No Sedimentation Pond? No Problem.

This city epitomizes the challenges of every modern American municipality: a mushrooming population taxing an aging underground infrastructure combined with government regulations mandating clean environmental practices.

By John Haukaas

Fridley, a suburb of Minneapolis, sits on the glistening eastern banks of the Mississippi River. Within Fridley is Rice Creek Way, a residential area developed in 1962. A church and a major county road cutting through the area generate high traffic levels. Drainage from curbs and gutters takes in salt and sand used to stabilize winter roads. Stormwater is conveyed through a system that flows to Locke Lake, the upstream end of which has a sedimentation basin area. Fridley, encompassed by the Rice Creek Watershed District, is the final stormwater entry point from a host of other upstream watersheds before it discharges into the Mississippi River.

During a street reconstruction project in Rice Creek Way, curbs and gutters were redone, but there was no place for a sedimentation pond to trap oils, greases, and floatables before they entered Locke Lake. In 2001, the Rice Creek Watershed District provided Fridley with a grant to install stormwater treatment systems to retrofit Rice Creek Way's stormwater system. Many alternatives were considered.

Based on cost, installation, location, ease of maintenance, and a quick delivery time, Fridley decided to install a pair of primary stormwater treatment units using locally available precast concrete manholes. The tangential inlet pipe provides optimum swirl distribution for sediment removal. A 4- to 5-ft deep sump offers ample sediment storage. Treated surface water enters a floatables chamber where floating oil and organic debris are trapped by a baffle wall. An underflow opening in the bottom of the baffle wall directs flow to the system outlet pipe.

The V2B1 stormwater treatment systems are from Environment 21, LLC (www.env21.com). The company provided the technical expertise and Royal Concrete Pipe, Stacy, MN, a licensed manufacturer of the V2B1's, assembled the units. According to Rick Odland of Royal Concrete, treatment ponds are usually the first choice for a Best Management Practice, if feasible, but the V2B1's are best suited for places that do not allow for ponds. Environment 21 develops stormwater technology and provides technical support to allow concrete precasters to use their standard precast chambers for stormwater treatment. Technical support includes a site-specific site data sheet/sketch plan, sediment removal efficiency and pump out interval analysis, design storm backwater analysis, and a precaster detail drawing in AutoCAD (Autodesk, Inc., www.autodesk.com).

Vigilant Maintenance

The chamber's effectiveness depends on vigilant maintenance, making it a key factor in the unit's design. Chambers are located next to an access road with their floors typically 8 to 12 ft below grade. Properly-designed chambers are expected to give effective sediment and floatables removal with several years between pump outs.

Pumper truck containing sediment sludge pumped from the swirl chamber.

Fridley's two stormwater treatment systems each have two chambers, one each for sediments and floatables. Drainage is from a typical residential locale where about 20 percent of the area is paved, 20 percent covered by dwellings, and the remaining 60 percent vegetated. The systems are sized to provide 80 percent sediment removal efficiency.

The first 7.6-acre drainage area is served by a Model 6, which has a 6-ft diameter swirl chamber. It is flanked by 25 ft of 15-in. diameter inlet pipe and 95 ft of 18-in. diameter outlet pipe. A second 17.6-acre drainage area is serviced by a Model 17, which has a 10-ft diameter swirl chamber and is flanked by 50 ft of 33-in. diameter inlet pipe and 180 ft of 36-in. diameter outlet pipe.

Once the systems were designed, W. B. Miller, Elk River, MN, handled the installation. Royal Concrete had provided the city with detailed installation instructions. According to Mike Walker, a Miller supervisor, a six-man crew took four days to install the units in what was their first installation.

"They were easy to install," Walker noted. "Having not installed one before, it looked a lot more technical than it really was. In the end, it was just a big piece of concrete—you dig a hole and set it into the ground with the pipe in it. The inside piping was fairly easy to figure out how to put together."

For ease of pump-out, access openings were located next to the curb.

Yet, there were challenges. Space was confined and public utilities, such as gas mains and phone cables, criss-crossed the excavation area. There were also some sewer and water mains to dig around, under, and shore up to deliver the right sized excavation.

Once the systems were installed, Fridley developed a fastidious maintenance procedure. City crews monitor system sediment every two months using a telescopic pole with a 4- by 4-in. metal plate on the end to estimate how much material is in the unit. Spring cleanings are crucial to monitor sediment created from the salt and sand used for winter road clearance.

Miller did the first post-installation maintenance in Spring 2002. In July 2003, Fridley performed another maintenance program. Over two and a half days, crews removed 11 yd of material from both systems—one had been three quarters full; the other, half. No washout of trapped pollutants was detected.

The manufacturer believes that pumping sediment from a chamber is preferable to pumping sediment from a storm pond. Annual pump out of the systems is recommended until operations justify longer intervals between pumpings. Fridley's goal is to clean them twice yearly, unless interval checks determine otherwise.

Fridley's three-person maintenance crew starts with pumping of all the water until only material remains. A jetting machine creates slurry that is vacuumed. The waste is disposed of at a local waste treatment facility.

A crew member trained in confined space enters the lower chamber. Although Fridley is using manned entry as a maintenance procedure, Odland says it's not mandated beyond what is required.

"By physically being down there to move the end of this pipe as we are sucking it out with this vacuum truck, when we have these units cleaned, they are cleaned right down to the bottom and look like the day the structure was installed," Kottsick notes.

Kottsick says the systems are easy to maintain because they have been installed behind curbs and are easily accessible. "One aspect you definitely want to consider when setting these structures up for installation is the ease of maintenance and accessibility. You don't have a bunch of components inside the structures that would block getting the tube of the vacuum truck to get in there and clean it out. We normally try to put two openings in each structure so that they can reach from two sides of the manhole with their vacuum truck." GE

Mr. Haukaas is the Director of Public Works, Fridley, MN.

Rails to Trails in Connecticut

The Farmington Canal Heritage Trail is a trail system covering over 60 mi and follows the canal that opened in 1828. The Farmington Valley Greenway and Farmington River Trail will ultimately be joined to trails in Cheshire and Hamden, CT, to form a multi-use trail and greenway.

URS (www.urscorp.com) was selected for this "Rails to Trails" project, consisting of the design and preparation of plans necessary to convert two railroad bridges into bicycle/pedestrian bridges as part of the Farmington Valley Greenway, Rails-to-Trails Program. This section of the trail is approximately 1.5 mi long starting on the north side of Route 4 and ending at Red Oak Hill Road. One of the bridges (known locally as "Big Bird") spans a two-lane roadway, Route 4, and the other is 400 ft long and 50 ft high spanning the Farmington River.

To convert both bridges into bicycle/pedestrian bridges, URS' design work efforts included:

- Replacement of the rails with a deck, superstructure repairs, seismic retrofit, scour countermeasures, and structure jacking to provide additional clearance over Route 4.
- Replacement of the existing railing system with a new system that will support the required design loads, will be visually pleasing, and provide maximum visibility from the bridge. Also, installation of a reinforced concrete deck system was recommended so that cantilevered bump-outs in the deck could provide seating areas for people to sit on the bridge to enjoy the panoramic views of the Farmington River.

The fence railing system incorporated steel tube post with steel picket and rails all hot-dipped galvanized and shop-painted, without the six-month wait for galvanizing to oxidize. This paint process reduced the construction schedule by a full season.

Stay-in-place galvanized steel forms were used at the underside of the cast-in-place concrete deck. The stay-in-place forms offered the contractor a fast, environmentally safe, and economic way to construct the concrete bridge deck over the Farmington River.

The unique scour warning system helped to reduce costly construction of scour countermeasure treatment at the bridge's river piers. Farmington has a link with a river flow-monitoring agency that alerts the town of an impending high water event in the river that would require the town to close the bridge.

The efficient use of spot painting of the bridge at only the structure's bearings minimized painting costs over the Farmington River. The design analysis of the existing structure incorporated section loss over the lifetime of the structure. Based on the analysis, the entire superstructure did not require painting, reducing both construction cost and environmentally sensitive issues. Completed in May 2003, 1.5 months ahead of schedule, final total construction cost for the project was $997,102. GE