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January 4, 2012

Somerville Housing Authority
Joe Macaluso, Executive Director
30 Memorial Road
Somerville, MA 02145

Re: Flooding Issues at 23-25 Irvington Road, Somerville

Dear Mr. Macaluso:

DESIGN CONSULTANTS, INC. (DCI) has reviewed the following material associated with the flooding issues at 23-25 Irvington Road, Somerville:

1. A letter from SLB Group, LLC dated October 17, 2011, revised December 2, 2011.

This letter provides an overview of documents that SLB Group, LLC (SLBG) has reviewed, people that have been contacted by SLBG, a chronological sequence of SLBG's activities regarding the flooding issues at 23-25 Irvington Road, and conclusions and recommendations of SLBG relative to the flooding issues at 23-25 Irvington Road, Somerville.

SLB Group's Conclusion

In general, SLBG believes that stormwater from the Capen Court development's infiltration and drainage system is not being recharged to groundwater due to poorly draining soils and is instead flowing laterally below grade to the crushed stone bedding and sand backfill around the relocated MWRA 5' diameter water main. SLBG concludes that this stone bedding and sand backfill acts as a conduit and transports the stormwater in a northeasterly direction where it flows laterally into the basement at 23-25 Irvington Road, creating a flooding problem.

Background

SLBG's letter provides some background to the flooding issues at 23-25 Irvington Road, with some key statements reiterated below followed by clarifications by DCI.

"The Clients purchased their home at 23-25 Irvington Road, Somerville, Ma in 2006 knowing that they had a slightly damp basement with a sump pump which would normally operate in the spring during heavy rain events as acknowledged in the Home Inspection Report." Sump pumps are not installed in basements that are slightly damp. Dehumidifiers are used to control dampness. Sump pumps in basements are used to either remove ponded surface water within a basement or to lower groundwater if the basement slab elevation is located at or below the average groundwater table. Home Inspection Reports are typically performed in one day, with historical details such as "normally operate during heavy rain events" being provided by the home seller. It is worth noting that the first full year of the clients purchasing their home had an annual rainfall total below normal (according to National Oceanic and Atmospheric Administration statistics), which may have lead to a misconception of how damp the basement would typically be.

"The Client's house was originally constructed about 1 foot lower than other homes on Irvington Road. If the basement floor was 1 higher most of the flooding problems would not be evident." This statement seems to admit that the basement floor elevation is located within the groundwater table, which is consistent with the installation of a sump pump in the basement.

"The natural surface drainage of Capen Court prior to construction drains directly towards 23-25 Irvington Road and 501 Mystic Valley Parkway as well as 27-29 Irvington Road. It is assumed that the groundwater flow pitches in the same direction." This statement is partially true. The natural drainage pattern from the Capen Court site in the pre-construction condition was divided into two subcatchment. Approximately 2/3 of the site drained to the municipal storm drain connection on site while the remaining 1/3 flowed overland to either the properties along Irvington Road to the northeast or northwest to 501 Mystic Valley Parkway and the adjacent MWRA property. It is also worth noting that the properties along Irvington Road drop in elevation from approximately 37 at 43-45 Irvington Road to approximate elevation 29 at 23-25 Irvington Road. Groundwater flow direction varies due to many conditions. While the assumption that the groundwater flow will follow the surface contours may be correct, the only way of determining groundwater flow paths is to install monitoring wells along with a monitoring program. DCI has not performed this analysis nor are we aware of any study performed by SLBG.

SLBG's Conclusion

Page 7 of the SLBG letter provides their conclusion of the cause of the flooding at 23-25 Irvington Road as follows:

"Based upon observations and the collected data-SLBG concludes the following potential causes for flooding on the Client's property and basement:

Once the stormwater enters the recharge system, water fills the chambers and surrounding crush stone. The system is designed to percolate the water through the bottom and sides of the recharge system into the natural ground however the poor receiving soils probably prevent the water from percolating fast enough into the ground and is spilling over into the sand and gravel surrounding the MWRA water main which passes close to the recharge system. Because water seeks its own level, the water will follow the crushed stone below the water main and try to find an outlet or the natural groundwater which is flowing towards the Client's property. Even if the recharge system is working and the water is reaching the groundwater, the recharge system would cause a mounding effect to the groundwater which would flow naturally to the Client's property. The recharge system was designed to have an overflow in the event the system fills up and cannot absorb the water. Even with the overflow working, there would be about 30-inches depth of water contained within the recharge system that would be recharged to groundwater. Groundwater does not flow quickly through the ground especially if the soil contains glacial till. The groundwater takes several days to flow through the ground to reach the Client's property. The estimated distance between the edge of the recharge system and the Client's property line is approximately 212 feet. The Client's sump pump has mimicked this scenario countless times since the Capen Court construction. The sump pump would start pumping during heavy rainstorm and continue to pump for several days after a storm even in July and August."

We believe this conclusion is incorrect based on the following:

1. DCI has extensive photos ranging from pre construction to post construction. We cannot determine the nature of the soils below the MWRA water main which was not relocated. Typically water mains installed by MWRA are bedded on a layer of sand fill. The MWRA water main is highest at the eastern most corner of the site and lowest at the western most corner of the site. If stormwater were to enter the crushed stone bedding

and sand fill around the MWRA water main, is would flow to the west, along the water main, not north towards 23-25 Irvington Road.

2. The stormwater runoff contained within the infiltration field cannot "spill over" into the MWRA water main trench, as there is no connection between them. The naturally occurring till soils either remain between the infiltration field and the MWRA water main trench or were used as backfill, creating a barrier of low porosity soils between the two. This same barrier also exists between the MWRA water main and the property line of 23-25 Irvington Road. This means there is no direct conduit from the infiltration field to the MWRA water main trench to the basement of 23-25 Irvington Road.
3. The cross section of the infiltration field is composed of 6" of crushed stone above and below the infiltrators. The bottom of the stone layer is at elevation 27.40. The bottom of the chambers is at elevation 27.90. The top of the chambers is at elevation 30.44. The top of the stone above the infiltrators is at elevation 30.94. The Infiltration System has an inlet elevation of 27.90, which is also the elevation of the overflow drain line. This means the depth of stormwater runoff that is not directly piped out of the infiltration field is 6" (the crushed stone layer), not the "30-inches" as stated.

Based on the HydroCAD® model of the infiltration field, stormwater runoff starts to enter the system approximately 6 hours after the storm begins for the 2 year storm and approximately 3 hours after the storm begins for the 100 year storm. During the 2 year storm, the system will drain to the top of stone layer 15.75 hours after the storm begins and during the 100 year storm the system will drain to the top of stone layer 19.25 hours after the storm begins. This means that for the 2 year storm, the infiltration field has stormwater runoff in it for almost 10 hours and for the 100 year storm the field has water in it for approximately 16 hours. The maximum volume of the infiltration field is approximately 2,000 cubic feet. The short length of time stormwater is within the infiltration field and the small volume of stormwater held is certainly not enough to elevate the groundwater table as would be required to create the scenario as described by SLBG. The more likely reason for the sump pump action following the storms is a result of the till soils in the surrounding areas, which very typically hold water which falls from precipitation for several days, until the water eventually percolates to the groundwater.

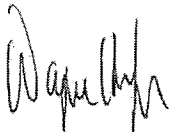
Conclusion

In conclusion, DCI believes that the flooding experienced at 23-25 Irvington Road is not caused by the Capen Court development, but more likely is caused by the natural till soils in the area and the basement elevation of the property being within the groundwater table.

If you have any questions, please do not hesitate to contact me at (617) 776-3350 x 102.

Sincerely,

DESIGN CONSULTANTS, INC.



Wayne Keefner, P.E., LEED AP
Senior Project Manager

Cc: Tim Healy, Somerville Housing Authority
Paul Mackey, Somerville Housing Authority