ON TO 2050

Stormwater and Flooding

ON TO 2050 Strategy Paper

CMAP Environment and Natural Resources Working Committee

July 7, 2017

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Agenda

- Brief recap of purpose and scope
- Regional Flooding Susceptibility Index
- Draft policy framework
- Next Steps

Purpose

- Integrate a better understanding of the extent and costs of both urban and riverine flooding, as well as how those could grow due to climate change, into ON TO 2050.
- Identify the barriers to effective stormwater management and develop policy approaches to reduce flooding impacts.
- Focus efforts in areas of greatest need in the region.
- Build connections with other policy work being developed for the next plan.

Progress to date

- Reviewed causes and drivers of flooding
- Summarized existing flooding impacts and extent
- Reviewed existing responses and approaches to stormwater and flood mitigation and prevention
- **Identifying policy framework and priority areas for flooding mitigation activities**

Regional Flooding Susceptibility Analysis

Purpose

Identify priority areas across the region for flooding mitigation activities.

Potential applications of the indexes

- Help CMAP focus Local Technical Assistance Projects.
- May help coordinate partners:
  - Inform open space preservation and restoration decisions?
  - Inform vulnerability assessments?
  - Other activities?

Regional Flooding Susceptibility Indexes

What it is:

- Uses flooding-related factors to identify priority areas based on past flooding locations
- Study area:
  - Developed areas in the CMAP region
  - Riverine Index: areas within FEMA 100-yr floodplain/MWRD 100-yr inundation
  - Urban Index: outside of these areas

What it's not:

- Floodplain Inundation mapping
- Sewer System modeling
- Rainfall-runoff modeling

Frequency Ratio Approach

Statistical method to identify higher risk areas based on the observed relationship between reported flooding locations and flooding-related factors.

$$\frac{Percent\ of\ flood\ events\ in\ factor\ category}{Percent\ of\ study\ area\ in\ factor\ category} = Frequency\ ratio$$

Frequency Ratio Approach

Calculation example:
Combined Sewer Service Areas for the Urban Index

Factor	Categories	Percent (%) of Study Area	Percent (%) of Flood Locations	Frequency Ratio
Combined Sewer Service Area	Present	15.8%	27.4%	2.35
	Absent	84.2%	72.6%	0.75

$$\frac{27.4\%\ of\ flood\ locations\ in\ "Present"\ category}{15.8\%\ of\ study\ area\ is\ "Present"\ category} = FR\ of\ 2.35$$

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Frequency Ratio Approach

Five Step Process

Step 1: Assemble & categorize reported flooding locations

Step 2: Assemble & categorize potential flooding-related factors

Step 3: Calculate the frequency ratio for factor categories

Step 4: Add frequency ratios for selected factors

Step 5: Access accuracy of indexes

Frequency Ratio Approach

Step 1: Assemble and categorize reported flooding locations

- Address level NFIP claims from 1978 to 2016
- Point data for City of Chicago 311 standing water calls (related to mosquito abatement) from 2010 to 2017

Step 2: Assemble and categorize potential flooding-related factors

- Percent Impervious Cover
- Age of First Development
- Combined Sewer Service Areas
- Elevation derivatives (ex: parcel elevation compared to BFE)
- Soils data (ex: wetland soils)
- Etc.

Frequency Ratio Approach

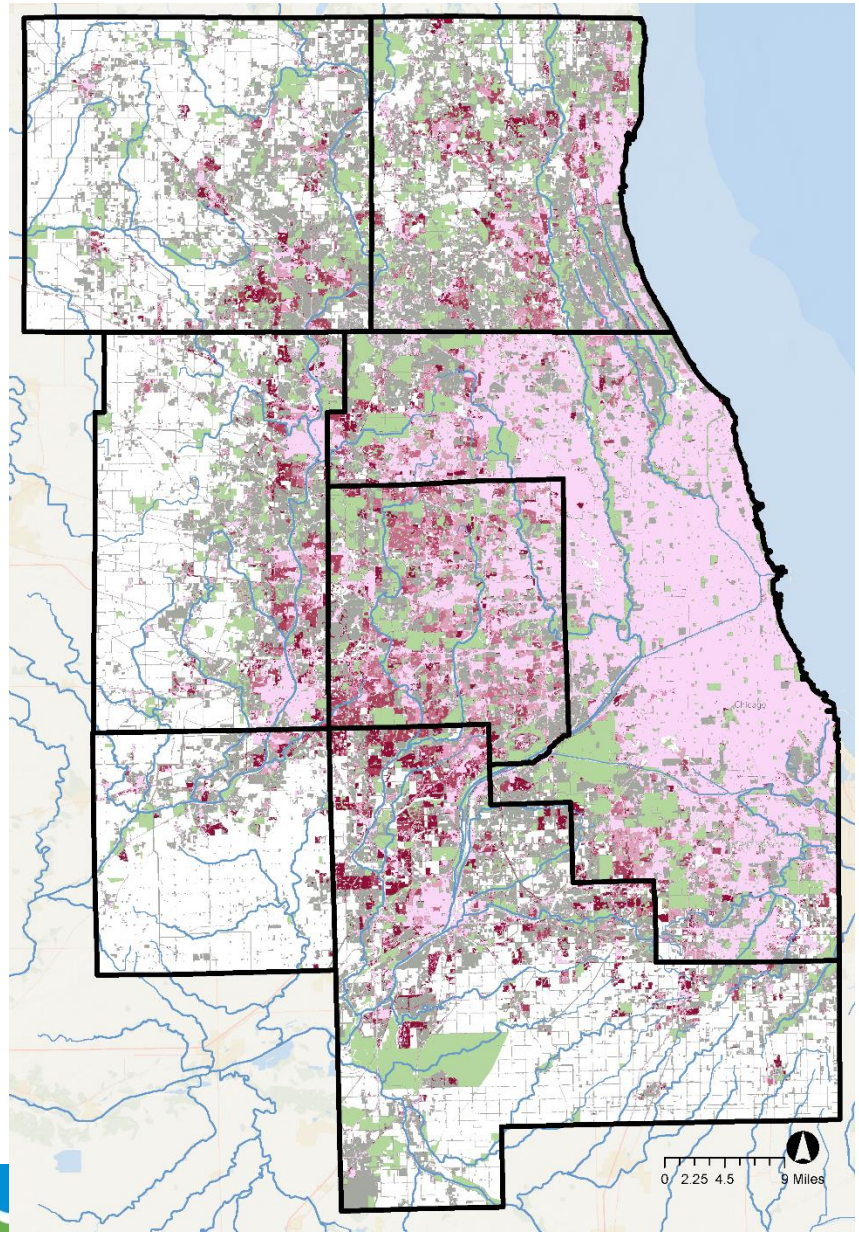
Step 3: Calculate the frequency ratio for factor categories

Completed using a GIS-based tool to summarize the flood location counts and area for each factor category.

Example: Age of First Development

- **Logic:** Identifies areas that were developed under different stormwater and floodplain management standards. Areas developed prior to these practices may be more likely to experience flooding.
- **Source:** USGS National Water-Quality Assessment (NAWQA) Wall-to-Wall Anthropogenic Land Use Trends (NWALT) 1974-2012 land cover datasets
- **Categorization:** Split into categories based on time period first developed.

Urban Flooding Susceptibility Index



Age of First Development

	Categories	Percent (%) Study Area
1	Prior to 1974	41.2%
2	1974-1982	5.4%
3	1982-1992	3.3%
4	1992-2002	5.0%
5	2002-2012	4.6%
6	Undeveloped/ post-2012	40.6%

Urban Flooding Susceptibility Index

Age of First Development

	Categories	Percent (%) of Study Area	Percent (%) of Flood Locations	Frequency Ratio
1	Prior to 1974	41.2%	74.0%	1.8
2	1974-1982	5.4%	4.4%	0.81
3	1982-1992	3.3%	1.9%	0.56
4	1992-2002	5.0%	1.9%	0.38
5	2002-2012	4.6%	1.1%	0.24
6	Undeveloped/ post-2012	40.6%	16.8%	0.41

Frequency Ratio Approach

Step 4: Add frequency ratios for selected factors

Some factors were tested but revealed poor correlation or noisy FR results; these were excluded from the draft Indexes.

Step 5: Assess accuracy of index

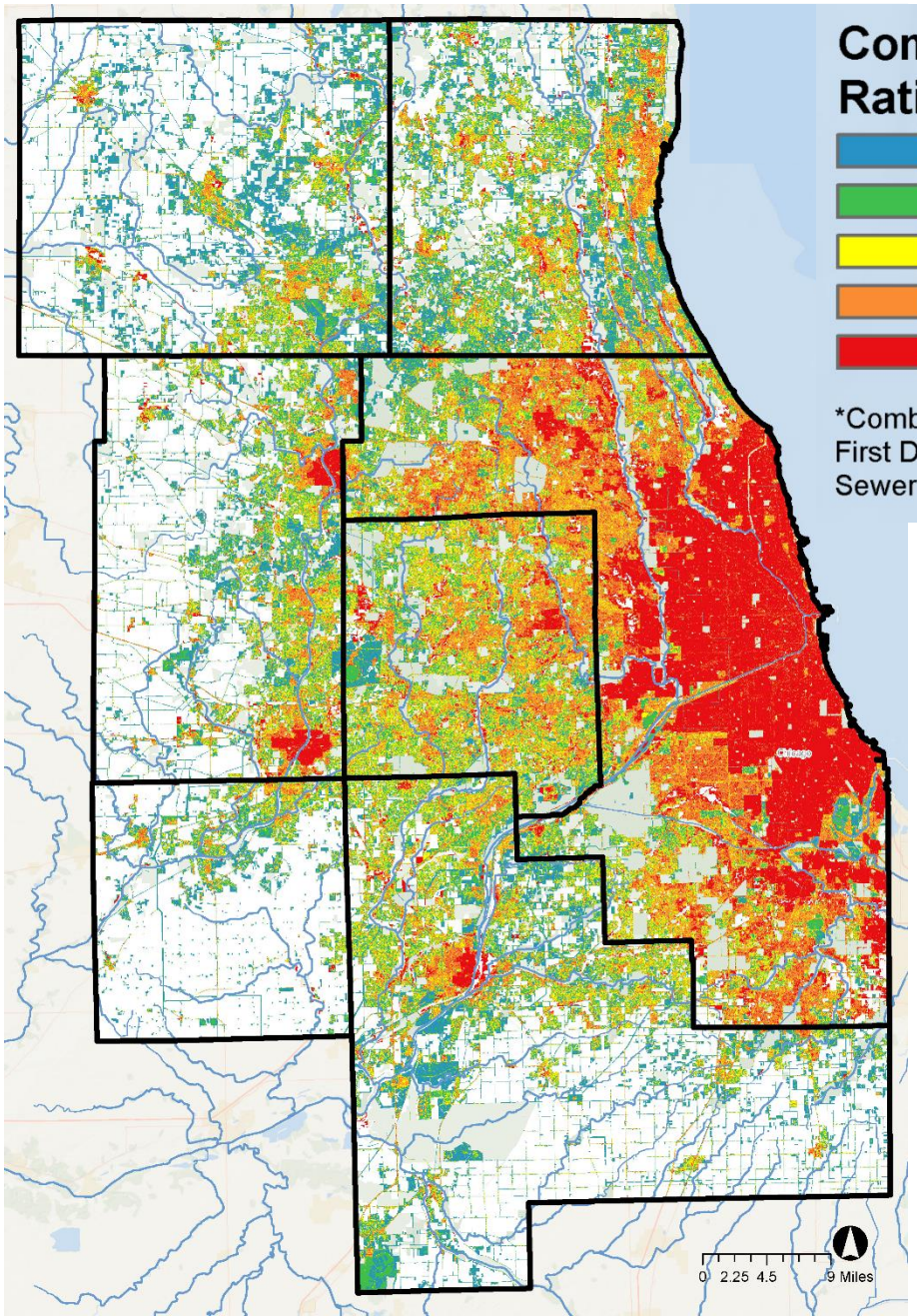
Compare the Validation locations (that were held aside from FR analysis) to the final Index values.

Urban Flooding Susceptibility Index

Urban Analysis

- All areas **outside** of the 100-yr FEMA floodplain or MWRD 100-yr Inundation area
- Flooding-related factors:
  - Topographic Wetness Index
  - Combined Sewer Service Area
  - Elevation differential between property and nearest FEMA BFE
  - Impervious Cover
  - Age of First Development

Urban Flooding Susceptibility Index



Accuracy assessment using validation data

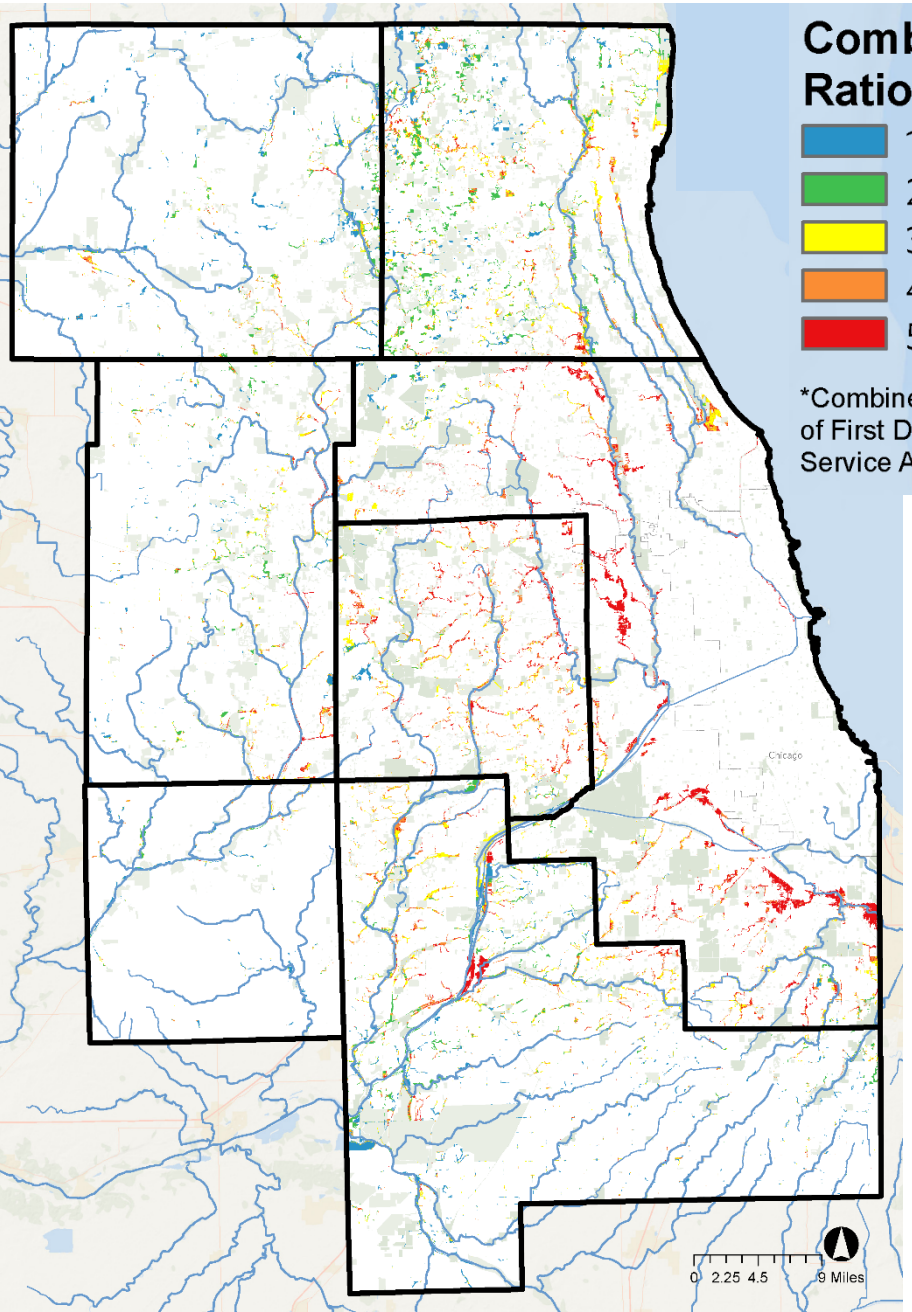
	Total Acreage	Count of Flooding Locations	Flood Occurrence (%)
1 (lowest)	206,234	33	1.3%
2	244,497	88	3.3%
3	255,748	185	7.0%
4	286,967	457	17.4%
5 (highest)	262,258	1,867	71.0%

Riverine Flooding Susceptibility Index

Riverine Analysis

- All areas **inside** the 100-yr floodplain or the MWRD 100-yr Inundation area.
- Flooding-related factors:
  - Combined Sewer Service Area
  - Impervious Cover
  - Impervious Cover by NHD+ Catchment
  - Age of First Development

Riverine Flooding Susceptibility Index



Accuracy assessment using validation data

	Total Acreage	Count of Flooding Locations	Flood Occurrence (%)
1 (lowest)	16,345	33	1.9%
2	14,251	60	3.5%
3	14,774	196	11.3%
4	14,413	321	18.5%
5 (highest)	14,460	1,129	64.9%

Potential Improvements

- Met with County stormwater leaders, June 29
- Looking for additional Reported Flooding Locations
- Exploring potential new flooding factors:
  - FEMA Flood Zone categories
  - Distance to Trunk/Interceptor Sewers
  - Precipitation variation within the region
  - Other suggestions?
- Exploring potential applications of the index

Policy Framework

Purpose: provide an outline for your feedback as we begin to draft the policy recommendations for the strategy paper

Related ON TO 2050 Policy Development:

- Integrating Green Infrastructure
- Climate Resilience
- Water Resources

Policy Framework

Five themes

1. Identify and communicate flooding risk
2. Advancing planning efforts to reduce current and future risk
3. Increase resiliency of transportation system
4. Invest and maintain grey, green, and natural infrastructure
5. Enhance coordination and governance

Policy Framework

Key questions

1. What are the priorities?
2. What is missing?

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Policy Framework

1. Identify and communicate flooding risk

- Update floodplain mapping
- Update precipitation data and account for future scenarios
- Enhance understanding of urban flooding risk
- Utilize CMAP's regional flooding susceptibility indexes
- Continue to assess vulnerability of populations, critical assets, and transportation network to flooding
- Enhance education efforts for residents

Policy Framework

2. Advancing planning efforts to reduce current and future risk

- Continue improving county stormwater management ordinances
- Explore flooding solutions in watershed planning efforts
- Expand floodplain management education and compliance
- Enhance development guidelines for properties at risk due to urban flooding
- Explore strategies for infill development in critical reinvestment areas

Policy Framework

3. Increase resiliency of transportation system

- Update infrastructure design standards to reflect changing climate data
- Incorporate green infrastructure into road construction, rehabilitation, and retrofits to capture and infiltrate stormwater
- Develop and enhance operational strategies to maintain performance

Policy Framework

4. Invest and maintain grey, green, and natural infrastructure

- Maintain capacity of existing drainage assets through restoration and maintenance
- Expand green and natural solutions
- Connect open space acquisition to watershed scale analysis
- Build better understanding among residents of strategies and resources
- Expand assistance programs for residents
- Expand investment in stormwater solutions

Policy Framework

5. Enhance coordination and governance

- Improve coordination across county stormwater agencies
  - Broader modeling efforts for coordination across jurisdictions
  - Improved monitoring programs and data sharing
  - Sharing best practices
- Advocate flood insurance and disaster relief reform

Next steps

- **July/August**
  - Feedback on Draft Regional Flooding Susceptibility Indexes
  - Feedback on the Policy Framework
  - Please send to Nora by Friday, July 21.
- **September –** Draft Strategy Paper with Flooding Susceptibility Indexes
- **October –** Final Strategy Paper

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Comments or Questions

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