



Project Description

Camp Courageous (CC) currently deals with high nitrate concentrations in the primary aquifer, impacting the groundwater used by two of its four wells. Nitrate is a compound that can occur naturally, but high levels of nitrate are often a result of common agricultural practices and biological waste which can lead to health problems in infants. The project objective entailed reducing contaminant concentrations through short- and long-term approaches. The raw water nitrate data for Camp Courageous and St. John's church are shown in Figure 2.

About Camp Courageous

Camp Courageous is a year-round recreational and respite care facility that provides for individuals with special needs and their families. They are located five miles east of Monticello, IA next to the Maquoketa River.

Current Water Practices at Camp Courageous

Camp Courageous uses anion exchange in order to treat two of its four public wells, Main Camp (WL02) and Beckwith (WL03). All four of its wells are chlorinated and softened. CC's current treatment system works effectively in maintaining contaminant levels according to state and federal regulations. Each well is treated on site. They have a newly constructed wastewater treatment plant that has UV disinfection and trickling filter system.

Site and Well Service Map

In order to understand where the nitrates are affecting Camp Courageous, the team created a map in Figure 1 that shows where each well is and what parts of the camp it services. This gave a better understanding of the building and treatment techniques.

Well Head Protection for Camp Courageous

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The Groundwater of Camp Courageous

The team worked with Matthew Graesch, an environmental specialist, to get the stratigraphy beneath Camp Courageous mapped out. The following drawing in Figure 3 depicts the aquifers that the four wells pull water from, the zones where the water enters the well, and the static water levels in each of the wells.

Masterplan Recommendations

Short Term: The team recommends to continue with current water treatment practices that are most cost effective as of today. Additionally, CC could give informational brochures to local farmers on nitrate reduction. Finally, CC

should get well casings inspected to check for any damage or cracks that could be allowing nitrates to enter wells from surface water.

Long Term: On a broader scope, CC can lead the way to protecting the groundwater through its leadership in conservation practices. CC can demonstrate to area farmers practical and profitable techniques for reducing the impact of farming operations on the aquifer. If the groundwater continues to deteriorate, CC may need to consider a transition to a centralized water treatment system using reverse osmosis to prevent emerging contaminants, such as PFAS or "forever chemicals," from being consumed in drinking water as they become more prevalent in Iowa groundwater.



Figure 1. Well Service Map of Camp Courageous

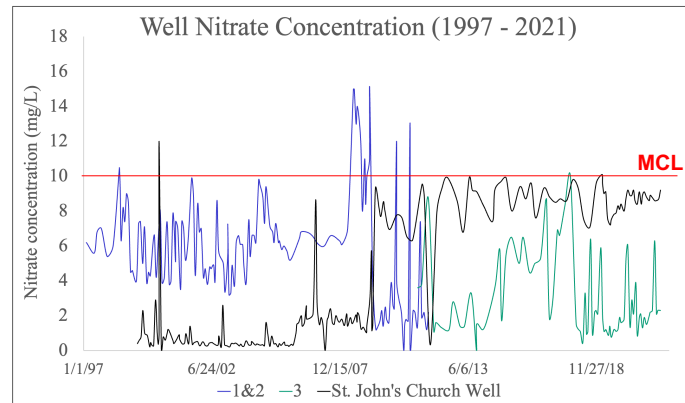


Figure 2. CC and St. John's church Nitrate Concentration data (1997-2021)

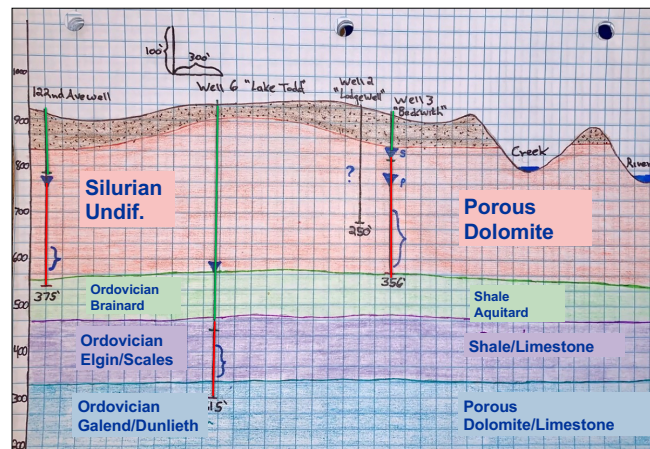


Figure 3. Stratigraphy Beneath Camp Courageous (Matt Graesch, 2021)

Project Cost

Due to the broad variability and factors of the masterplan approaches, dollar signs are used to distinguish relative cost for comparing approaches.

Approaches	Relative Cost
Flyers/ Information Sessions	\$ > \$100
Well Inspection	\$\$ > 1,000
Conservation Practices*	\$\$\$ > 5,000
Backwash Storage Tanks	\$\$\$ > 5,000
Centralized System	\$\$\$\$\$ > 100,000

* Subsidies can reduce expense if eligible