

## Eliminating Infiltration Requires a Holistic Approach in Naperville, Illinois

### Background

In April 2013, Chicago and its neighboring suburbs experienced a 100-year rain event resulting in extensive flooding, sewer system surcharges, and basement back-ups. One city in particular, Naperville, received a total of 7.34 inches of rain between 7 A.M. April 17, and 7 A.M. April 19. There was a public outcry, but the residents of the City of Naperville knew these were extreme circumstances. The Department of Public Utilities re-prioritized their Inflow and Infiltration (I&I) program to include areas affected by the rain event. Having a separated sanitary/storm system, they understood that during a rain event, any change within their wastewater flows was caused by I&I. As with most municipalities, events like this trigger new priorities and create an overwhelming call to action.

The City of Naperville has a population of 145,000—the fifth largest city in Illinois. Its sanitary system includes 540 miles of sewer mains, 41,822 residential and commercial customers with 41,767 lateral connections, 13,372 manholes, 22 pumping stations and 7 back flow prevention stations, managing an average daily flow of 17 MGD and a peak flow of 55 MGD at a single WWTP. The Utilities Department of the City of Naperville is self-funded through rate-payers and has made it their objective to provide reliable, high quality, and cost effective service to their customers.

### Assessment

The focus of Naperville's efforts was centered on a sub-division named Cress Creek. Wastewater Collections and Pumping Supervisor, Tony Conn, has had several flow monitors and groundwater level measuring wells located within this subdivision, and had been collecting data to more accurately determine an average daily flow. While utilizing their own mainline and lateral sewer televising equipment, Naperville's PACP and LACP certified operators were able to make comprehensive assessments of their underground systems which enabled Tony

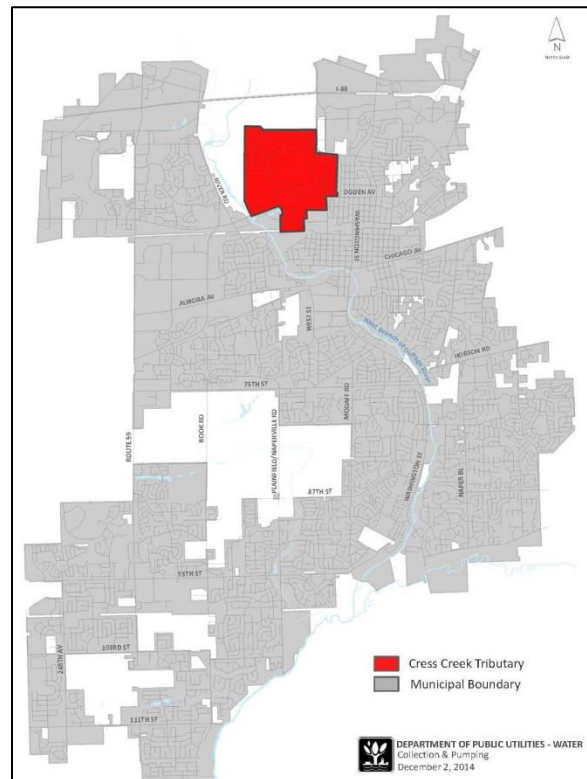


Figure 1. City of Naperville, IL municipal boundaries—Cress Creek neighborhood shown in red

to build an action plan without the expense of hiring an engineering firm.

With clear evidence of structural decay in mainlines, laterals, and manholes, CIPP Lining and manhole rehab was a natural choice. However, within this basin, the groundwater levels were shown to be consistently higher than the sanitary trench. Infiltration was so great that Naperville could not proceed with a lining project until the active leaks in the manholes, mainline joints, lateral connections and lateral joints were stopped to avoid resin wash-out.

### **The Holistic Approach—Targeting Infiltration at all Four Points of Entry**

Infiltration elimination requires that all possible entry points into a sewer system are addressed. “Grouting and lining are not mutually exclusive options- they are complementary technologies and both are required.” says Tony. “Lining does not eliminate infiltration - it relocates the flow of infiltration to another entry point. It is imperative to seal the entire system.” Sanitary trenches allow for groundwater to flow freely throughout an area. As water inflow is eliminated in one area, infiltration is commonly noticed in another. This is often seen when mainlines are lined. Water will make its way through the annular space present in CIPP and enter the sewer line at the reinstated lateral connections and manhole terminations. Groundwater levels will also rise and find their way to the laterals and manholes.

Naperville’s Cress Creek presented a new challenge. During the initial lateral televising, Tony saw that the infiltration problems were not only limited to the mainline joints. Heavy inflow was seen as far as 80 linear feet (lf) from the lateral

connection. Enter – National Power Rodding (NPR). As a subcontractor, NPR was hired to grout the lateral connections using a 38 foot lateral sock. “Tony initially wanted to grout the lateral joints from the mainlines going the full 80 feet”, said John Manijak, Project Manager for NPR. “It was a very ambitious move, however the equipment and the technology to go the full distance just does not exist. Our in-house testing indicated that NPR’s equipment was capable of handling the challenge.” A full scale model of a sewer main and 60 foot lateral was erected at the NPR shop. “Not only were we trying to confirm the air pressures needed to inflate and retrieve the 38 foot sock, we needed to determine the amount of time needed to grout the lateral at that length.” After two full days of equipment testing, it was determined that NPR needed at least a full five minute gel time to allow for the AV-100 acrylamide grout to not only reach the end of the 38 foot sock, but to also penetrate the joints in the lateral and saturate the ground surrounding the pipe.



Figure 2. 38 foot lateral sock

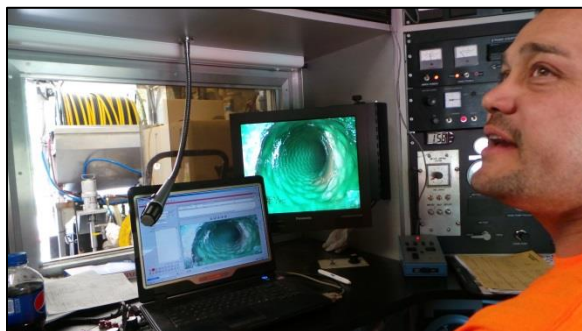
### **The Preparation Process – The First Days On-Site**

In order to prepare the laterals for the insertion of the 38 foot sock, NPR cleaned and televised each lateral first. Heavy roots and mineral deposits located throughout the

laterals were removed from the mainline using NPR's specialized equipment. Angel Lozada, NPR's lead grouting foreman said of the laterals: "Without having cleanouts, proper preparation of the lines presented new challenges." By removing the deposits, old points of infiltration were reopened. "Some laterals had so much infiltration, they looked as though they were connected to an open hydrant", says Angel.

Grouting began immediately after the cleaning was complete. "It was an exciting moment after the first lateral held the air test and the 38 foot sock was successfully retrieved." said John Manijak. A handful of laterals came together and connected to the mainline at a single point. Recognizing that these laterals could not be grouted from the mainline, Naperville installed Vac-A-Tees (Cleanouts) near the homes – allowing NPR to employ a sausage lateral bladder through the cleanout to complete the grouting of these lines.

On average, it took a minimum of 30 gallons of grout to seal each lateral. "One particular lateral took almost 90 gallons", said John. "We weren't surprised at the amount of grout it took to seal after seeing the amount of water that was coming in through the joints." As water enters the pipe through the joints, it also carries with it small particles from the substrate that supports the pipe.



**Figure 3. Angel Lozada monitors the sealing of laterals through CCTV inside the grout truck**

Not only does this inflow of water and material contribute to debris within the pipeline, it also leaves a void on the exterior of the pipe, allowing the pipes to shift and break over time. Chemical grouting does not only stop infiltration by creating a seal on the outside of the joint, it also fills in the voids and replaces the missing support system of the pipe. "After each lateral was sealed, we re-televised each one and confirmed that the grout was not only reaching the full distance of the sock, but that there was only a minimum residual amount remaining in the lateral." Manijak stated.

The mainline joints were tested and sealed upon the completion of the lateral process. It was found that 60% of the mainline joints failed their initial air tests. "Early in preparing for the project, we decided to grout the lateral first." said Angel, "Starting from the highest point and working downward would concentrate the groundwater in the sanitary trench at the mainline."

"At each step in the rehabilitation process, we continued to see the groundwater levels rise", comments Tony. Upon completion of the grouting and CIPP lining, the walls of the manholes in the areas began to leak - prior to grouting and lining, the manholes showed no signs of infiltration. "I knew that the project was in its final manhole rehab phase when I received a call from Naperville." said John. "Groundwater had now found its way to the manholes. Everywhere and anywhere it could get in –it was." After the structures were sealed with chemical grout, the manholes were lined, completing the process of the holistic approach to infiltration elimination.

## The Numbers

The overall scope of the project included 57,045 lf of lining with CIPP, lining of 176 manholes, mainline grouting of 2,205 lf of 12-inch mainline and sealing 46 laterals using a 38 foot lateral sock at a cost of \$2.4 million. Lining began in March of 2014 and was completed in June 2014. The grouting portion began in April of the same year and was also completed in June 2014. The manhole rehab was completed in July 2014. While Naperville is still in the early phases of flow data analysis, the change in the daily inflows are apparent. Flow meters located in the grouted area (Burning Tree) recorded .52 MGD in November 2013. In November 2014 the meters in the same locations recorded .45 MGD for a reduction of 13.5%

or 70,000 gallons of groundwater inflow per day for this 2,200 lf area of sewer line. The entire project area has seen a total reduction of 340,000 gallons per day. Given an industry wide \$3 per 1,000/gallon treatment cost, the project will pay for itself in the first six years.

Inspired by the results he has seen in the Burning Tree area, Tony has now set in place a plan to seal all of the laterals within the Cress Creek basin area within the next four years using chemical grout.

“Eliminating infiltration has many hidden benefits” said Tony, “including longer lifecycles of your existing assets.” Reduced pumping and treatment costs means being able to keep rates down.

## about the authors



**Tony Conn**  
City of Naperville  
Collection & Pumping  
Supervisor  
630-305-5537  
[connt@naperville.il.us](mailto:connt@naperville.il.us)  
[www.naperville.il.us](http://www.naperville.il.us)

Tony Conn is Supervisor of Collection and Pumping for the Department of Utilities-Water at the City of Naperville. With 24 years of experience, Tony is a certified IEPA Collection System Operator, IEPA Certified public water supply operator, member of the IWEA Wastewater Collections committee, member of the IWEA Golden Manhole Society and NASSCO Cert. Operator.



**John Manijak**  
National Power Rodding  
Business Development  
800-621-4342  
[jmanijak@nationalpowerrodding.com](mailto:jmanijak@nationalpowerrodding.com)  
[www.nationalpowerrodding.com](http://www.nationalpowerrodding.com)

John Manijak is a Project Manager with 15 years of experience at National Power Rodding, a Carylton Company. He is a member of NASSCO, ICGA, APWA. IWEA and WEF.