Large-Pipe Monitoring for I&I Surcharge Reductions

Twin Cities, MN

Case Study

TELEDYNE ISCO
A Teledyne Technologies Company

Expertise in Flow

The ADFM Pro20 Velocity Profiling system from Teledyne Isco, Inc. is helping to quantify large-pipe Inflow and Infiltration (I&I) flows of communities within the twin cities of Minneapolis and St. Paul.

ADFM® Pro20 sensor for large pipes and channels

- 2% flow rate measurement accuracy
- Accurate velocity measurement in difficult hydraulic conditions
  - Turbulence
  - Near zero/ zero velocity
  - Peak velocity shifting from side to side in channel
- Large flow measuring span (0.2 - 6 m level)
- 4 Piezoelectric ceramics measuring velocity in multiple points (bins) and pointing in different directions of the flow
- Measures velocity even if 1 or 2 sensors are covered
- Generates a true flow profile
- Calibration-free technology with zero drift of ultrasonic level

Background

The Metropolitan Council Environmental Services (MCES) provides Wastewater Treatment and Water Supply Planning for the Minneapolis/St. Paul Twin Cities area. MCES operates over 600 miles of interceptor sewers and seven regional treatment plants. These plants treat on average 260 million gallons per day of wastewater. One hundred and five communities own and operate local sewer systems connected to the MCES regional interceptor system.

A 2002 study found that groundwater and stormwater runoff were periodically overloading the interceptor system with uncontaminated clear water. This I&I is consuming interceptor and treatment plant capacity originally designed to serve future urban growth. During significant rainfall events, portions of the system are at risk of causing wastewater backup into basements or spilling into the environment.

During master planning, MCES examined long-range implications based on current levels of I&I with continued development through 2030. The costs of expanding interceptor capacity to serve regional growth was estimated at approximately half a billion dollars above that of I&I reduction, while hydraulic capacity of the Metro WWTP would have to double. Since elimination or slowing of development was not an option, the Council concluded that the only viable long-term option was to eliminate excessive I&I flows at their source.

The Challenge

A policy was created, establishing peak flow limits for communities, as well as financial incentives for meeting established I&I reduction goals. Communities that do not meet the goals, or exceed the limitations, incur large penalty fees, which are deposited into a special fund for future improvements to the Metropolitan Disposal System. The policy allows for communities to build credits or recoup surcharge

Pro20 System Options:

- Stationary or portable
- Communication:
  - Data logging
  - Analog (4-20mA)
  - Digital (MODBUS/ Ethernet)
  - Relay Alarms
  - GSM/GPRS
  - CDMA/1xRTT
- Flowlink 5.1 software:
  - Data Analysis
  - Diagnostics
  - Graphs/Tables
  - Editing
  - Reports

"The Isco Pro20 system was the only solution for what we were trying to accomplish in this large-pipe application."
–Alva Rankin, Principal, SEH

money in the amount spent on improvements that result in a demonstrated I&I reduction in discharge within a set deadline.

The ability to demonstrate the effectiveness of these improvements requires ongoing accurate measurement of dry and wet weather flows. The Metro Council contracted Short Elliott Hendrickson, Inc. (SEH®) of Saint Paul, to perform the flow monitoring needed in order to quantify each community's I&I before and after improvements. The financial implications, often reaching into the millions, required a highly accurate, reliable, and verifiable flow measurement.

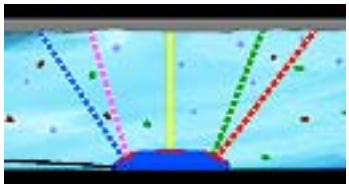
It was therefore crucial to both the communities and the Council to have a method for accurate monitoring in large-pipe locations with diameters of 60 inches or greater, and with flow depths ranging from two feet to completely full.

Solution: ADFM® Pro20 Pulsed Doppler System

Being familiar with the limitations of various flow measurement technologies, SEH set about exploring all options available. SEH contacted Teledyne Isco, and received a recommendation of the ADFM Pro20 flow measurement system. The ADFM Pro20 is especially suited for large pipe flow measurement. Advanced algorithms automatically adapt to changing flow characteristics, removing the need for in-situ calibration and ensuring accurate flow rate measurement even in difficult hydraulic conditions.

Figure 1: Preparing to lower the ADFM into the manhole

The ADFM Pro20 system measures flow rate to within 2% of actual value, in depths up to 20 feet (6 meters). Four pulsed acoustic beams pointing in different directions in the flow measure velocity at multiple level points, called bins, while the middle ceramic points straight up, providing ultrasonic level sensing.



SEH currently uses several Pro20 systems to perform collection system flow analysis successfully for MCES.

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