LINCOLN COMPANY, LLC

Strategic Soil Solutions Since 1987

Sinkhole Back-filled with Stone

Open Cut Solutions. Quick and Safe with Minimal Disturbance.

During the early spring of 2011, in the Village of Oak Park, Illinois, a bulkhead used to seal the "future use" stub of an 8.5-foot combination storm water and sanitary sewer failed. The failure of the bulkhead allowed the subgrade soils and pavement base course material to enter a sewer junction chamber, creating a sinkhole measuring approximately 12 feet by 20 feet by 24 feet deep in the pavement area. The intersection is located adjacent to a large high school and must accommodate heavy pedestrian and vehicle traffic prior to and after the school day. As an emergency measure, the affected area was back-filled with approximately 12 feet of CA-07 and 12 feet of CA-06. Both "open cut" and "no dig" solutions were considered for the repairs.

In order to complete the bulkhead repair using an "open cut" solution the following ancillary activities would be necessary:

- Installation, maintenance and removal of temporary construction fence
- Removal and replacement of porous granular backfill
- Excavation to the bottom of the sewer junction chamber (approximately 30 feet) with the associated shoring and safety issues
- Removal and replacement of an existing 8-inch water main in conflict with the work
- Isolation of a portion of a 12-inch gas main in conflict with the work
- Support of a ComEd electrical duct
- Removal and replacement of at least 20 feet of B6.12 curb
- Removal and re-setting existing street light pole
- Parkway restoration including topsoil and sod

In order to complete the bulkhead repair using a "no dig" solution the ancillary activities would be limited to:

- Slurry grouting the aggregate materials previously placed as sinkhole backfill

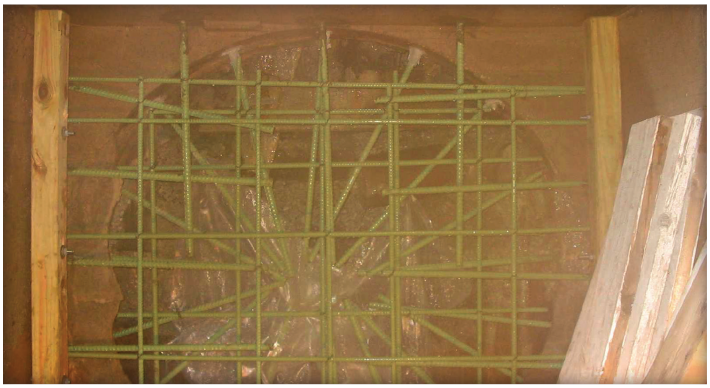
Remediation Options

Prior to issuance of the Plans and Specifications, Lincoln Company, LLC was able to provide recommendations for the project's grouting specifications. Lincoln Company's recommendations included quality control, mixing and pumping systems, pipe installation, clean up and measurement and payment. Additionally, Lincoln Company provided proposals for slurry grouting to a number of the bidders.

Bids ranging up to $422,750 for the "open cut" solution and from $165,000 to $312,500 for the "nodig" solution were received. The low bidder for the "no-dig" solution was chosen and Lincoln Company was subcontracted for the grouting and bulkhead construction. Included in the "no-dig" solution were costs for backfill stabilization, debris removal from the pipe, concrete bulkhead construction, epoxy coating of the pipe junction chamber, and replacement of the pavement base course and asphalt in the affected pavement area.

Slurry grouting to stabilize the sinkhole backfill was accomplished prior to removal of the soils and aggregate material that entered the sewer through the failed bulkhead. Nine 2-inch grout pipes were driven to depths ranging from 12 feet to 24 feet into the sinkhole backfill. Each pipe was then lifted approximately 4-inches prior to injecting the first stage of grout. Subsequent stages varied in thickness between 1 foot and 2 feet. The quantity of grout injected for each stage ranged from 10 gallons to 140 gallons. Both the stage thickness and

Grouted Soil Mass



Bulkhead Steel Reinforcing

Formed Concrete Bulkhead with Injection Tubes

grout quantity were dependent on backfill material, proximity to the failed bulkhead, and void volumes in communication with the grout stage.

The grout was mixed onsite and pumped using a ChemGrout CG-500 portable batch plant. During the slurry grouting the ground surface and pavement surrounding the injection site, as well as the visible surroundings of the failed bulkhead, were visually monitored. Grout injection was stopped when any stage caused inflow of grout to the inside of the sewer through the failed bulkhead or if grout seepage was observed at the ground surface. Grout inflow through the failed bulkhead was observed during 14 of the stages and surface seepage was observed during 2 stages.

The entire grouting process was completed in 3 days. Lincoln Company's capability to stabilize the loose aggregate backfill with a grout matrix made it possible to accomplish the bulkhead repairs quickly and safely with minimal disturbance to the neighborhood, especially the traffic patterns surrounding the school. Grouting operations required only a portion of the intersection be closed to vehicle traffic and allowed pedestrian traffic to continue normally.

Due to the extended period of time needed for the debris removal, and several days of rain which created a situation where the water in the sewer was too high to work, the grouted material was left exposed for approximately 2 weeks prior to placement of the bulkhead.

During the debris removal a 15 cubic yard dumpster was placed atop the sinkhole backfill. The dumpster was used to separate the water and debris discharged by the vacuum truck. The water that was separated from the debris was discharged directly to the sinkhole backfill, where it was allowed to infiltrate the sink hole backfill. Despite the weather delays and added stress from the debris separation activities, no additional material collapsed into the sewer after the slurry grouting.
To complete the project, Lincoln Company installed the reinforcing steel per the project plans and specifications and formed the bulkhead.

The bulkhead concrete was placed by pumping and allowed to attain the 4000 psi design strength prior to form removal. The junction chamber, where the bulkhead was placed, is scheduled to be epoxy coated following a 28-day cure period. the project.

For more information, please contact:

Steve Trout
strout@lincolnllc.com
T (630) 980-0339
F (630) 295-9197

75 Monaco Drive
Roselle, IL 60172-1956

www.lincolnllc.com

LINCOLN COMPANY, LLC