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MEMO

TO: Aldermen, Mayor Speaker

FROM: Tom Grisa

SUBJECT: Flooding of June 7-8, 2008

DATE: July 11, 2008

The City of Brookfield experienced severe flooding and basement backups as a result of the storms on June 7 and 8, 2008.

During this two day period, the City experienced anywhere from 7.5 inches to over 9 inches of rain, most of which fell in the first eight hours of the storm. This rain fell on top of saturated soils from a previous rain event on June 5th when 1.33 inches of rain saturated the ground. This results in increased runoff of water from the storm.

Approximately 5.8 inches of rain fell in the first eight hours. The proverbial 100 year storm consists of 5.88 inches of rain falling in 24 hours. So this event exceeded the 100 year storm by having the same amount of rain fall three times as fast as the 100 year storm. Additional rain fell after the first eight hours also, further exceeding the 100 year storm. The City's standard for design, confirmed and adopted by the City-wide Flood Task Force and Common Council after the floods of 1997 and 1998 is the 100 year storm. The 100 year storm is also the national standard.

The City's regional treatment plant normally handles 7 million gallons per day (MGD). Our treatment plant is designed to treat a maximum of 50 MGD. On June 7th and 8th the plant peaked at 68 MGD. That is 50% higher than the plant has ever processed before since the plant was upgraded in 1996-1999 (previous record 44 MGD). Flow from contract communities to the west was extreme as they were hit hard and more subject to flooding as rivers and lakes continued to rise in their area.

The Riverview interceptor (along the Fox River) normally operates at 2 MGD and jumped to a flow rate of 28 MGD in two hours indicating that direct inflow sources were getting into the system. This was not a typical response of infiltration of water through leaks in the system. It

was later discovered that power outages upstream of this interceptor lead to hundreds of houses and buildings having sump pump failures. These failures resulted in flooding of basements, flowing into floor drains and into the sanitary sewer. This also resulted in basement backups throughout the area. This power outage lasted for five hours – essentially throughout the worst part of the storm.

Following up with residents who called in to report their problems indicates that throughout the City, sump pumps were not working (power outages, burned out pumps, couldn't keep up, etc.) and poured water down floor drains in mass quantities, quickly overloading the sanitary sewers and resulting in many basement backups.

City crews were out working throughout the storm over that weekend addressing flooded roads, inlets, yards, pumping out sewers to relieve basement backups as best as possible and repairing washouts of roads and closing roads where flooded.

The City pumped out sewers in 8 locations to minimize and prevent basement backups. See attached report for more information on locations and amounts of wastewater pumped out of the system.

Staff immediately began collecting data during the storm including locations of flooding, basement backups, amount of rain and response to the storm. We have continued to collect data and encouraged residents to report information about flooding and basement backups so we can distinguish between the type of problem that occurred.

On Monday, June 9th the City ran its standard tests of the City water system. All tests on the water system indicate the water was and continued to be safe to drink throughout the storms - no compromise of the system, unlike many private wells.

Staff started picking up flood damaged debris the following Thursday, June 12th and continued through the end of June. This also provides data on which properties may have been flooded or experienced basement backups who may not have reported this to the City.

On Thursday, June 12th the City experienced another storm with a total rainfall of between 2.57 inches and 2.81 inches of rain from 3 p.m. to 5 a.m. June 13th. Adding this to previous totals raises the rainfall total to nearly a foot during the previous week. Adding in the rain on Thursday, June 5th makes this an even more extreme event. Furthermore, these rain events fell on high groundwater tables caused by the nearly 100 inches of snow over the winter months resulting in groundwater flooding throughout the area taxing sump pumps and basement walls and floors throughout the City.

The combination of back to back storms exceeded the 100 year event for a ten day period. Throughout the duration of these storms they exceeded the 100 year storm event at all points on the curve.

Despite the damage to many parts of the City, there are a number of areas that had routinely been inundated in the past that fared much better than they have previously (even with

smaller storms). In addition, other areas that were flooded or experienced basement backups seem to be hit less hard than in previous events.

There are numerous reasons for why the City experienced flooding and basement backups during these storms.

The amount and intensity of rain was a major factor. This storm exceeded the City's design standard of the 100 year storm. The public infrastructure is just not designed to handle the magnitude of this type of storm. In some areas, the City is still in the process of upgrading its systems and we recommend that the City continue to do so in accordance with the approved plans for sanitary sewer and storm sewer improvements.

The City's storm sewer and ditch system are designed generally to handle a rainfall event of a 10-year design frequency. Ditch enclosures have compromised this system and they should be reevaluated on a case by case basis to see if removal would reduce flooding. After the storm sewer and ditches fill up, secondary drainageways including streets, backyard and sideyard swales, and other drainage courses convey flood waters. These systems should be designed to handle the 100-year event without causing structure flooding. This does not mean however that the flood waters won't surround a property during such an event.

Power outages for hundreds of properties (up to 5 hours in duration) were a major factor causing sump pumps to not operate leading to flooded basements draining into floor drains resulting in basement backups elsewhere.

Blocked drainage ways, inlets, culverts and storm sewers resulted in flooding of streets and yards. Mulch, branches and mud blocked inlets, culverts and storm sewers. Once these were cleared drainage was typically restored. In some cases structures and landscaping blocked overland drainage paths through drainage easements.

Failed sump pumps for other reasons (not large enough to handle the flow, discharge pipe submerged and could not pump against the high pressure of water, pump burned out, circuit breaker blew, etc.) contributed significantly to flooding of basements and flows in the sanitary sewer system.

The City is still in the process of repairing its sanitary sewer system for leaks and should continue to do so as routine maintenance, just like road maintenance continues each year.

Flow into our sewer system from contract communities of the Fox River Water Pollution Control Center was significantly higher than normal as well indicating they had similar issues as Brookfield. We should continue our work with these communities to tighten up their systems as well.

It appears in some areas underground parking garages were flooded resulting in these flood waters entering the sanitary sewer system and causing basement backups in other locations. In one instance we had a sanitary sewer pump station fail and the pump did not keep up with the incoming flow. This resulted in basement backups in the area tributary to the station.

Staff addressed this failure as soon as we were aware of it and returned the pump station back into service as quickly as possible.

The question that the Council will need to answer is what can or should the City do about this type of flooding and basement backups. It should be repeated that the type of storm experienced during this period was extreme, exceeding the City's established standards for design.

It would be extremely costly and disruptive to expand the level of service beyond the 100 year event. In addition, there is no guarantee that whatever design storm is selected would be adequate to handle all subsequent storms as there may be a larger storm that inundates the system with equally or greater devastating effects. Essentially this is a matter of risk management and how much service is affordable. Staff recommends the City retain its 100 year design standard as previously approved by the City's Flood Task Force and Common Council in 2000. All studies in the City have been based on this event. Changing this would require all the studies to be reconducted and the improvements installed to date may have to be reconstructed at great expense. Furthermore, the City could not move forward with improvements for some time until these studies were completed.

That being said, there are still some things that can be done to minimize the frequency and severity of flooding and basement backups during these type of events. Attached is a list of methods for improving stormwater drainage, reduce flooding and minimize basement backups. They include a list of tasks to perform on the public system as well as an information and education program to assist residents with protecting their property and by doing so protecting the system and other properties as well.

Since the sanitary sewer system and storm water systems are systems, they involve multiple components and connections. Accordingly it makes sense that the City addresses this issue on a systemwide basis and in a holistic manner. Addressing both public sector and private sector sources of inflow and infiltration into the sanitary sewer system and reducing flooding of structures will go a long way in improving the operation of these systems.

Some of the methods identified are things the City would do anyway as part of its on-going maintenance and improvement program. Others are new programs that can easily be implemented. Still others would require a significant change in policy and should be carefully considered before implementing.

We welcome your thoughts on the methods identified in the attachment and on this report in general. The Boards and Council should consider what improvements or changes to existing standards and programs should be implemented and direct staff accordingly.

Cc: Karen Flaherty, Dean Marquardt, Robert Scott, Jeff Chase, Ron Eifler, Terry Starns, John Carlson, Theresa Caven