TO: Dave Stoneback, City of Evanston  
DATE: December 8, 2011

FROM: Paul Moyano, Brenna Mannion

SUBJECT: Hydraulic Model Services  
Task Order No. 08 – University Place Water Main Analysis

Objective

The objective of Task Order No. 08 was to perform an analysis to determine the impact of abandoning the 4- and 6-inch water main on the north side of University Place between Sherman Avenue and Sheridan Road. The purpose of this memorandum is to summarize and document the analysis performed and the results obtained.

Approach

The City’s 2009 Updated Hydraulic Model was used to perform an analysis of the water distribution system and evaluate the effects of abandoning the 4- and 6-inch main on University Place. Parallel to the water main to be abandoned is an active 8-inch diameter water main that also runs along University Place between Sherman Avenue and Sheridan Road. The model was updated for all simulations to reflect the previous abandonment of a 6-inch water main along Sheridan Road between Chicago Avenue and Hinman Avenue and a small portion of 4-inch water main extending south along Hinman Avenue.

Four scenarios were developed to analyze the system before and after the abandonment of the water main. Steady-state model simulations were designed for each scenario to understand the impact on the system’s ability to provide adequate fire flow under a maximum day demand condition and to provide adequate system pressure under a peak hour demand condition. Each scenario and corresponding simulation is described in the next section.

Model Simulations

The following section describes the model simulations used for the analysis of the failed water main abandonment on University Place.

Baseline Scenario

The Baseline Scenario is defined as the City of Evanston’s existing system operation and performance (current to the 2009 Updated Hydraulic Model) prior to the abandonment of the 4- and 6-inch diameter water main on University Place.
Scenario 1

Scenario 1 is defined as the Baseline Scenario with the 4- and 6-inch water main on the north side of University Place between Sherman Avenue and Sheridan Road not in operation and demands associated with this pipe transferred to the remaining 8-inch main.

Each scenario was analyzed under both the maximum day and peak hour demand conditions described in Table 1 below. The model input parameters for two demand conditions were provided by the City and represent 2009 values which remain generally consistent with current system operation. The four resulting simulations are summarized in Table 2.

Table 1 – Summary of Model Input Parameters

<table>
<thead>
<tr>
<th></th>
<th>Demand Condition 1: Maximum Day Demand plus Fire Flow</th>
<th>Demand Condition 2: Peak Hour Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Plant Pumpage</td>
<td>60.544 MGD</td>
<td>63.692 MGD</td>
</tr>
<tr>
<td>Pump Operation</td>
<td>Pumps 7, 5 &amp; 9</td>
<td>Pumps 7, 5 &amp; 9</td>
</tr>
<tr>
<td>Evanston Demand</td>
<td>13.992 MGD</td>
<td>16.777 MGD</td>
</tr>
<tr>
<td>Northwest Water Commission Demand</td>
<td>35.225 MGD</td>
<td>32.472 MGD</td>
</tr>
<tr>
<td>Skokie Demand</td>
<td>11.327 MGD</td>
<td>14.444 MGD</td>
</tr>
<tr>
<td>North Standpipe Water Level</td>
<td>69 feet (HGL = 130 ft)</td>
<td>63 feet (HGL = 124.5 ft)</td>
</tr>
<tr>
<td>South Standpipe Water Level</td>
<td>111 feet (HGL = 130.5 ft)</td>
<td>105 feet (HGL = 124.5 ft)</td>
</tr>
</tbody>
</table>

Table 2 – Summary of Model Simulations

<table>
<thead>
<tr>
<th>Simulation</th>
<th>Scenario</th>
<th>Demand Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation 1</td>
<td>Baseline Scenario</td>
<td>1: Maximum Day with Fire Flow</td>
</tr>
<tr>
<td>Simulation 2</td>
<td>Baseline Scenario</td>
<td>2: Peak Hour</td>
</tr>
<tr>
<td>Simulation 3</td>
<td>Scenario 1</td>
<td>1: Maximum Day with Fire Flow</td>
</tr>
<tr>
<td>Simulation 4</td>
<td>Scenario 1</td>
<td>2: Peak Hour</td>
</tr>
</tbody>
</table>

For model simulations under Demand Condition 1, available fire flow was calculated at each model node to simulate available flow from the distribution system at these locations. Model results are shown in Table 3. The fire flow analysis was performed using a minimum residual pressure of 25 psi to account for minor losses from the modeled node through the actual hydrant and lead which are not explicitly included in the model. This approach is consistent with the fire flow analysis historically performed by MWH.

Model Results

Key model results from simulations described above are summarized in the following section.
Available Fire Flow

Available fire flow was calculated with Simulations 1 and 3 and results are presented in Figures 1 and 2. Model nodes are color coded to reflect the available fire flow with a residual pressure of 25 psi under a maximum day demand condition. Fire flow results from a selection of model nodes in the area of the University Place are shown in Table 3.

Review of the results presented in Figures 1 and 2 show that there is little change in available fire flow between the two scenarios. As shown in Table 3, the decrease in available fire flow between the Baseline Scenario and Scenario 1 is less than 100 gpm. The node showing the greatest reduction maintains greater than 2,000 gpm of available fire flow in Scenario 1. These results show that the abandonment of the University Place 4- and 6-inch water main does not have a significant impact on available fire flow in the area. Please note that general assumptions inherent to modeling the water system, field conditions, system demands, and operation will result in variation between the modeled available fire flows and actual available fire flow at hydrants.

Table 3 – Summary of Available Fire Flow for Select Model Nodes

<table>
<thead>
<tr>
<th>Select Hydrant Node ID</th>
<th>Baseline Available Flow at Hydrant (gpm)</th>
<th>Scenario 1 Available Flow at Hydrant (gpm)</th>
<th>Difference in Available Flow (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-034</td>
<td>2,727</td>
<td>2,727</td>
<td>0</td>
</tr>
<tr>
<td>13-049</td>
<td>4,700</td>
<td>4,637</td>
<td>63</td>
</tr>
<tr>
<td>13-068</td>
<td>1,885</td>
<td>1,863</td>
<td>23</td>
</tr>
<tr>
<td>14-001</td>
<td>2,109</td>
<td>2,012</td>
<td>97</td>
</tr>
<tr>
<td>14-230</td>
<td>13,769</td>
<td>13,769</td>
<td>0</td>
</tr>
</tbody>
</table>

System Performance at Peak Hour

Model Simulations 2 and 4 were completed assuming a peak hour demand condition. Results from these simulations are presented in Figures 3 and 4 which show system pressure and pressure contours. There is virtually no change in pressure between the two scenarios. The maximum pressure difference between Simulations 2 and 4 at the nodes identified previously is 0.01 psi. These results show that the abandonment of the University Place 4- and 6-inch water main does not have an impact on the pressure in the area under the modeled conditions.

Conclusion

Model results confirm that the abandonment of the 4- and 6-inch water main along University Place between Sherman Avenue and Sheridan Road does not significantly impact available fire flow under maximum day demand conditions, nor does it negatively impact the available pressure for the area under peak hour demand conditions.
Legend

Available Fire Flow (gpm)
- Less than 500
- 500~999
- 999~1500
- 1500~3500
- Greater than 3500
- Select Nodes

Figure 1
Simulation 1: Baseline w/ Max Day and Fire Flow
University Place WM Analysis
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Figure 3
Simulation 2: Baseline at Peak Hour Demand
University Place WM Analysis
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Figure 4
Simulation 4: Scenario 1 at Peak Hour Demand
University Place WM Analysis
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