

A History of Groundwater Contamination and Treatment in Wooster, Ohio

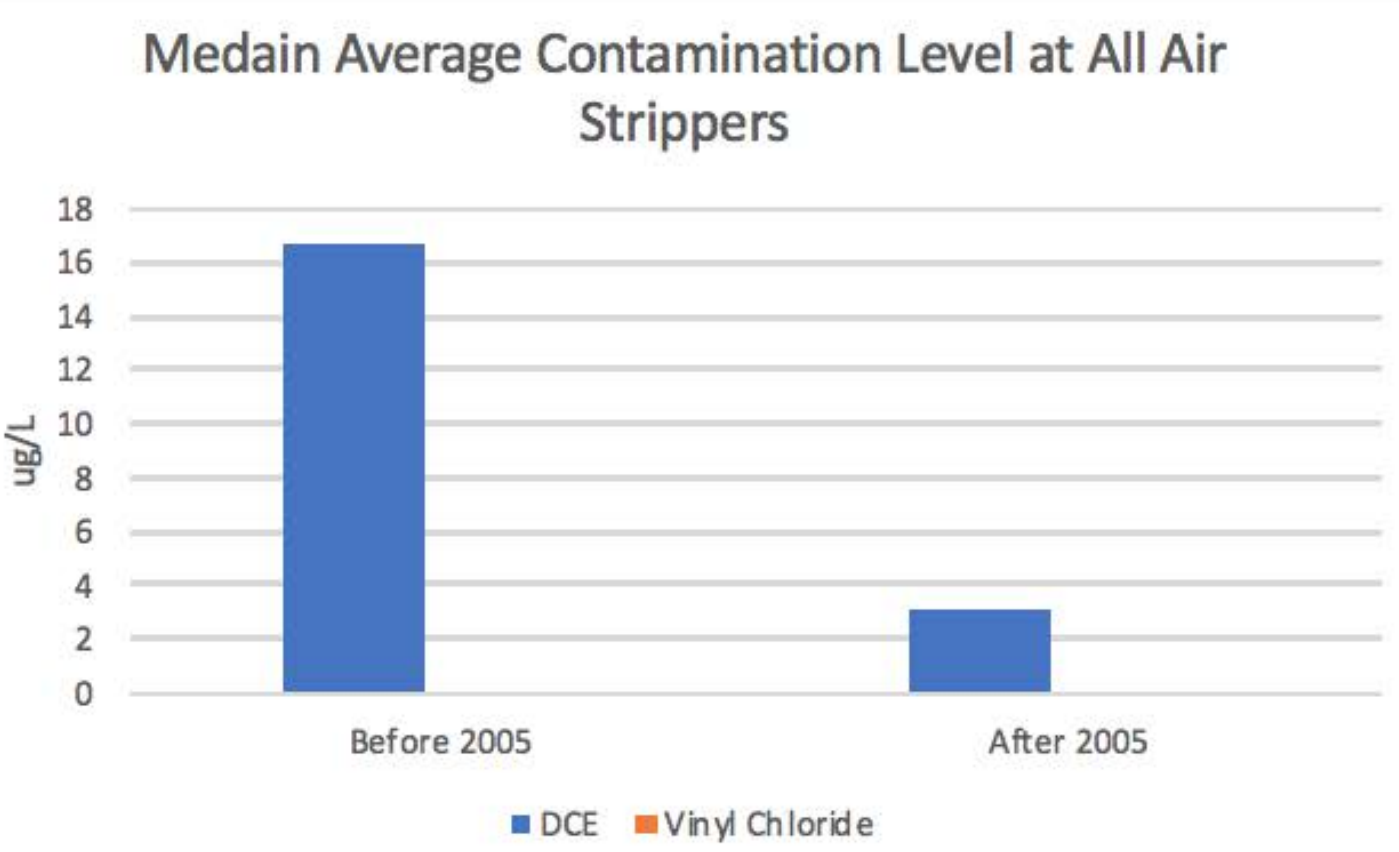
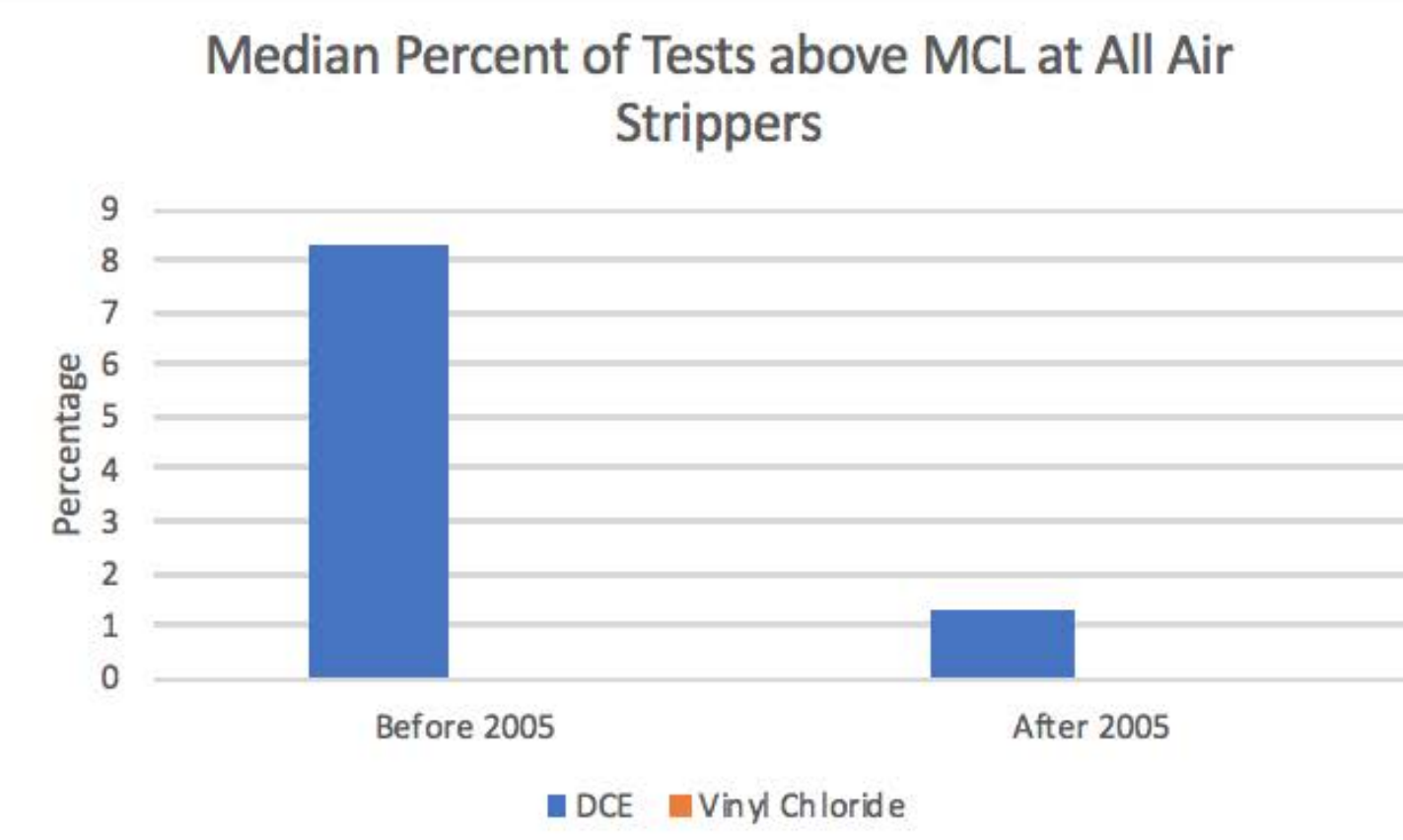
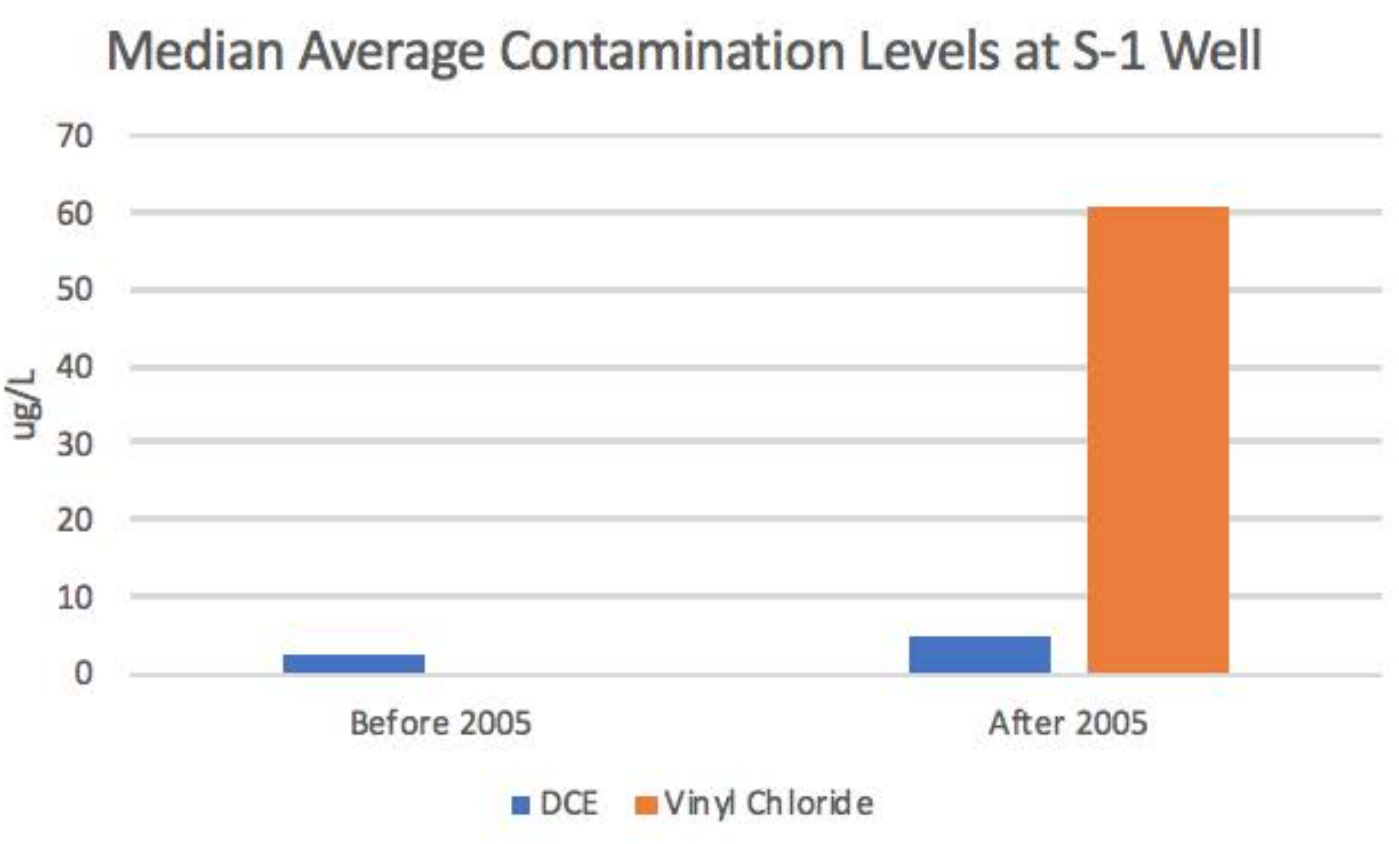
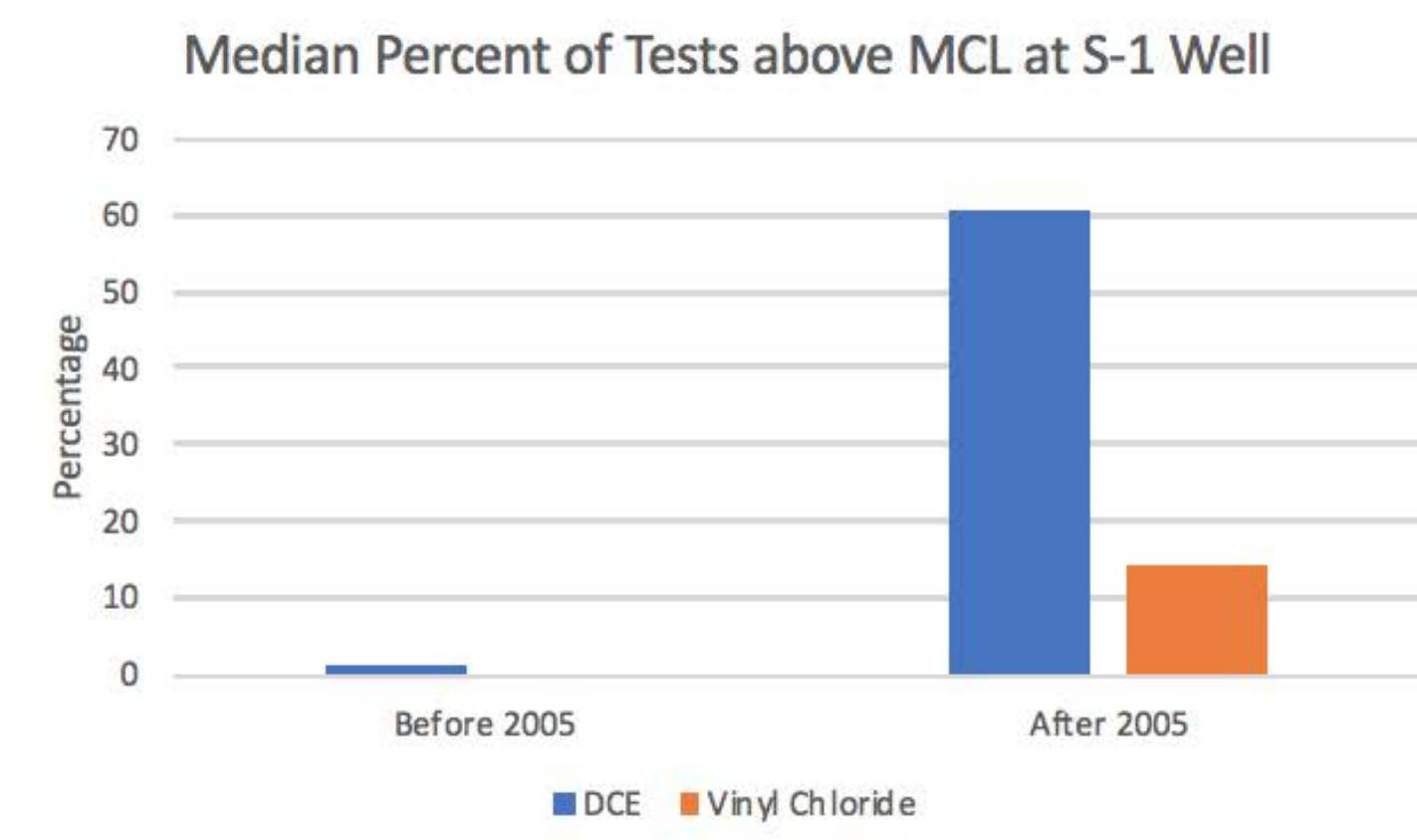
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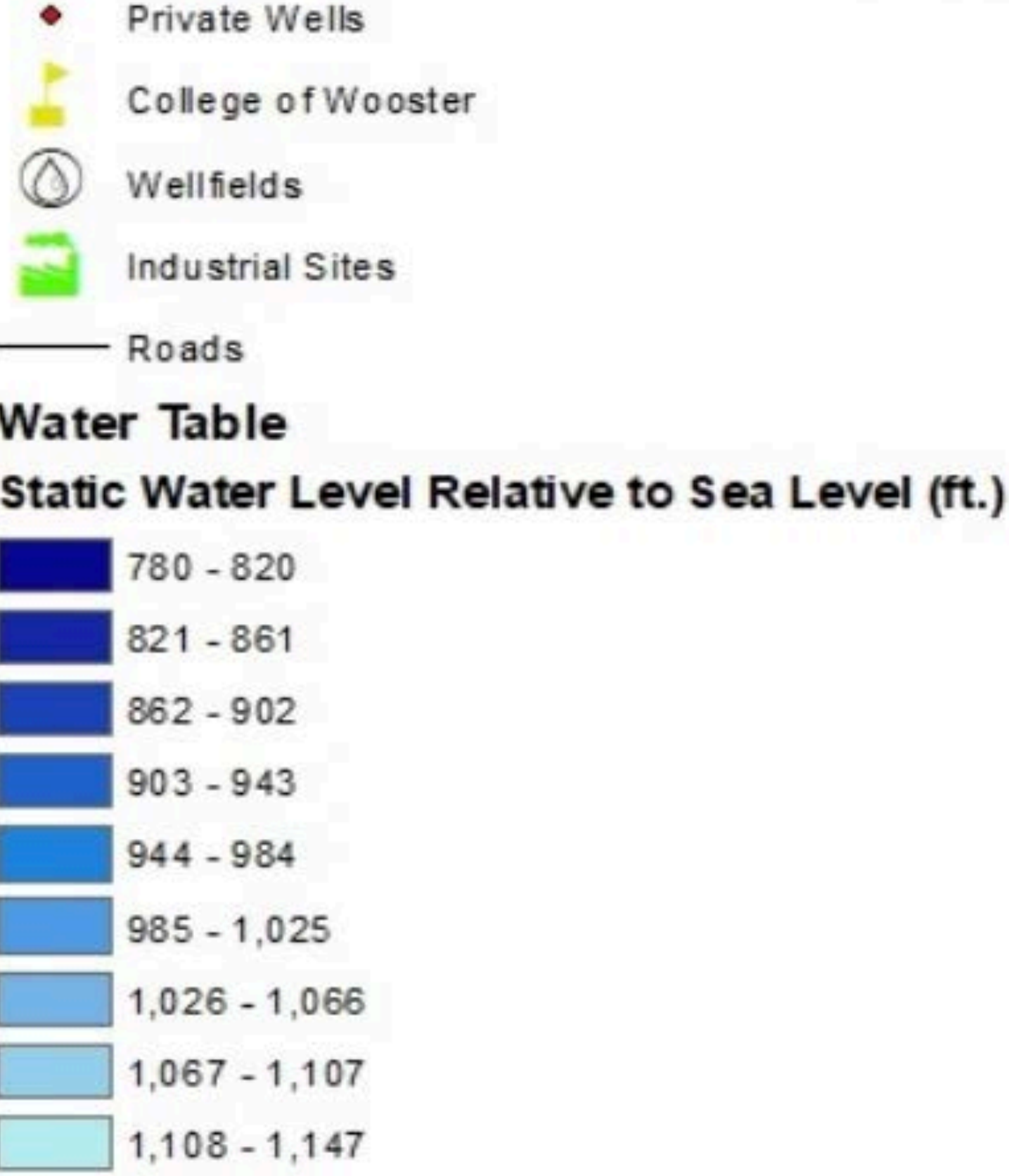
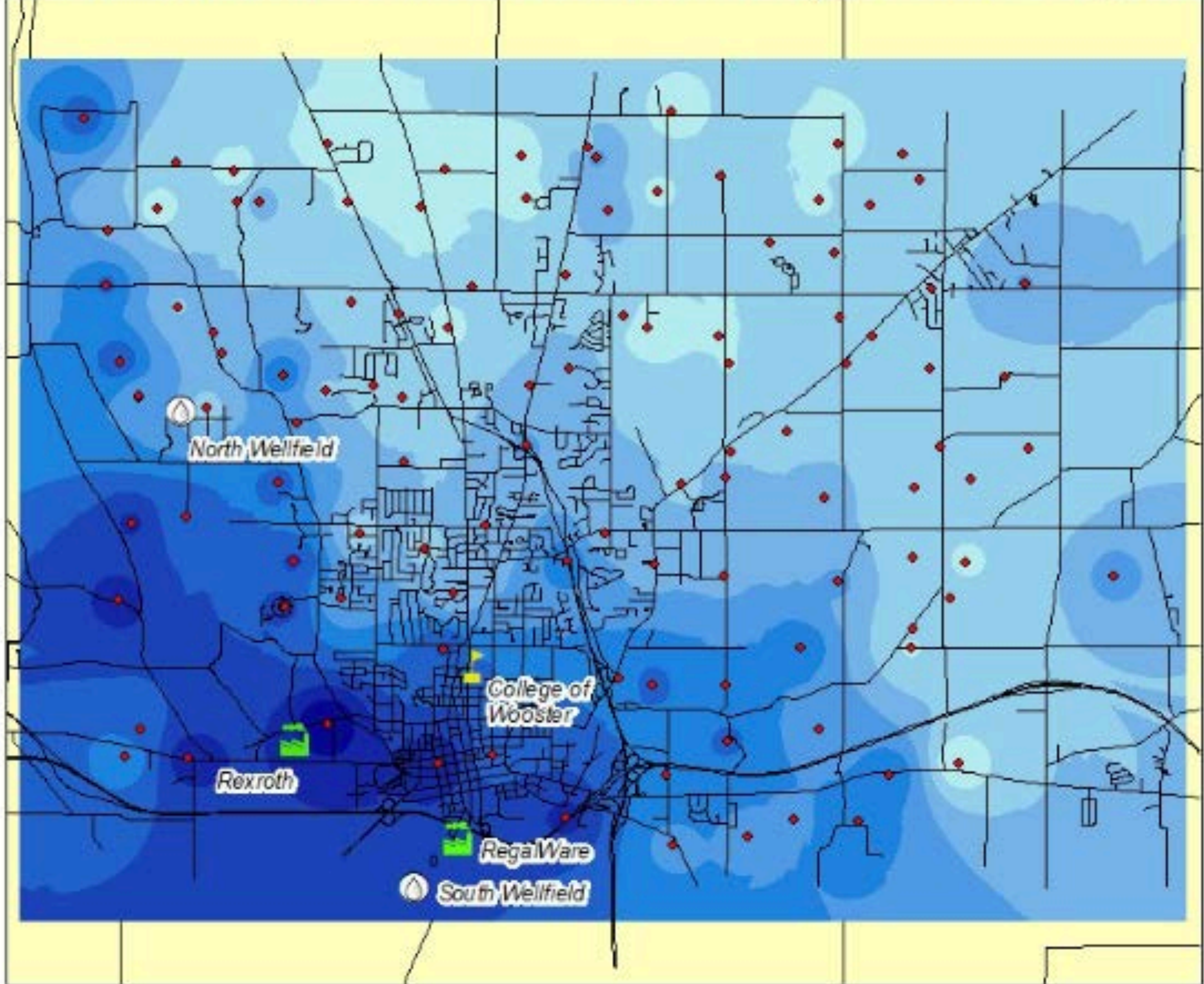
Introduction: Wooster has a long history of manufacturing industries that have been great for the local economy, it also brought many of the environmental problems associated with these kinds of industries. In the past, Wooster's aquifer has been a place of interest due to its previous contamination of TCE, an ingredient is discontinued degreasing product used in metal plants. After several periods where the contamination levels exceeded the EPA standard, thus requiring the town to implement several efforts to decrease contamination levels and prevent future problems. Overall, the City of Wooster has managed to bring contamination down to a level safe for drinking and has not reached previous levels since then. This study looks to examine how successful these remediation efforts has been, as well as how the past contamination levels were able to reach them in the first place.

Methods

- Well data was collected by using well logs for private wells provided by the Ohio Department of Natural Resources
 - Depth to water, elevation, and location of each well was recorded
 - This data was assigned to points in a GIS map
 - The ArcGIS spatial analyst tool IDW was used to determine the changing trend of the water table at the surface
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- Wooster's water treatment plant keeps record of all test results for volatile organic compounds (VOCs) that have been done since 1985
 - After digitizing them into Excel, the spreadsheets could be uploaded into R to run statistical analysis.
 - Annual data was analyzed for TCE, DCE, and Vinyl Chloride at the S-1 Well and the air stripper towers
 - Annual average contamination levels and the percent of tests that exceeded the EPA standard for these contaminants were plotted



Static Water Level of Wooster, Ohio's Aquifer



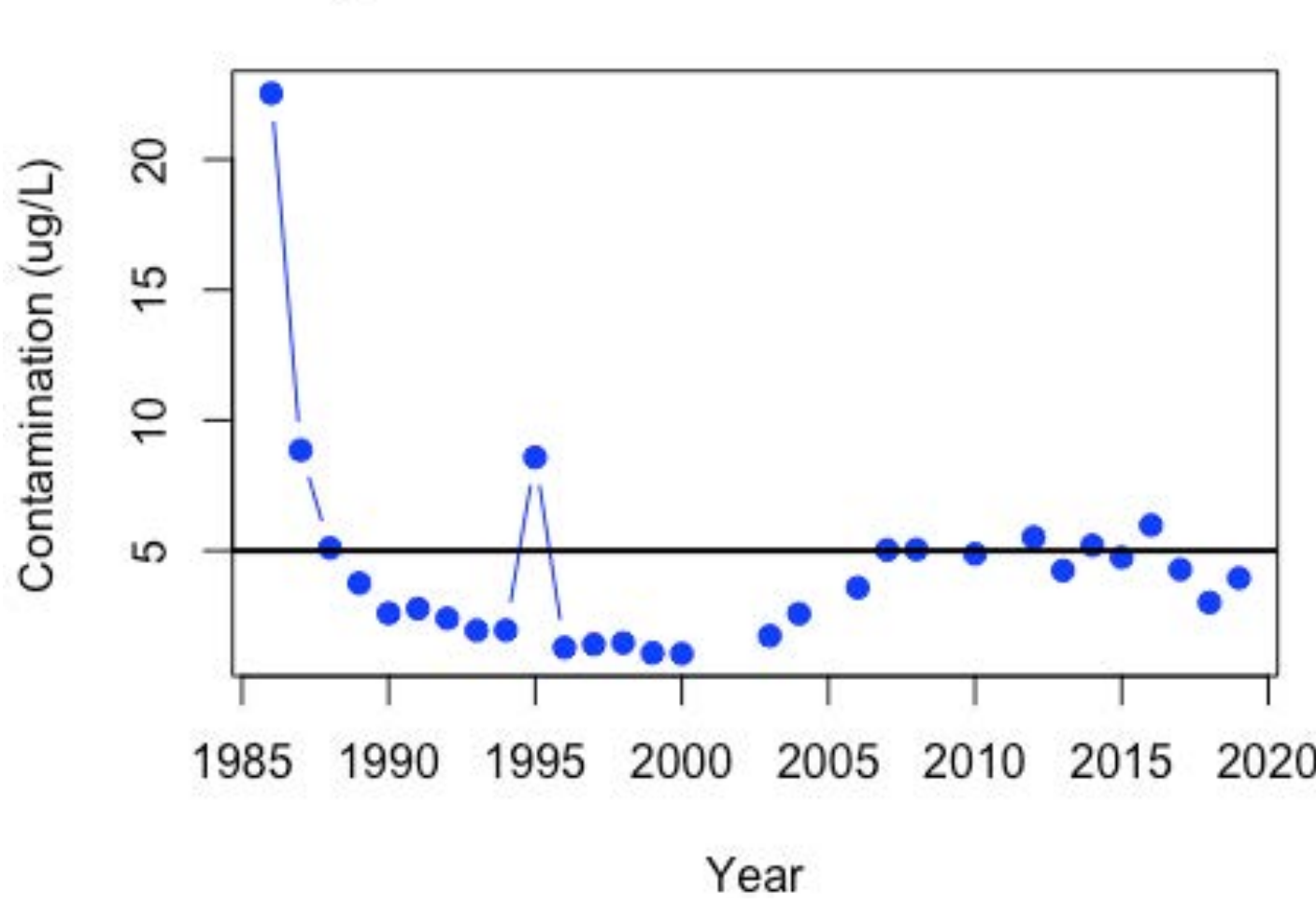
Aquifer Map

- The above map shows the elevation of the static water surface in Wooster
- Groundwater will flow from the highest parts of the aquifer (light colored) to the deepest (dark colored), bringing any contamination with it
- Wells in deeper areas are susceptible to contamination that occurs anywhere else in the aquifer, contamination that occurs in deeper parts will stay in the area
- The wellfields are in areas vulnerable to contamination, making the drinking water supply vulnerable as well.

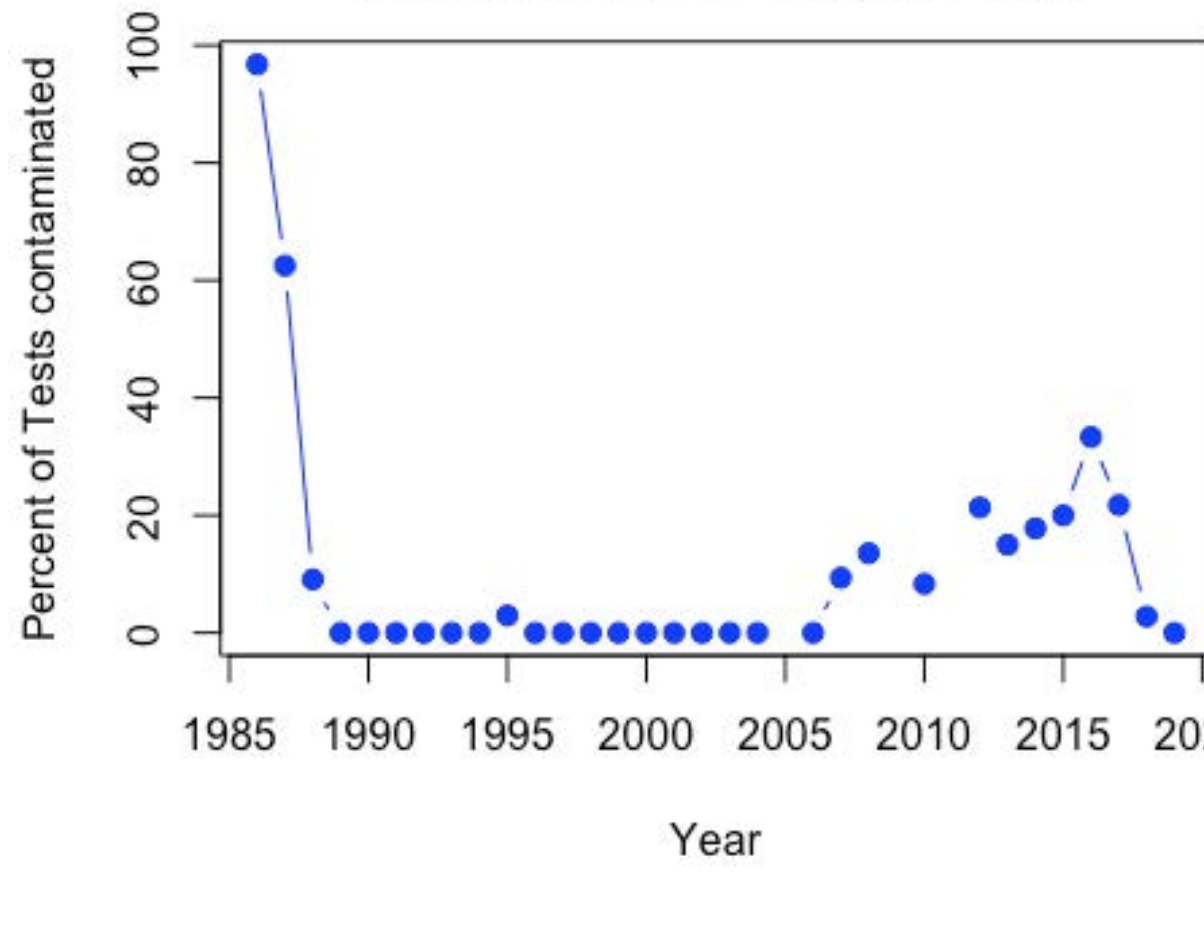
VOC Data Results

- Average annual amount of contamination were calculated, along with the percent of tests that exceeded the maximum contamination level (MCL) per year
- TCE was not present enough in the data to be examined. Dichloroethane and Vinyl Chloride are degradation products of TCE were present in more significant amounts.
- Contamination levels decrease soon after data is recorded, increases again around 2005
- DCE levels never return to historically bad levels
- Vinyl chloride increases after 2005 but not enough of for long enough for the EPA to get involved.
- DCE levels in air strippers decrease quickly and remain low for most of the time with some outbursts due to mechanical error
- Vinyl chloride was almost entirely nonexistent in air stripper data.
- Low results from the air strippers imply that they are lowering contamination levels.
- Contamination increases were likely due to either degradation of other contaminants, or a different source

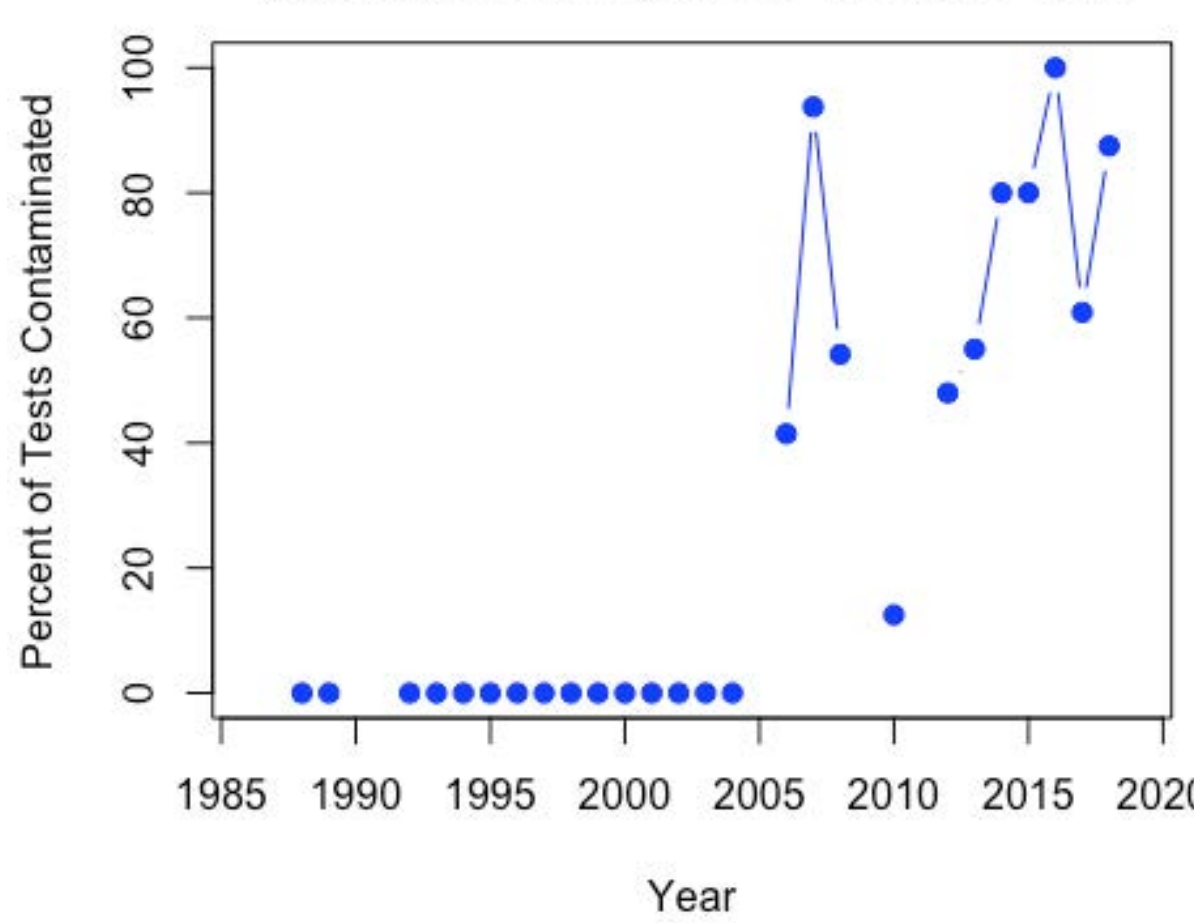
Average Contamination of DCE in S-1 Well



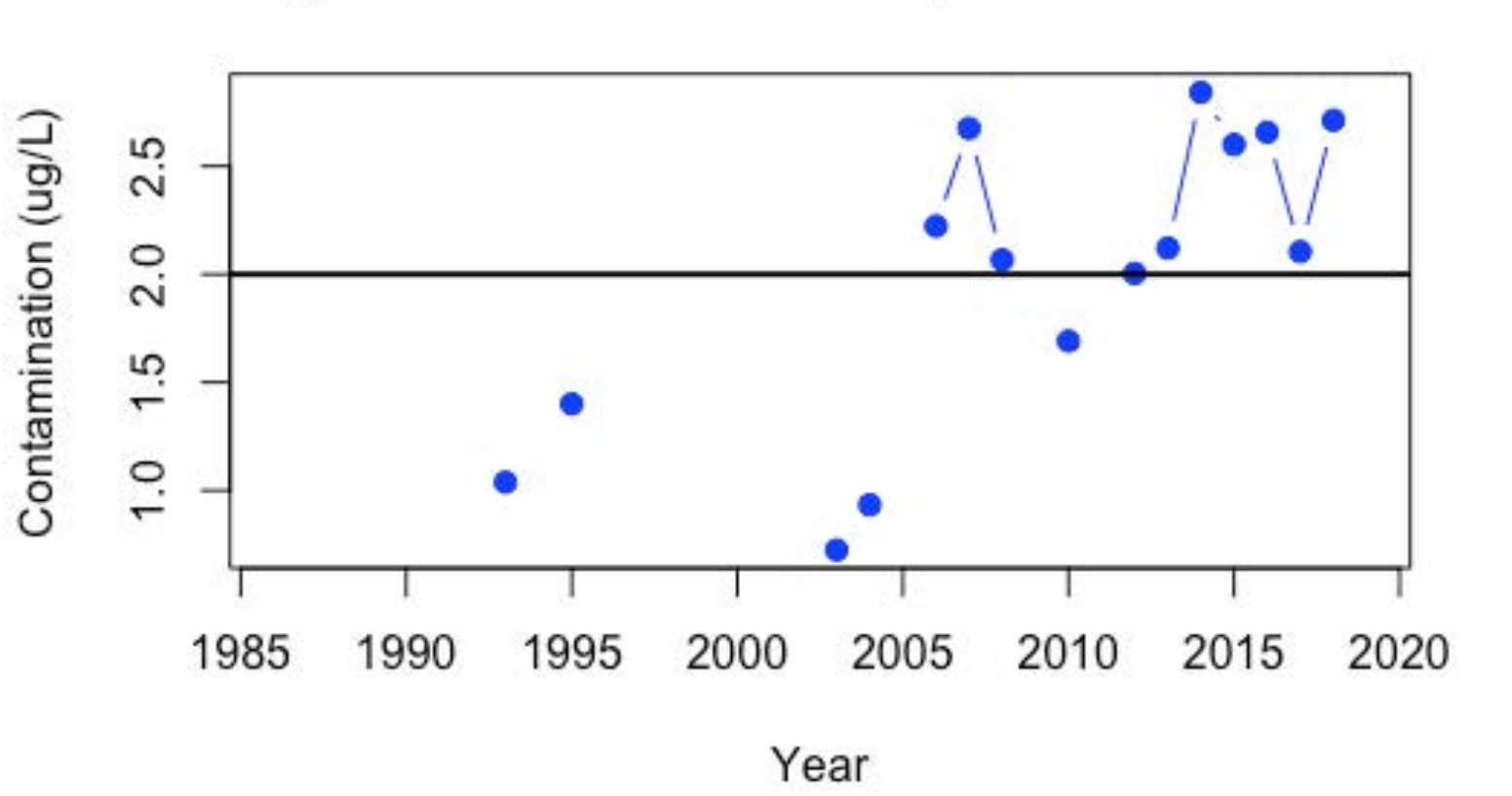
Percent of DCE Tests at S-1 Well Above Contamination Level per Year



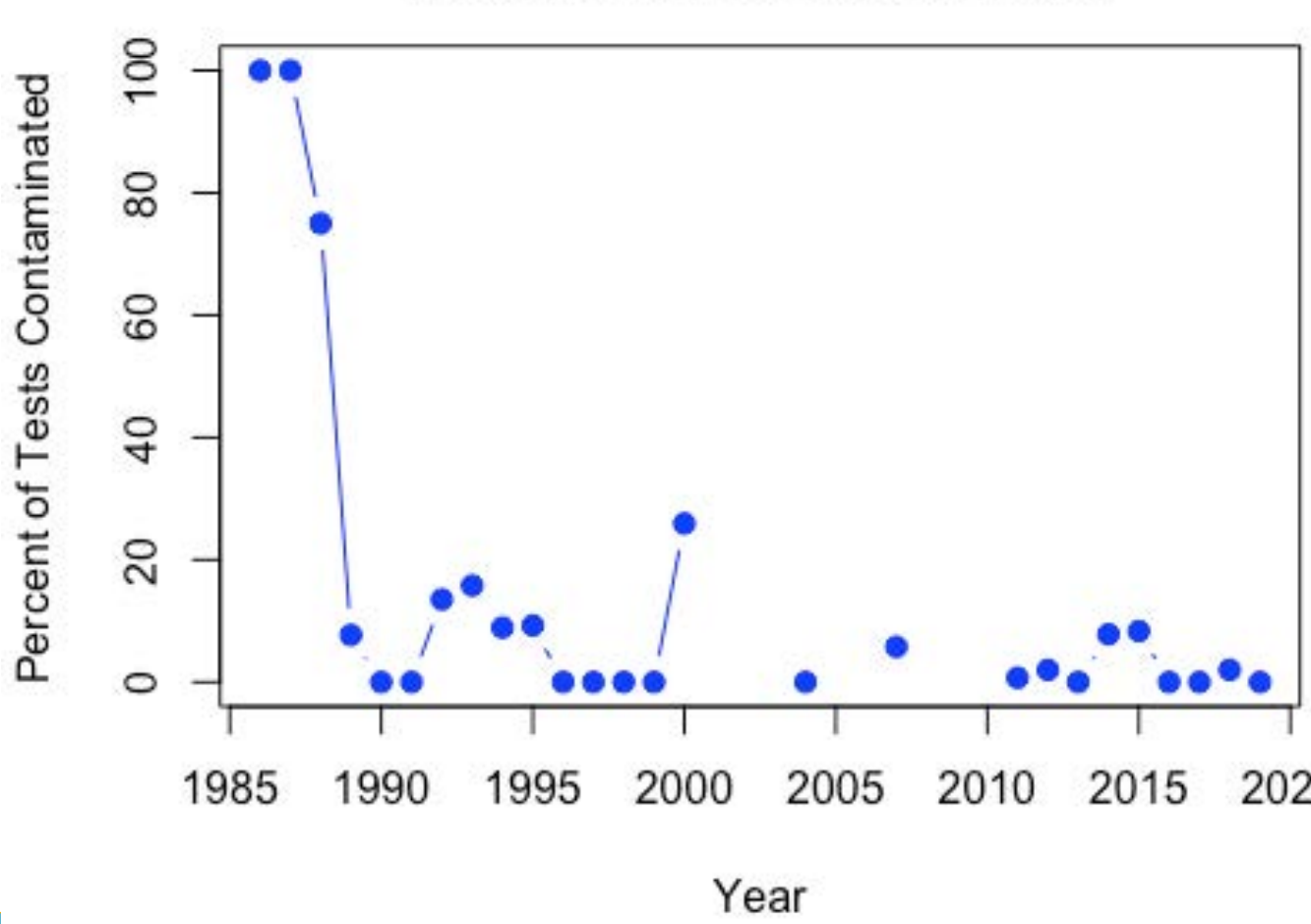
Percent of Vinyl Chloride Tests at S-1 Well Above Contamination Level per Year



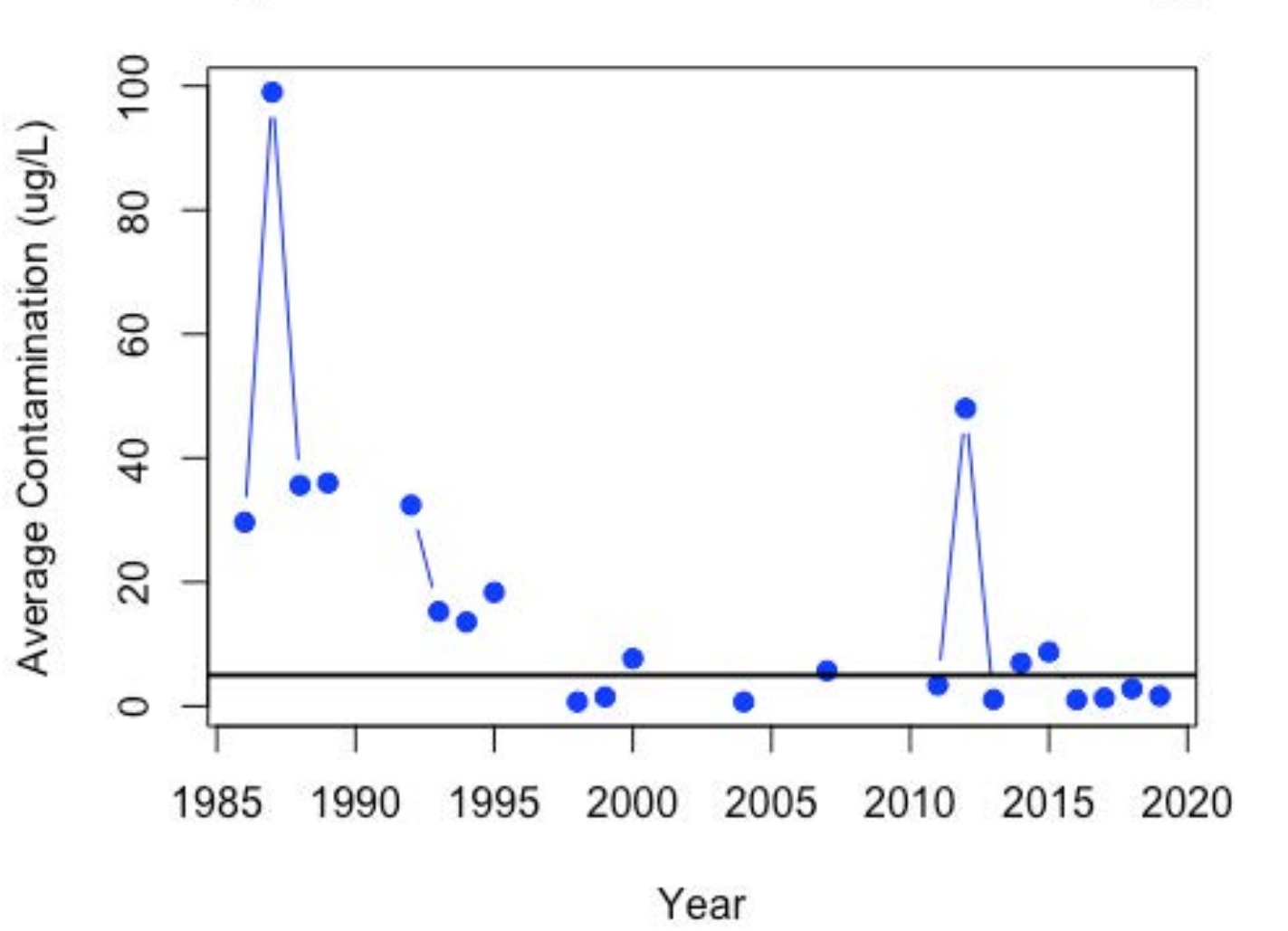
Average Contamination of Vinyl Chloride in S-1 Well



Percent of Tests for DCE in All Air Strippers Above Contamination Level



Average Contamination of DCE in All Air Strippers



Acknowledgments:

I would like to thank Dr. Crawford and Dr. Wiles for all their advising help. I would also like to thank Kevin Givins and everyone at the Wooster Water Treatment plant for all their help with providing data for this study.

Conclusions

- Contamination levels have decreased as a whole
- Air stripper towers have been successful in reducing contamination levels in the aquifer
- The south wellfield is in the deepest part of the aquifer and is vulnerable to contamination from anywhere else in the aquifer.