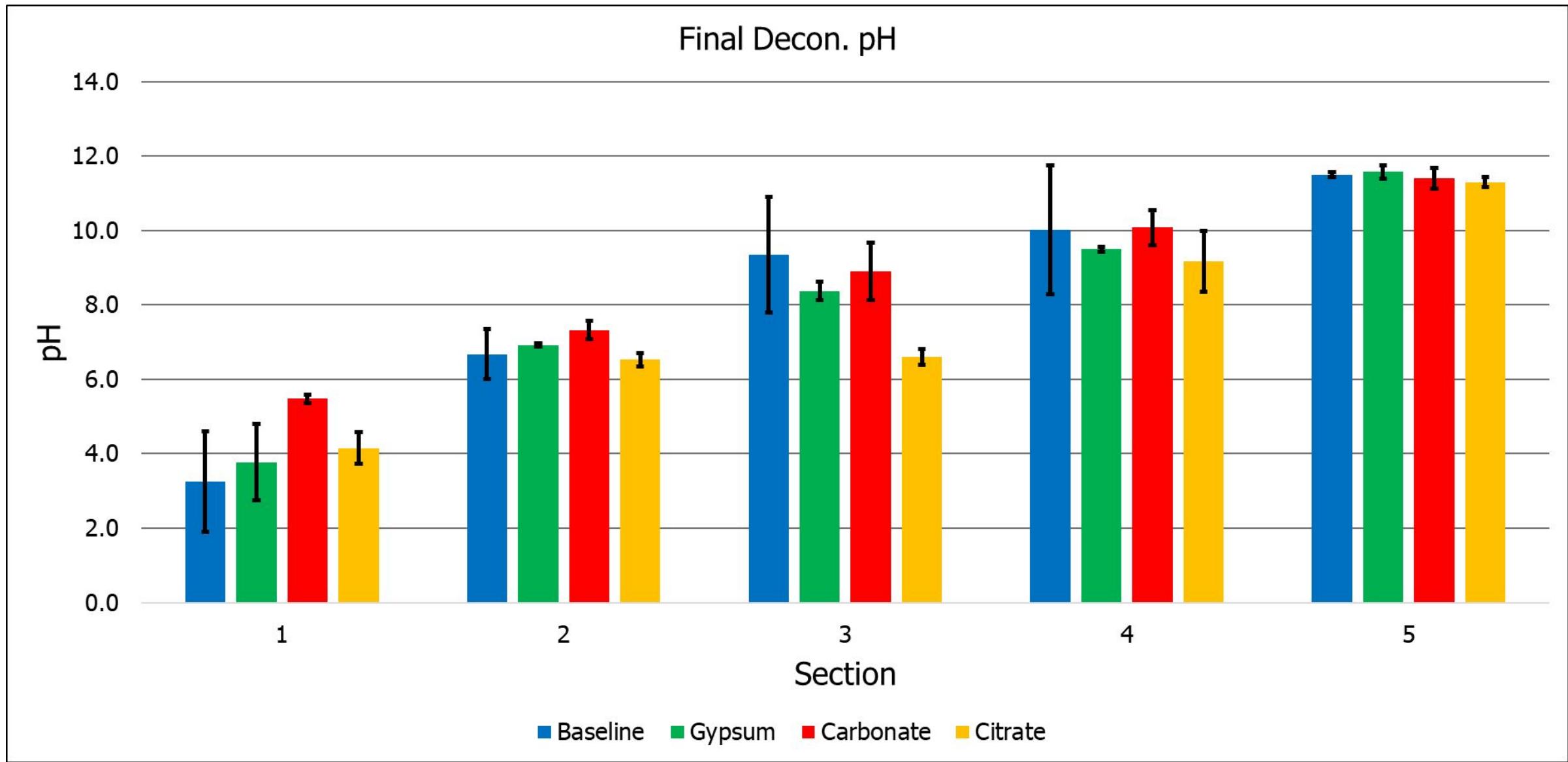
pH over time



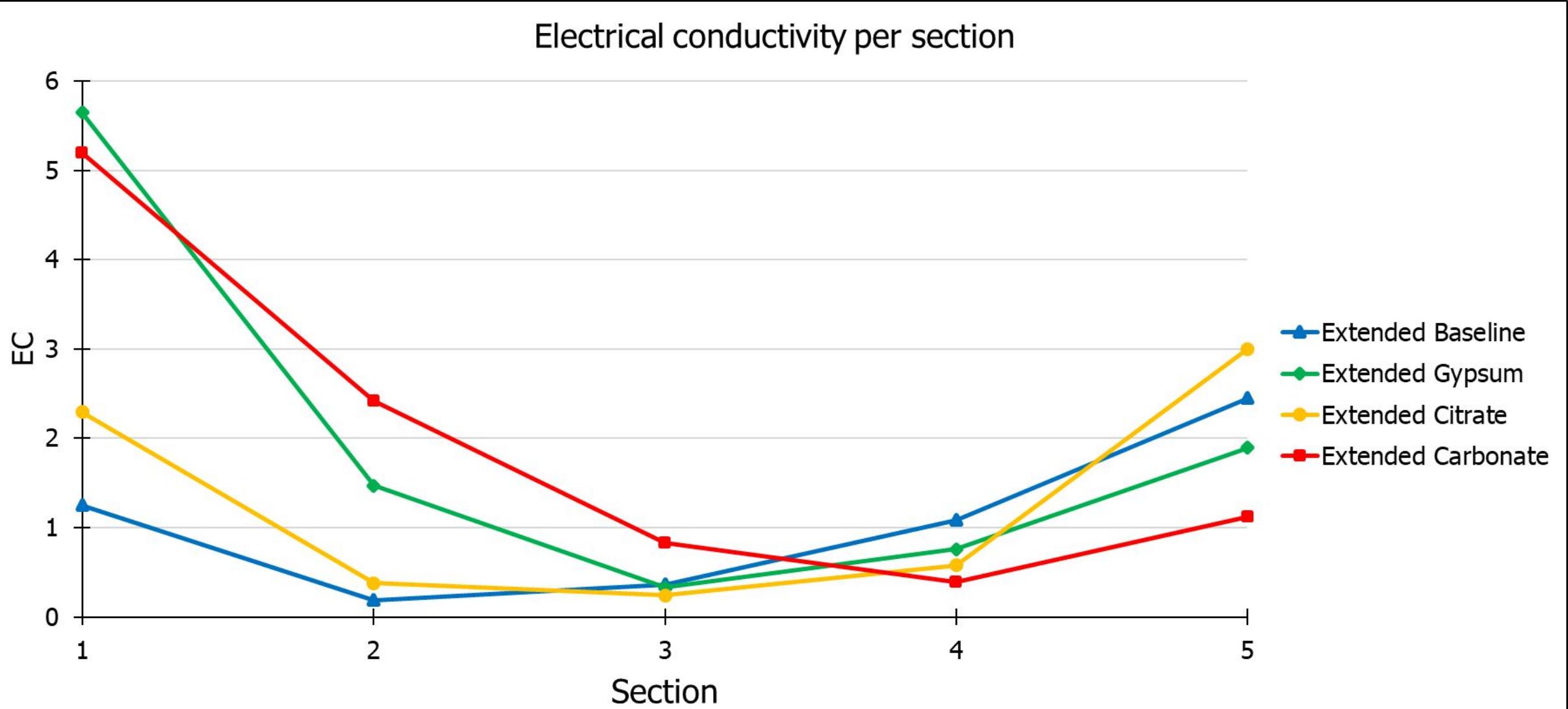
How the final soil samples are taken from each section during deconstruction of the device



The soil samples are averaged and recorded

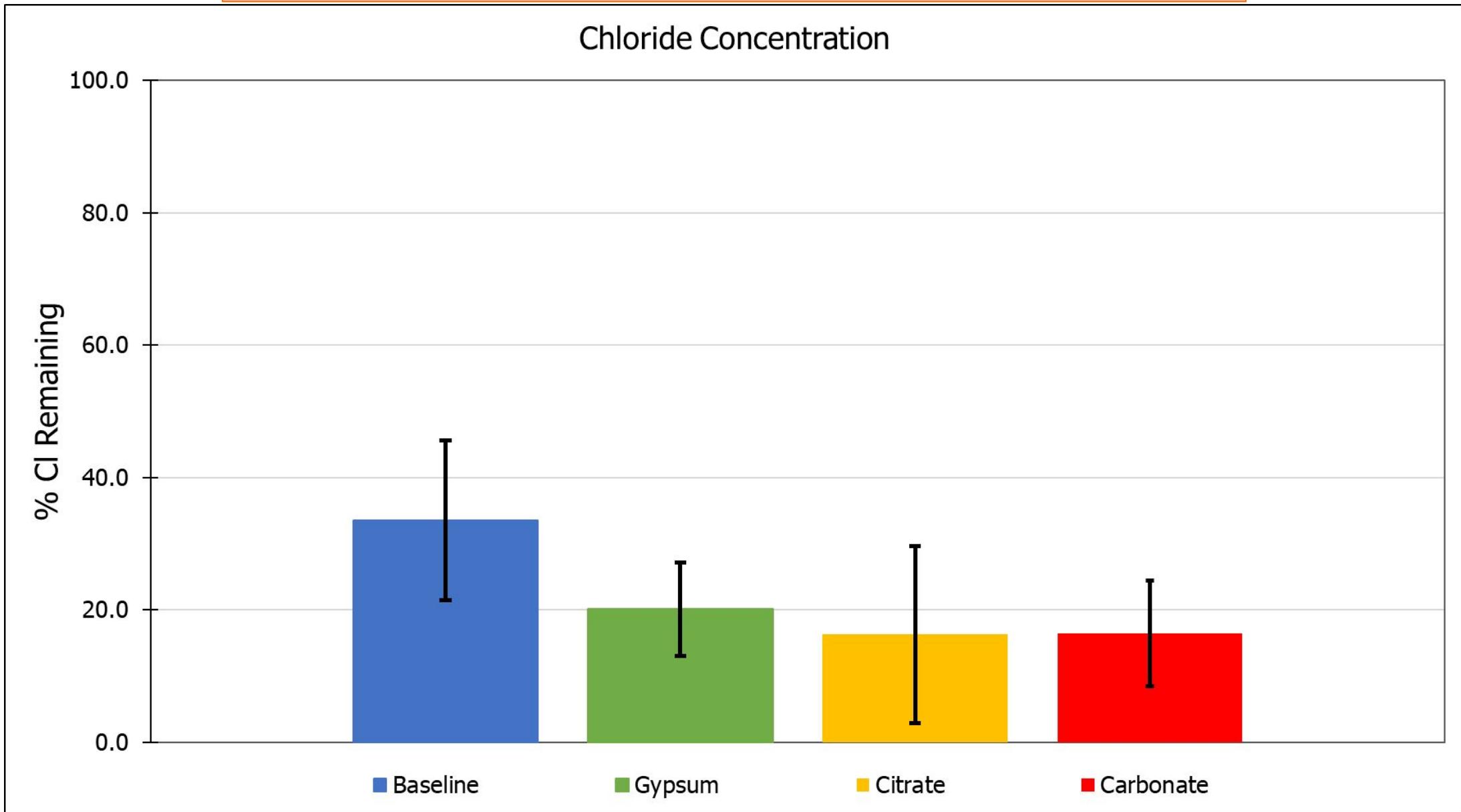


Electrical conductivity is recorded in the soil after testing



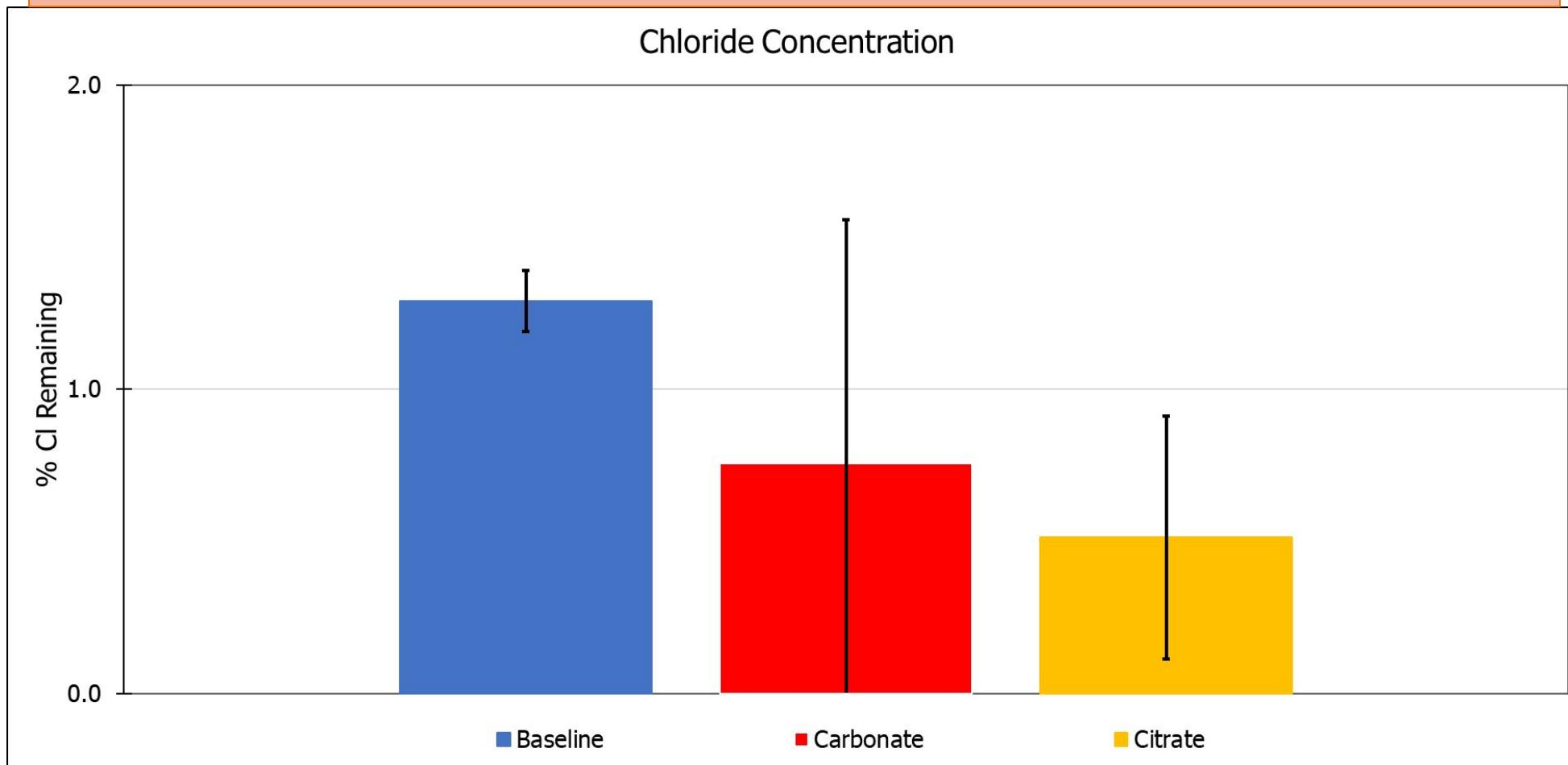
1 wk.

The 1 week long tests show a drop in chloride concentration but with high standard deviations



3 wk.

The 3 week long tests had a much more significant drop in chloride concentrations being less than 2% with citrate additive being the most effective



Any Questions?