North American Society for Trenchless Technology (NASTT)
NASTT's 2014 No-Dig Show

Orlando, Florida
April 13-17, 2014

MA-T3-02

Rehabilitation of the Coral Gables Wastewater Collection System

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ABSTRACT

The City of Coral Gables located in the Miami-Dade County has a population of approximately 50,000 and is home to the University of Miami. The City of Coral Gables recently completed a sewer rehabilitation project to comply with a consent decree caused from excessive flows in the collection system. The project was based in an area known as "Gables by the Sea", located on the Biscayne Bay. This area is known to have low elevations (See Figure 1). Like most sewer rehabilitation projects in coastal areas, the greatest challenge was controlling the water flooding the collection system located by the sea. The primary goal of this project was to mitigate the serious amount of sea water infiltrating the system during high tide; and to extend the service life of the piping system using trenchless technologies for at least another fifty years. This project was a successful collaboration between the city of Coral Gables, the consulting engineer, and the contractors. Proven trenchless products were used to obtain the highest quality of rehabilitation results for "sealing" this portion of the city's collection system. The mainline pipe lining was accomplished with a folded PVC pipe-liner. The upstream and downstream ends of the mainline PVC liner were sealed using a seamless molded "end seal" gasket that prevents water from tracking behind the liner and leaking at the liner ends (at the manhole). The lateral pipes were renewed using CIPP including a full-hoop main-connection liner outfitted with a main/lateral compressible gasket. Two methods for installing cleanouts were utilized, the traditional open cut method and using a vacuum truck to form a small bore hole down to the lateral pipe, then remotely attaching a pipe saddle from above ground. The project posed significant challenges with respect to the tidal induced infiltration and ground settlement which had caused the main and lateral pipes to crack and offset.

Despite the challenges faced on the project, the results outlined in the paper below, prove how the combination of professional engineering design, experienced contractors, and high quality products yielded success as the city boasts a reported decrease in pump run times from approximately 20-hours a day to 4-hours. This reduction is approximately an 80% decrease in pump station run times. This paper further elaborates on the project details, including method of application of the trenchless technologies and the challenges faced. Furthermore, the benefits of the rehabilitation project are illustrated using post inspection videos as well as historical and current flow data supplied by the engineering firm of Hazen & Sawyer.

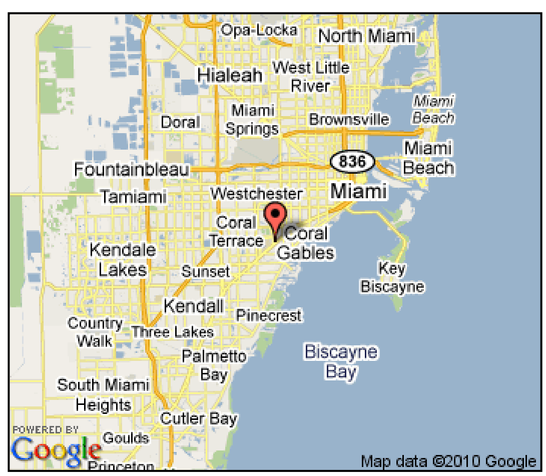

Figure 1: Location of Coral Gables
(Source: Google Maps)

INTRODUCTION

Clean water infiltrating a sewer collection system (See Figure 2) and consequently excessive pump run times is a real problem for many municipalities. This problem is compounded even further if the sewer system is tidally influenced. The City of Coral Gables, known as the City Beautiful is bordered by the Biscayne Bay on its east coast which leads out to the Atlantic Ocean. During the high tide events the collection system would be surcharged, overwhelming the pumping capacity of the stations. Even though the pumps were running at full capacity, the manholes would not pump down and remained surcharged so much so that the pipe invert could be seen through 8 feet of clear water in a manhole.

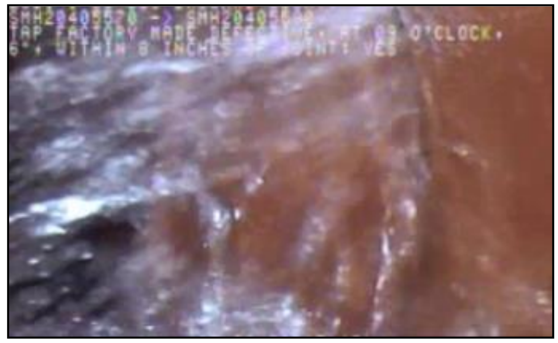

Figure 2: Infiltration at a Lateral Joint

THE PROJECT IMPETUS

The lift station addressed during this project (Lift Station A: Lugo/San Pedro) consists primarily of Vitrified Clay Pipe (VCP), in a system that was constructed approximately 40 years ago. This station was experiencing an average pump run times of 20-hours per day, most of which was around high tide events. The system was further burdened by rain events. The City of Coral Gables is under a state consent order which mandates that all pump stations running in excess of 10 hours a day must be rehabilitated to bring the pump run times into compliance. In this case, sea water was infiltrating the system which also lead to corrosion issues with pumps and negatively affected the biological process at the treatment facility.

THE PROJECT SCOPE

Table 1: Project Stakeholders

Entity	Location and Contact	Services Provided
Utility Owner	City of Coral Gables Mr. Jorge Acevedo, P.E.	
Engineering Firm	Hazen & Sawyer, P.C. Mr. Ethan Heijn, P.E.	I&I Studies and Flow Data
Mainline Contractor	Miller Pipeline Corp	Mainline Rehabilitation with EX Pipe-PVC Folded Mainline Liner/Insignia End Seals
Lateral Lining/ Sectional Contractor	LMK Pipe Renewal, LLC	Lateral and Sectional Rehabilitation with T-Liner®/ Insignia Connection Seals Sectional CIPP/Insignia Connection Seals
Cleanout Installation Contractor	TeleVac South, Inc.	VAC-A-TEE® Minimally Invasive Cleanout

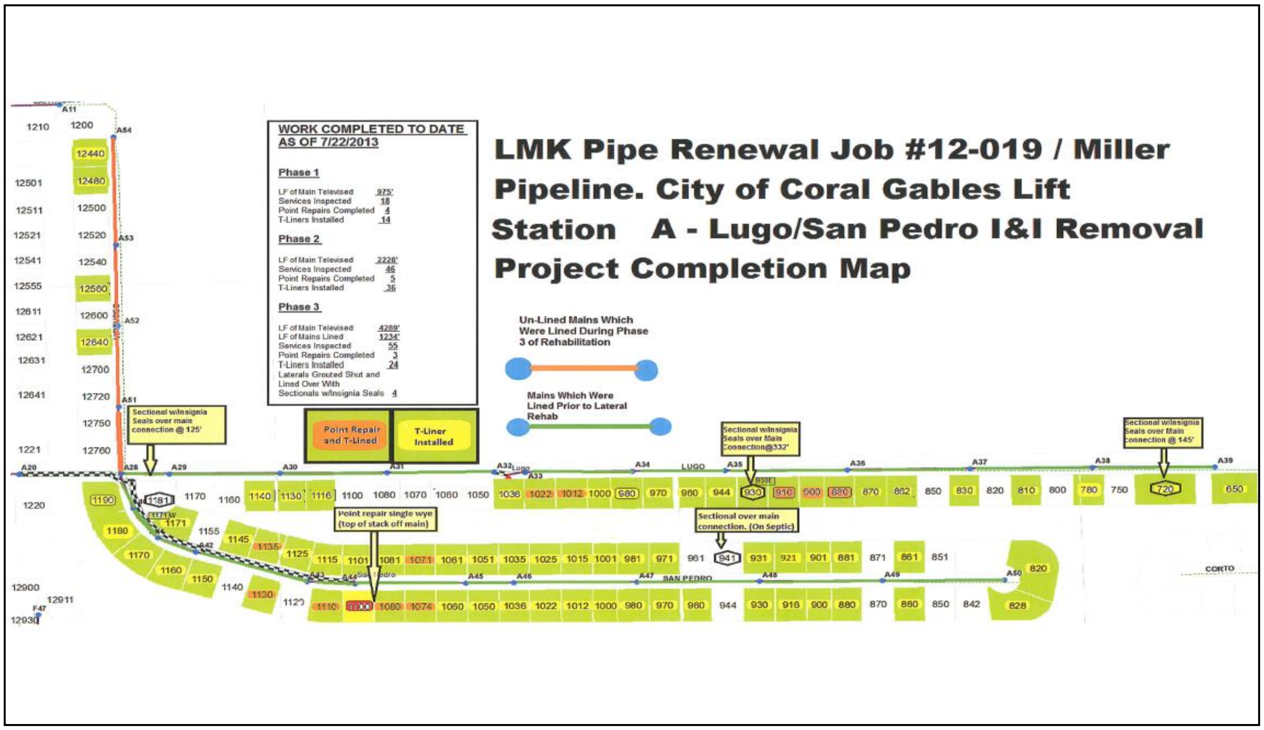

Figure 3: San Lugo/Pedro Basin

The City of Coral Gables kicked off the project by conducting flow studies during peak flows as well as non-peak flow times to obtain pre-rehabilitation flow data. In August 2012, the city began the rehabilitation work to renew and seal the Lugo/San Pedro Basin (See Figure 3). Lift Station A consists of 8-inch mainlines; with the deepest main located at a depth of 11-feet and the shallowest at a depth of 4-feet depth. The city televised a total of 7,490 linear feet of mainlines of which 6,256 linear feet had been lined on a previous rehabilitation project. However, the laterals being the source of most of the water was infiltrating in to the system were not renewed. The water infiltrating into the system through lateral pipe defects then tracked behind the main liner, reentering the system at the service connections and manhole connections as shown below in Figure 4. It was recognized early on in the project that the ability to control the water would be key to the success of the pipe renewal processes. Good communication practices between the owner, the engineer, and the contractors also played a vital role in the overall success of this I&I removal project.

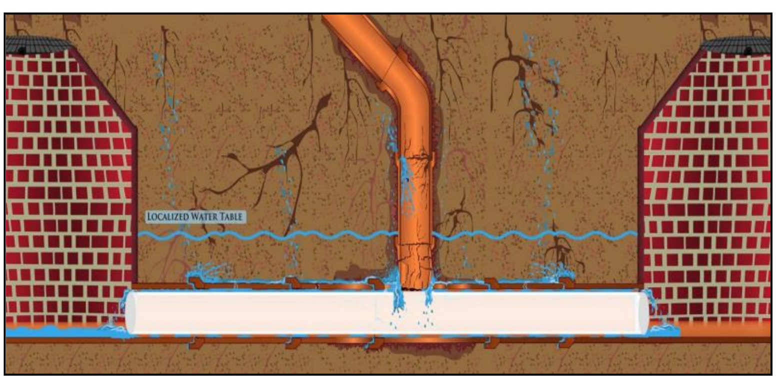

Figure 4: Water Reentering the System Post Mainline Rehabilitation

The work commenced with the crews setting up the required by-pass pumping system. The work had to be a carefully coordinated effort since it could only be scheduled around a falling tide otherwise the surcharged system would cause overflows in the lift station. A tremendous effort and timing was necessary to manage the water. The sea water was however vividly clear thus enabling the survey crew to collect the data using their CCTV equipment under water.

The first objective was to reduce the amount of water infiltrating into the system by installing liners during low tides. Chemical grout (Avanti AV-100) was pumped using a Logiball® Lateral Packer to control the seawater infiltrating the system. The grout was injected into lateral connections and manholes. Chemical grout was also injected between the host pipe and the existing folded mainline liner (6,256-feet from a previous lining project) that did not include end seals.

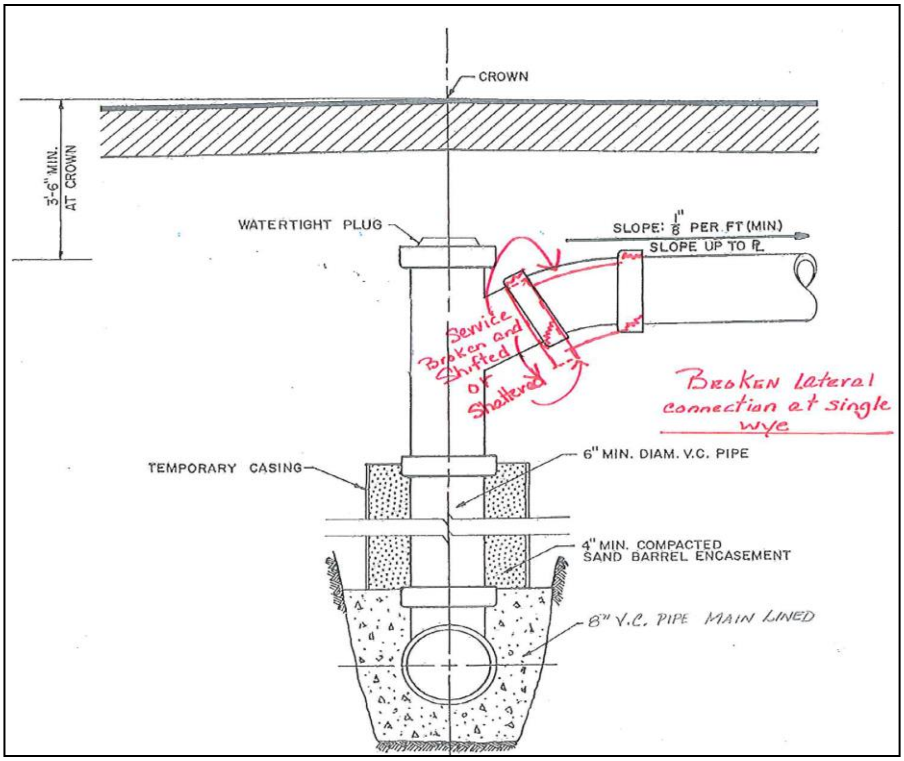

Figure 5: Cracked and Offset Joints Due to Ground Settlement

A few sections of mainline pipe in this system, approximately 1,234-feet, had not been lined. The mainline contractor renewed the remaining 1,234 linear feet of main pipe using the folded PVC liner. The Insignia™ End Seal, a tubular sleeve shaped gasket measuring 3.5-inches in length and having a gasket wall thickness of 2.5mm was inserted into each end of the mainline pipes. The gasket is made from neoprene rubber engineered to have hydrophilic properties that cause the gasket to swell when in contact with water which places the liner under compression and forms a positive flexible seal. The use of compression gasket seals at each manhole connection insured a water-tight connection to prevent water from tracking behind the liner and reentering the collection system. A number of inverted sectional CIPP liners were used to seal off abandoned service connections. The sectional repair methods and materials were compliant with ASTM F2599-11 and outfitted with compression gasket end seals ensuring a water-tight seal.

The service lateral pipes typically connected to the main pipe at 12:00 o'clock (a lateral stack) to bring the pipe up to a much shallower elevation where the pipe transitioned to a horizontal grade as shown in Figure 5. The crew used a special installation technique that consists of a flat rope (pull tape) that is positioned within the liner tube prior to resin saturation for the purpose of guiding the liner from the main pipe up and around fittings as shown in figure 5. This technique allows the operator to actually steer the liner in pipe configurations that would otherwise

Figure 6: Main to Lateral Connection Gasket

deadhead the liner into a capped sanitary tee fitting. A total of 74 service lateral pipes were rehabilitated using an ASTM F2561-11 compliant CIPP liner which includes compression gasket seals at the connection to eliminate infiltration into the collection system as shown in Figure 6. The average length of the rehabilitated lateral was 24-feet and every lateral liner was also outfitted with compression end seals at the upper end near the cleanout. Several of the lateral pipes required excavated point repairs due to settling and offset pipe sections.

THE RESULTS

This project was a small yet challenging job with big results that had major impacts on the entire collection system. The average daily flows and pump run times of the San Pedro/Lugo Station are demonstrated below in Tables 2, 3 and Figure 7. The pump run times went from a high of 30.81 hours in October of 2011 to a run time of just 4.23 hours per day post rehabilitation in August of 2013– essentially resulting in 86% decrease in pump run time.

Table 2: Pump Run Times Pre and Post Rehabilitation: Station A: San Pedro/Lugo

Month	Pump Run Times	Month	Pump Run Times
Aug-11	0.69	Aug-12	
Sep-11	21.26	Sep-12	20.39
Oct-11	30.81	Oct-12	22.80
Nov-11	28.66	Nov-12	
Dec-11	18.66	Dec-12	18.83
Jan-12	7.39	Jan-13	5.18
Feb-12	15.12	Feb-13	4.09
Mar-12	12.65	Mar-13	5.52
Apr-12		Apr-13	1.58
May-12	8.90	May-13	6.94
Jun-12	20.68	Jun-13	5.13
Jul-12	17.01	Jul-13	4.98
		Aug-13	4.23

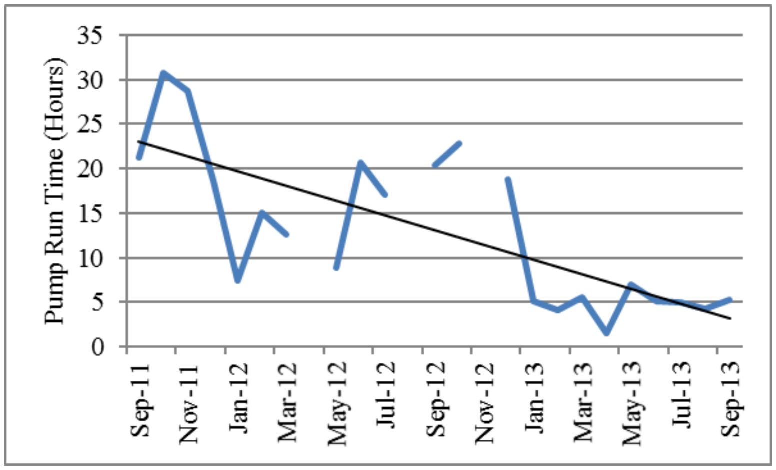

Figure 7: Decrease in Pump Run Times of Station A

Table 3: Average Daily Flow for Station A

Lugo Average Daily Flow (gpm)	
2012	**2013**
65	13
Lugo Cumulative Flow (Jun 15 to Sep 15) (gal)	
8.725 million	1.785 million

REFERENCES

ASTM Standard F1216, 2009, "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube," ASTM International, West Conshohocken, PA, 2009, DOI: 10.1520/F1216-09, www.astm.org.

ASTM Standard F2599, 2011, "Standard Practice for The Sectional Repair of Damaged Pipe By Means of An Inverted Cured-In-Place Liner," ASTM International, West Conshohocken, PA, 2011, DOI: 10.1520/F2599-11, www.astm.org.

ASTM Standard F2561, 2011, " Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner," ASTM International, West Conshohocken, PA, 2011, DOI: 10.1520/F2561-11, www.astm.org.