

# biotta<sup>®</sup> Biological Filtration Solution Demonstrates Nitrate Reduction in Illinois Community

Biological denitrification system reduces nitrate below 0.02 mg/L - N from drinking water wells without producing a concentrated waste stream

## PROJECT

The City of Taylorville (City) is a small community of approximately 11,000 residents located southeast of Springfield, Illinois. The community has been tracking nitrate levels in their water supply over the last two decades. In the 90's, the nitrate level was around 2-4 mg/L-N; however, today, tests indicate nitrate approaching the 10 mg/L-N maximum contaminant level.

The limited options for alternative water sources led the community to evaluate treatment of existing groundwater wells. Initially, the city looked to ion exchange (IX) as a solution for the community's nitrate contamination; however, it was determined during the initial feasibility of treatment the IX waste stream contained higher nitrate and salinity concentrations than the wastewater facility could process. This left the drinking water supply in jeopardy while waiting for a potential multi-million-dollar upgrade to the wastewater facility. The City had to look for other options to treat the nitrate in the water, and after careful due diligence, biotta was deemed the best choice for the community.

## SOLUTION

biotta was developed to address the increasing nitrate levels many communities face with their drinking water supplies. The treatment process harnesses the naturally-occurring microbes present in groundwater to reduce contaminants to a simple, non-harmful form. The dual-stage design is ideal for drinking water in that it provides a multiple barrier approach and the fixed-bed treatment process consistently treats nitrate to extremely low levels even in intermittent or continuous operation.

A carbon source and nutrient are added prior to the first stage bioreactor. GAC in the bioreactor provides a home for millions of microbes which reduce nitrate to nitrogen gas. This process completes the nitrogen cycle that often starts with the production of man-made fertilizers. Microbes are contained in the fixed bed and prevented from passing downstream

## STATS

Customer: Taylorville

Location: Illinois

Challenge: Reduce nitrate without producing a concentrated waste stream high in nitrate or TDS

Flow Rate: 2,800 GPD

Product: biotta<sup>®</sup> Model 110  
Results: Demonstrated consistently the reduction of nitrate to < 0.02 mg/L - NO<sub>3</sub>-N and nitrite to < 0.30 mg/L - NO<sub>2</sub>-N.

For more information on these solutions, visit [adedgetech.com](http://adedgetech.com).

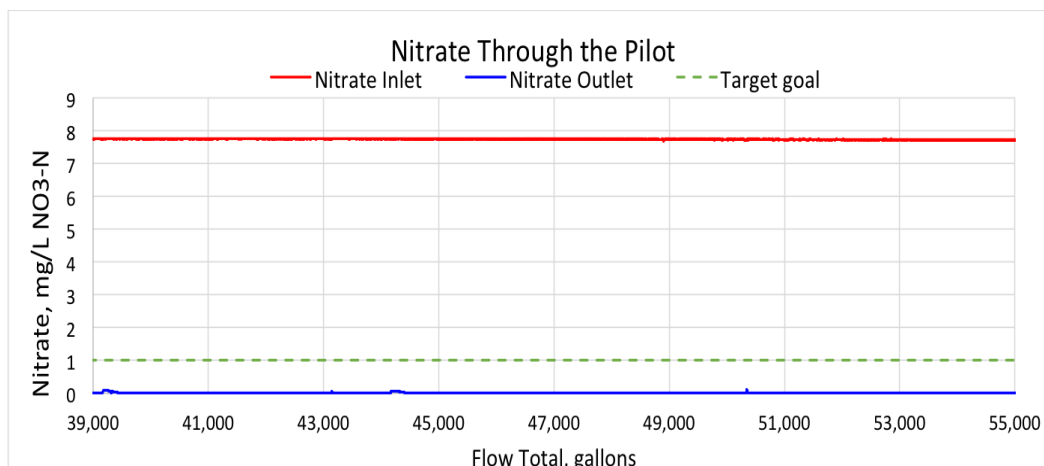
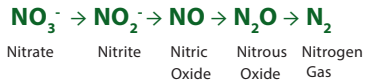


Figure 1: Nitrate concentration during the Taylorville pilot in the inlet water, outlet water, and target goal.

## CASE STUDY

with the second stage biofilter. Oxygen is restored across the biofilter and low turbidity is achieved through depth filtration.

### The Denitrification Pathway



### IMPLEMENTATION

The application of biottta for the City represents the first biological denitrification plant in the state of Illinois for drinking water. Scrutiny is high to demonstrate efficacy and uphold public health safety when a new technology like biottta is introduced into the market. The governing regulatory body granting acceptance for biottta at Taylorville would be the Illinois Environmental Protection Agency (IEPA). Initial discussions regarding dual-stage, fixed-bed biofiltration with the IEPA began in August 2015 and the final pilot report was completed in May 2016. The review and approval timeline was advantageous for such a short implementation period.

biottta's patented process uniquely integrates and simplifies an innovative process, equipment, and components common to the water treatment industry. The application of products and concepts already practiced in the industry helped to expedite Taylorville's approval process within the IEPA.

### RESULTS

The three month demonstration started with the acclimation of indigenous microbes to achieve denitrification in a 53°F (12°C) water in less than a 2 week period. Nitrate treatment effluent never exceeded 0.06 mg/L-N in third party test results following acclimation while operating between a 4 – 8 minute empty-bed-contact-time (EBCT). The successful reduction of nitrate to trace levels will enable the full scale WTP to treat half of the water flow to meet a treatment goal of 7 mg/L-N with 13 mg/L-N in the water supply. biottta® is patented under U.S. Patent Nos. 9,580,341 and 9,856,160, with other patents pending.

Evaluations were conducted at various times during the pilot demonstration to observe plant shut-downs, nutrient failures, disinfection byproduct formation, and accidental exposure of chlorine to the filtration bed. All evaluations resulted in encouraging plant operations and viability. Another operational key easily evaluated was backwash frequency necessary to control biomass in the pressure filters. Combined headloss across both stages did not exceed 6 psi at a backwash interval of 72 hours the bioreactor and biofilter. Over 98% of water will be treated with less than a 2% waste-stream when applying the backwash rate to the full-scale design. This 2% waste-stream is larger than some IX treatment practices; however, wastewater from biottta can be discharged to a pond, an option only available due to the low nitrate and lack of sodium or chloride in the wastewater often found in IX waste.

The 2800 GPD pilot provided operational insight and full-scale design considerations for the 3 MGD groundwater treatment plant at Taylorville while proving reliability of an innovative technology that addresses growing concerns with increased nitrate and chloride levels in groundwater aquifers.

Figure 2: Wastewater Characteristic Comparison Table

	IX < 1% waste stream	biottta 2% waste stream
Nitrate mg/L NO <sub>3</sub> -N	800	1.9
TDS mg/L	80,000	450

### Taylorville, IL Project Timeline



Figure 3: Taylorville, IL Project Timeline



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