TECHNICAL MEMORANDUM

TO: Coon Creek Watershed District Managers and Staff
DATE: March 7, 2013
SUBJECT: Atlas 14 Precipitation Changes

Background

The precipitation volumes the District and municipalities use to size storm sewers, ponds and set low floor elevations are about to change. Tom Gile gave an over view of what we currently use for rainfall data and how it will be changing at the February meeting.

For many years and almost at the District formation the standard was to use precipitation data from the U.S. Department of Commerce, Weather Bureau, Technical Paper Number 40 Rainfall Frequency Atlas of the United States, commonly known as TP-40. TP-40 gives volumes of precipitation for different frequency events of different duration. For example, to set low floor building elevations to keep them above the floodplain we use a 24-hour precipitation that would have a 1% chance of occurring in any one year on houses. This is known as the 24-hour, 100-year precipitation and from TP-40 in Coon Creek it is 5.9 inches.

TP-40 was issued in 1961 and for many years was seen as needing updating to account for a denser rainfall network, more years of data and shifting precipitation patterns. The replacement is call Atlas 14 and is expected to be published this March. The 24-hour, 100-year precipitation for Atlas 14 ranges from 6.7 to 7.6 inches across the watershed, Figure 1. This is a 14% to 29% increase as measured from north to south in the watershed. Figures 2 though Figure 8 show the Atlas 14 100-year precipitation depths in expanded detail for each city.

Understanding the increases in design precipitation volume is important to the District and municipalities in the watershed for the following reasons:

1. The existing Flood Insurance Studies, completed in the early 1980’s used the TP-40 precipitation depths. The Flood Insurance Studies are the regulatory basis for setting low floor elevations. Mortgage companies and residents rely on these studies to determine the level of risk from flooding and if flood insurance is needed. The flood studies in the Coon Creek Watershed District calculated flow rates at numerous points along Coon Creek and other creeks by using the TP-40 precipitation into a hydrologic computer model. The flow rates calculated in the hydrologic model were then put into a hydraulic model to estimate peak water surface elevations. The water surface elevations are known as the 100-year regulatory floodplain elevations.
2. Cities and the District use the Flood Insurance Studies to regulate building in floodplains through the municipal floodplain ordinance and watershed rules and standards. An increase in the 100-year elevation means there is more floodplain to regulate and potentially more structures that will now be considered as being within the floodplain or below the minimum low floor elevation.

3. The stormwater infrastructure in many first and second ring suburbs has commonly been designed to accommodate the 5-year storm event, while construction in the last few decades typically now use the 10-year storm event to size storm sewers systems. The 10-year precipitation has changed from 4.1 inches in TP-40 to a range of 4.3 to 4.7 inches across the watershed in Atlas 14. Therefore, storm sewer sizes will probably increase to get the same level of protection.

4. Channel design often uses the 2-year event to calculate bank full capacity. This will increase from 2.75 inches to a maximum 2.9 inches, or a 5% increase.

The District has a model that combines the hydrologic and hydraulic functions into one model called XP-SWMM. The model divided the entire Coon Creek watershed into smaller subwatersheds. For each of these subwatersheds a precipitation was assigned to it that best fit where it fell within the rainfall distribution map. The model was run and the results showing the increase in flood stage is shown on Figure 9. This model needs to be field verified because the flood flows are going between basins and in some locations we are estimating overflow elevations.

As can be seen there is an increase in flood plain elevation throughout the District with the greatest changes in the south in Fridley, Blaine and Coon Rapids and less so in Ham Lake and Blaine.

I spoke with Suzanne Jiwani, the flood plain mapping hydrologist at the Minnesota Department of Natural Resources. She said the DNR has no immediate plans to update the Flood Insurance Studies. It should be noted that flood studies that were done with stream gage data won’t be affected by the Atlas 14 numbers. At some future time the DNR will issue a policy statement on how the flood plain program will address the change in design precipitation numbers.

I had a phone conversation with Lisa Saylor, a hydraulic engineer at MnDOT. She said MnDOT will be very deliberate in how they apply the Atlas 14 rainfall and at the present time will allow each design engineer to use it at their discretion. She noted they are particularly concerned about how the July 23, 1987 “super storm” that dropped 6” of rain in 6 hours across much of the metropolitan area and up to 14” at the Bloomington Edina border might skew the data.

I also spoke with Jon Janowicz an engineer with the Federal Emergency Management Administration in Region III. Region III headquarters is in Philadelphia and they have been aware of and implementing the Atlas 14 numbers for almost ten years. He said they issue advisory notices whenever there are changes to data or other observed events based on “best available data”. For example, an advisory was issued after Hurricane Sandy showing flood areas that weren’t shown on previous published maps. Another recent example that applies to the District is the availability of LiDAR mapping through Anoka County. LiDAR mapping is infrared laser developed topographic maps that are accurate to 0.15ft to 0.25ft. Since
this mapping has been available models have been updated and advisory notices distributed showing properties that have been added and some removed from the flood plain.

The reason advisory notices are issued and not the Flood Insurance Study is that there is a statutory process to update an FIS. An advisory notice can be issued when new data warrants an announcement that the flood plain extent or elevations are noticeably different. It would be important for a permit applicant to be aware of the higher flood plain elevation resulting from the Atlas 14 rainfall so they can raise low floors or do other site changes to keep them from falling within the flood plain and needing flood insurance.

Recommendations

There are several actions for the District to stay current or ahead of the upcoming changes to the precipitation depths that are used by engineers and flood plain managers.

1. The District should continue discussing implications of increasing the design rainfall amounts with the Technical Advisory Committee who in turn are the administrators of their municipal flood plain ordinance.

2. The District should add an advisory notice section to the permit review template that would

   a. provide the Atlas 14 100-year elevation to applicants with a project along one of the creeks or within the flood plain and
   b. give the applicant the option to either calculate the Atlas 14 100-year precipitation peak water elevation with their model or have the District calculate it if they are constructing a pond or other water holding structure that the high water may affect a building.

3. The District should field verify the Atlas 14 XP-SWMM model.

4. The District should consider after consulting with member cities, the DNR, FEMA and district residents making the Atlas 14 XP-SWMM model the regulatory flood plain model.

Attachments:
Figure 1, Atlas 14 100 Year Isopluvials Coon Creek Watershed District
Figure 2, Atlas 14 100 Year Isopluvials City of Andover
Figure 3, Atlas 14 100 Year Isopluvials City of Blaine
Figure 4, Atlas 14 100 Year Isopluvials City of Columbus
Figure 5, Atlas 14 100 Year Isopluvials City of Coon Rapids
Figure 6, Atlas 14 100 Year Isopluvials City of Fridley
Figure 7, Atlas 14 100 Year Isopluvials City of Ham Lake
Figure 8, Atlas 14 100 Year Isopluvials City of Spring Lake Park
Figure 9, Elevation Change between TP40 and Atlas 14 100 Year Precipitation Depth