

# IMPLICATIONS OF PRECIPITATION CHANGES IN SOUTHEAST MICHIGAN AND OPTIONS FOR RESPONSE: A GUIDE FOR MUNICIPALITIES

## Table of Contents

1. What is NOAA Atlas 14?
2. Precipitation changes in Southeast Michigan
3. Changes to Key Storm Definitions
4. Implications for Floodplains
5. Implications for Detention and Conveyance
6. Solutions: Green Infrastructure
7. Solutions: Stormwater Regulations

*This fact sheet is part of a guide supporting decision makers and water resource managers as they adapt policies and practices in stormwater management in response to a changing climate.*  
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## IMPLICATIONS OF NOAA ATLAS 14: PRECIPITATION-FREQUENCY ATLAS OF THE UNITED STATES FOR STORMWATER MANAGEMENT

Across the region, patterns in precipitation have been changing. Historical records and projected trends indicate that these changes require modifications to the practice of stormwater management. Below is a summary of a new precipitation frequency analysis that improves design storm definitions to reflect the full historical record of precipitation data.

### What is it?

NOAA's Hydrometeorological Design Studies Center has updated precipitation frequency estimates (with 90% confidence intervals) for Michigan in Volume 8 of NOAA Atlas 14<sup>1</sup>. This analysis, released in 2013, incorporates precipitation data through 2011 and utilizes more data from more weather stations than previous efforts. Event storms have changed in magnitude with implications for stormwater management. The Atlas is now the official U.S. Government source of precipitation frequency estimates.

### What does it replace?

Currently within Michigan, rainfall depth-frequency data used in stormwater management comes from table 3.1 in *Computing Flood Discharges for Small Ungaged Watersheds*<sup>2</sup> provided by the Michigan Department of Environmental Quality (MDEQ). This table uses data from the *Rainfall Frequency Atlas of the Midwest*<sup>3</sup>, more commonly known as Bulletin 71 – a NOAA publication from 1992. Over the next several years, MDEQ will be revising storm definitions based on data from NOAA Atlas 14 which will become the standard for relevant regulation, permits and recommended best practices. However, municipalities can start making stormwater management and infrastructure decisions based on the improved data today.

### What is different?

The primary differences between Atlas 14 and Bulletin 71 are; 1) the inclusion of the most recent 30 years of precipitation data, and 2) the number of stations included in the analysis. Atlas 14 also provides estimates of 500-yr and 1000-yr events. In Southeast Michigan, all storm event definitions have *increased* in depth. Twenty four weather stations in Southeast Michigan were used in the analysis. NOAA has not aggregated data into regions. Instead data is accessed by station. Below is a table for the Ann Arbor station to illustrate the change in storm event size between Atlas 14 and Bulletin 71.

**Ann Arbor precipitation totals from Bulletin 71 and Atlas 14 (Bulletin 71/Atlas 14) in inches, for various design storms along with percent change between the two in brackets.** All percent change values are positive which means they are larger in Atlas 14. (*Ann Arbor station data is used throughout this resource kit as an example of how precipitation patterns are changing in southeast Michigan because of the quality of data records. Please consult NOAA Atlas 14 for additional data.*)

	1-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
1-hr	0.88/0.969 [10%]	1.06/1.14 [8%]	1.29/1.44 [12%]	1.47/1.70 [16%]	1.69/2.07 [22%]	1.87/2.38 [27%]	2.05/2.69 [31%]
12-hr	1.63/1.82 [12%]	1.97/2.06 [5%]	2.39/2.50 [5%]	2.72/2.90 [7%]	3.13/3.54 [13%]	3.46/4.09 [18%]	3.79/4.68 [23%]
24-hr	1.87/2.09 [12%]	2.26/2.35 [4%]	2.75/2.83 [3%]	3.13/3.26 [9%]	3.60/3.93 [9%]	3.98/4.50 [13%]	4.36/5.11 [17%]

### Where can I access the report and data?

NOAA has created a point-and-click website providing access to reports, data, and GIS and cartographic maps (<http://hdsc.nws.noaa.gov/hdsc/pfds>). The Precipitation Frequency Data Server is a public portal that allows users to download precipitation frequency-depth data in various formats via a map interface or manual selection of location. Data are available in tabular and graphical formats. Temporal distributions of heavy rainfall and annual exceedance probabilities are also available.

### How can it be used?

Using the best available information for the management of stormwater will increase the useful life of infrastructure and protect communities and water resources from unnecessary risk. The increase in volume of rain falling in most design storms has real consequences for the capacity of stormwater systems. Practitioners (e.g. municipalities and counties) need to start accounting for these changes. Atlas 14 can replace Bulletin 71 and Computing Flood Discharges for Small Ungaged Watersheds when making infrastructure sizing and design decisions for conveyance and detention. Local policy and regulations can be modified using the new storm definitions. New data can be used to redefine floodplains. Finally, the data can be used to communicate trends in rainfall that challenge conventional wisdom in the practice of stormwater management.

### Summary

Precipitation Frequency estimates currently used for stormwater management do not accurately reflect the depths falling during precipitation events in southeast Michigan. In reality rainfall depths are greater (3 -32%) than what is being designed for, especially for the largest storms. Climate change projections indicate rainfall volumes will continue to increase. This has implications for how rainfall is managed. Atlas 14 provides improved storm definitions that will allow appropriate adjustments to stormwater management systems and elucidate trends in rainfall that are expected to continue into the future. Adding in an additional margin of safety will help insure decisions with long-term implications accommodate expected changes in precipitation.

### References

1. Perica, et al. 2013. NOAA Atlas 14 Volume 8 Version 2, Precipitation-Frequency Atlas of the United States, Midwestern States. NOAA National Weather Service. Silver Spring, Maryland.
2. Sorrell and Richard, Computing Flood Discharges for Small Ungaged Watersheds. Michigan Department of Natural Resources and Environment, June 22, 2010. Lansing, Michigan.
3. Huff and Angel, 1992. Rainfall Frequency Atlas of the Midwest (Bulletin 71). Illinois State Water Survey, Champaign, Illinois.