

Watershed Specific Release Rate Analysis: Cook County, Illinois

Calumet Stormwater Collaborative and Metropolitan Planning Council
May 6, 2022

Gregory Byard

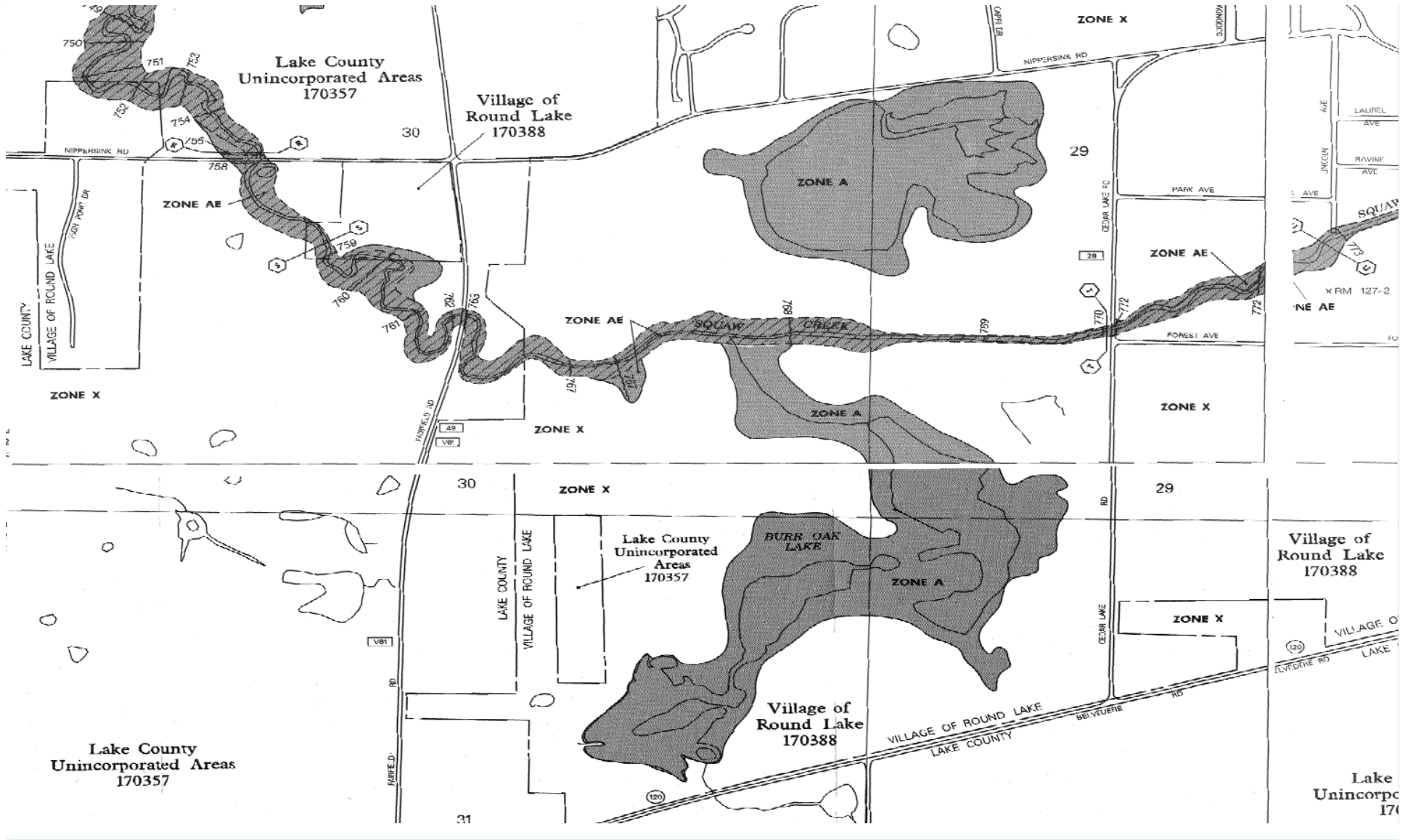


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 - Coordinated Hazard Assessment and Mapping Program

FEMA Regulatory Floodplain Mapping



FEMA Regulatory Floodplain Mapping



Illinois MT-2 LOMR Review

U.S. DEPARTMENT OF HOMELAND SECURITY
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OMB No. 1669-0016

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OMB No. 1669-0016
Expires February 28, 2014

OVERVIEW & CONCURRENCE FORM

PAPERWORK BURDEN DISCLOSURE NOTICE
Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20968-3005, Paperwork Reduction Project (1669-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. Please do not send your completed survey to the above address.

PRIVACY ACT STATEMENT
AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.
PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).
ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP), Letter of Map Amendment (LOMA) February 15, 2008, 71 FR 7990.
DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72).

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Example: 480301	City of Katy	TX	48470C	0205D	02/05/83
480287	Harris County	TX	48201C	0220G	09/28/80

2. a. Flooding Source: Riverine Coastal Shallow Flooding (e.g., Zones AO and AH)

b. Types of Flooding: Alluvial fan Lakes Other (Attach Description)

3. Project Name/Identifier: _____

4. FEMA zone designations affected: _____ (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

Physical Change Improved Methodology/Data Regulatory Floodway Revision Base Map Changes

Coastal Analysis Hydraulic Analysis Hydrologic Analysis Corrections

Weir-Dam Changes Levee Certification Alluvial Fan Analysis Natural Changes

New Topographic Data Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

FEMA Form 080-D-27, (2/2011) Previously FEMA Form 81-89 MT-2 Form 1 Page 1 of 3



Analysis of Extreme Rainfall Patterns

Contract Report 2016-08

Communicating the Impacts of Potential Future Climate Change on the Expected Frequency of Extreme Rainfall Events in Cook County, Illinois

Contract Report 2017-08
December 2017

Impacts of Potential Future Climate Change on the Expected Frequency of Extreme Rainfall Events in Cook, DuPage, Lake and Will Counties in Northeastern Illinois

Monocle

ISWS Bulletin 75

Precipitation Frequency Study for Illinois

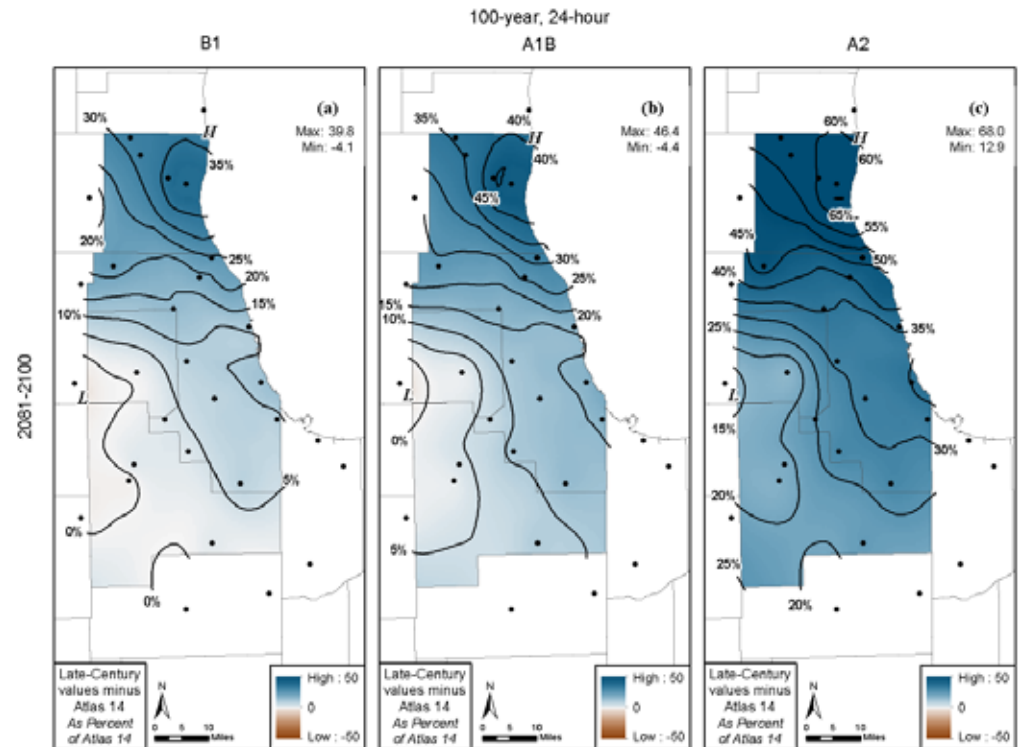
James R. Angel and Momcilo Markus

Contributing Authors:
Kexuan Ariel Wang, Brian M. Kerschner, and Shalendra Singh

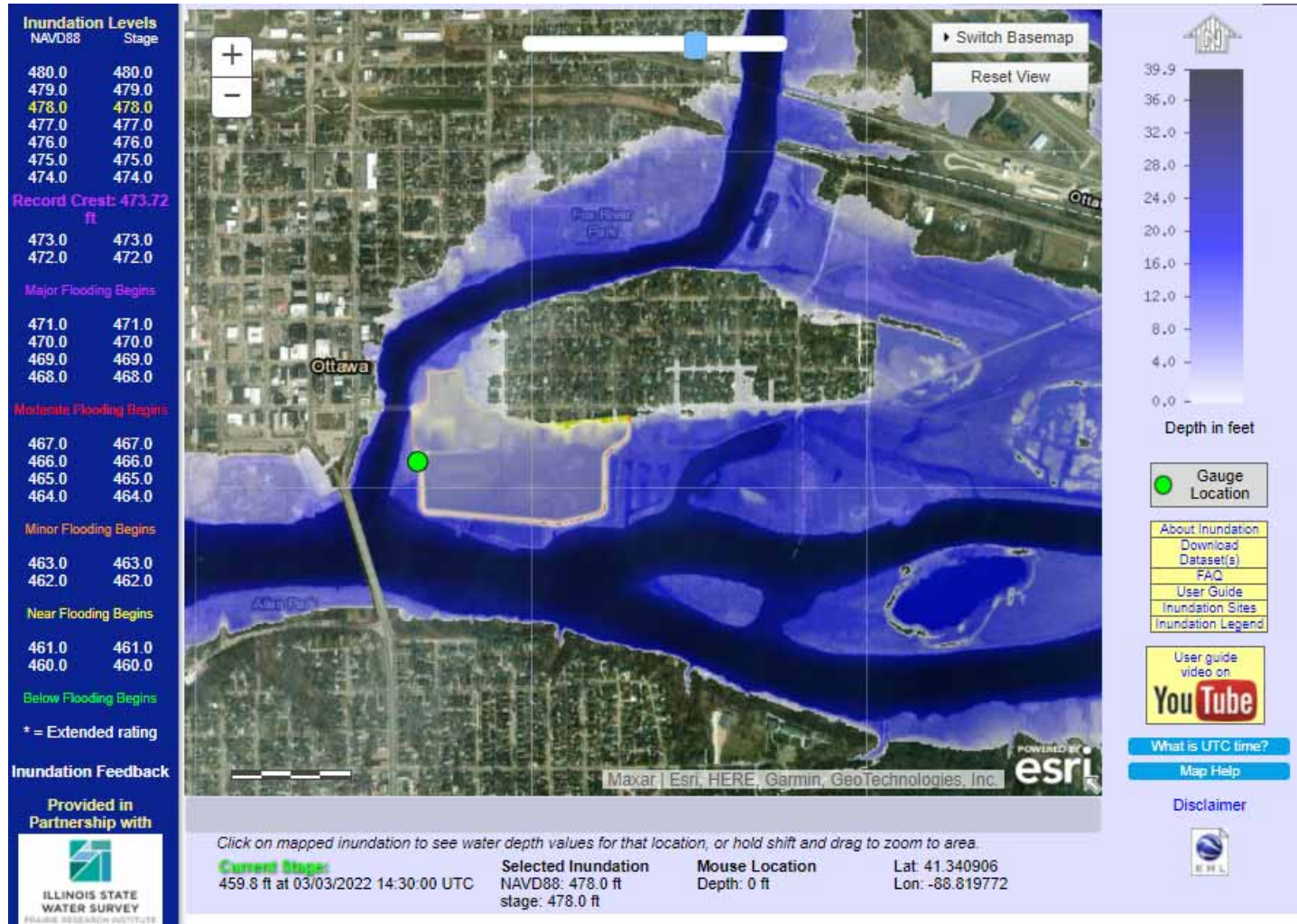
Illinois State Water Survey
University of Illinois at Urbana-Champaign

March 2020

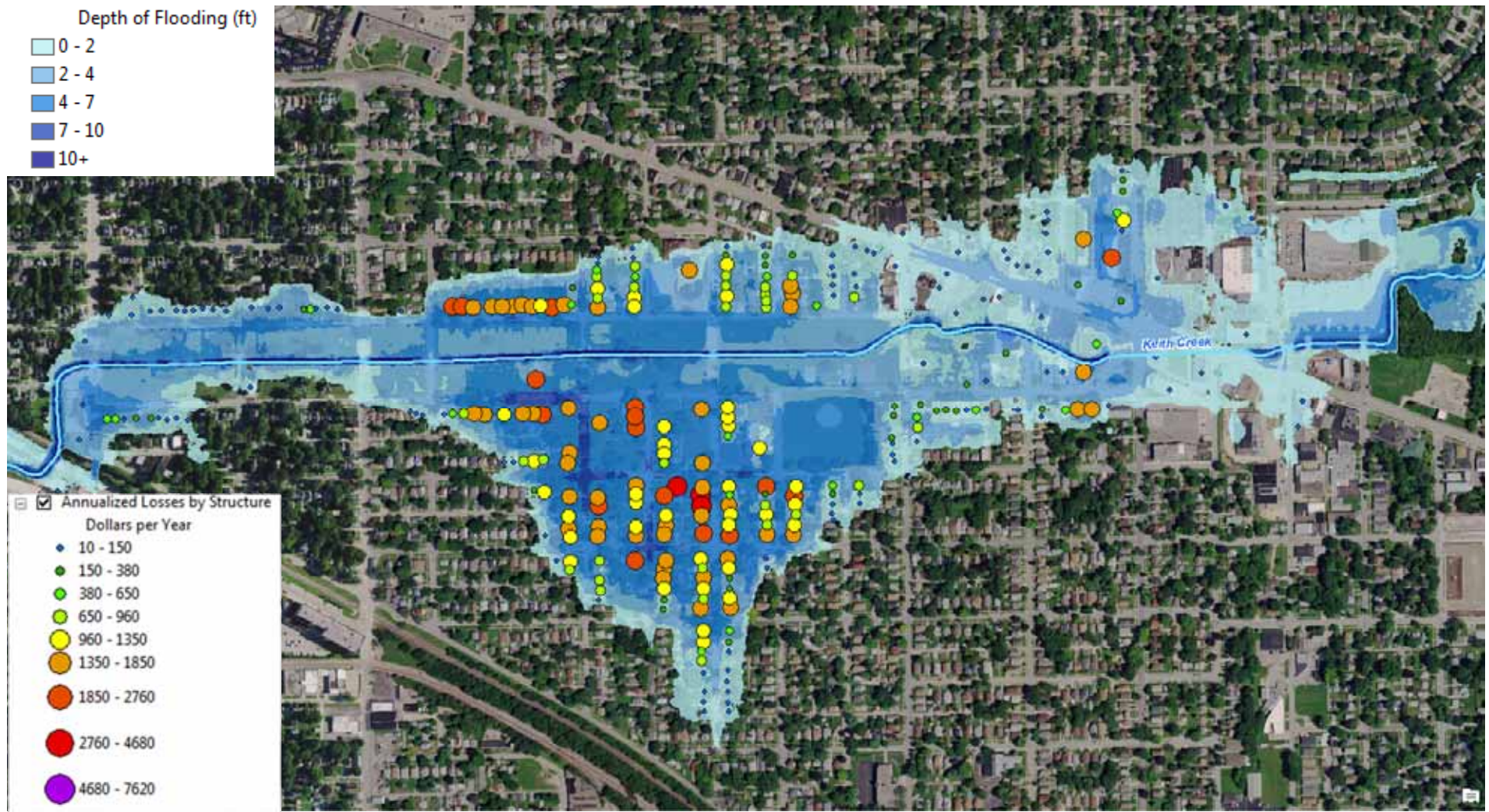
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Real-time Flood Forecast Inundation Mapping

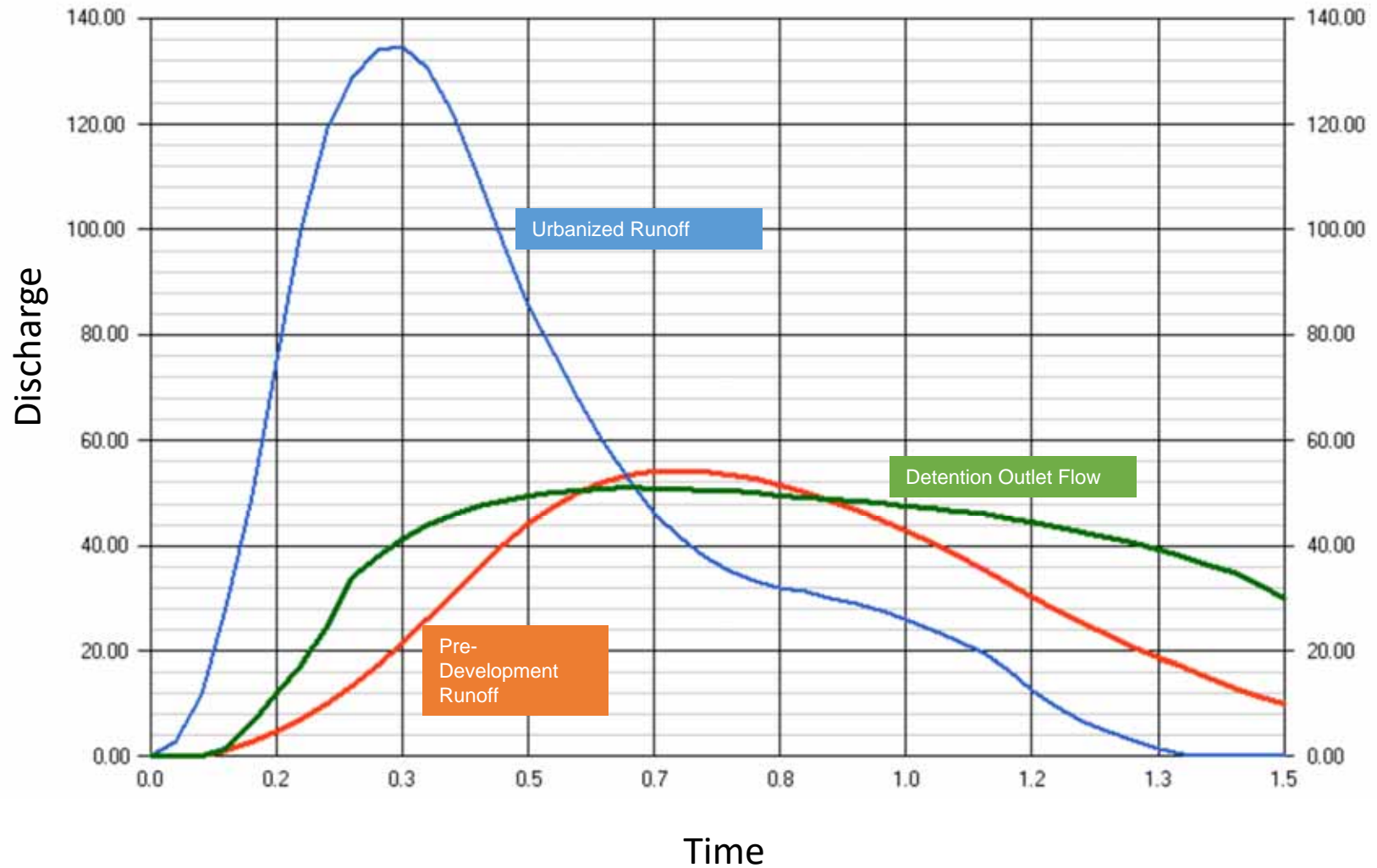


Structure Based Risk Assessments and Hazard Mitigation Planning



Watershed Specific Release Rate Project Review

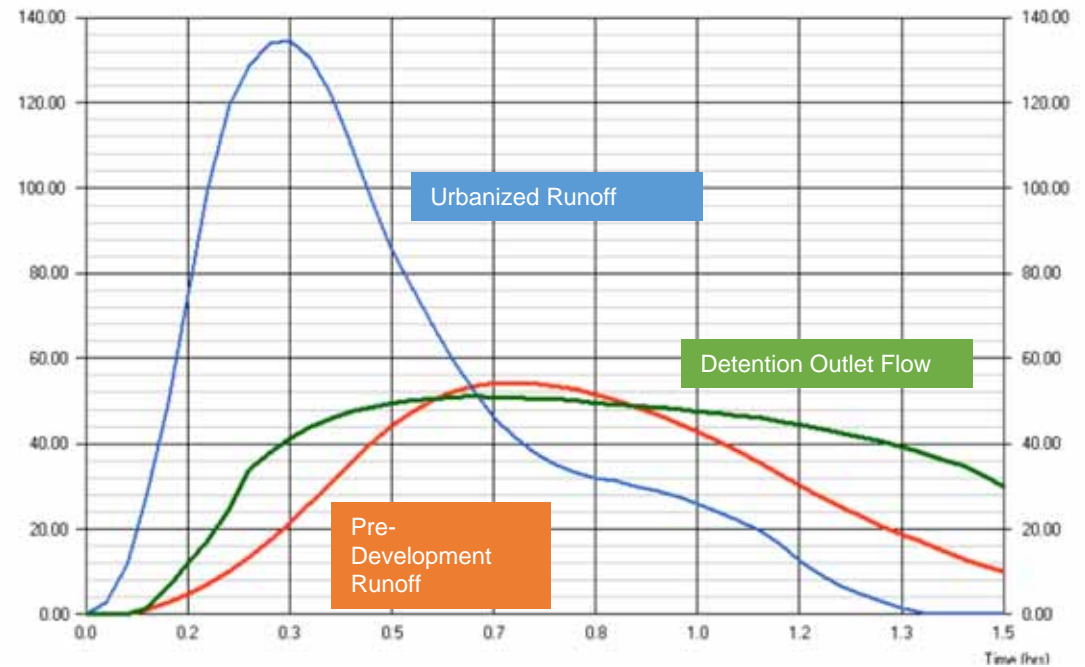
Development impact on hydrology



Development impact on hydrology

Factors determining the effectiveness of a watershed specific release rate:

1. Release rate compared to existing runoff rate
2. Watershed timing
3. Increased runoff volume / restrictive structures



Spatial Extents of Release Rate Analysis



Public Comments on Release Rates

Initial WMO Ordinance Draft Prior to 2014

- Initially: 0.30 cfs/ac, decreasing to 0.15 cfs/ac after 5-years
- Provides transition period to 0.15 cfs/acre

Selected Comments:

- “Serious concerns over the potential negative impacts to development and redevelopment due to increased cost”
- “Reasonable compromise”
- “This will put Cook County at a competitive disadvantage”
- “Make no further compromises on release rates”
- “Water quality and erosion control must improve, proper release rates based on science are a critical part of the WMO”

Project Goal

Article 5. Requirement for Stormwater Management, Section 504: Site Detention Requirements

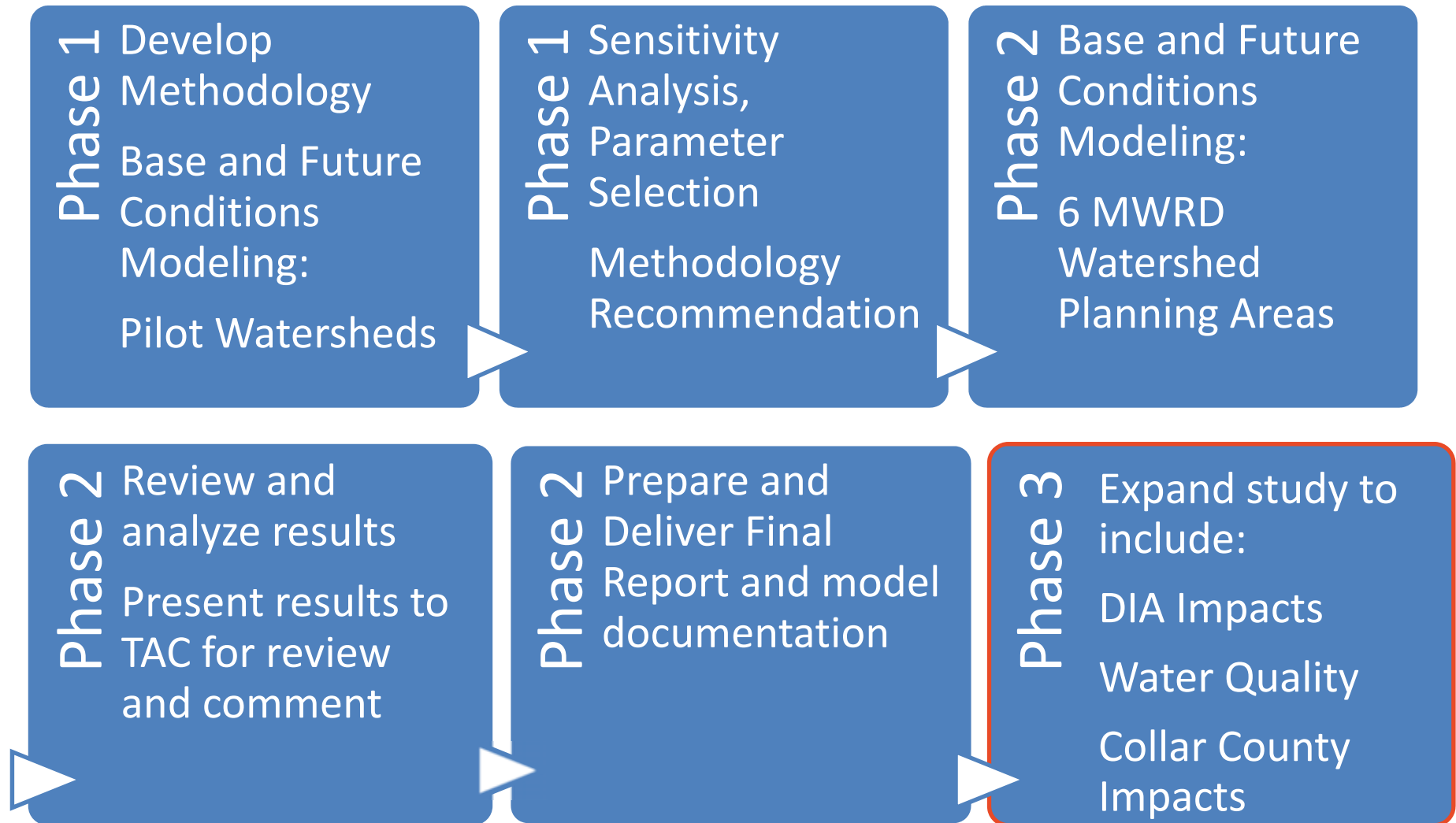
3. The **allowable release rate** for a **development** shall be determined at the time a complete **Watershed Management Permit** application is accepted by the **District** and shall be:
 - A. 0.30 cfs/acre of **development** for the **storm event** having a one percent probability of being equaled or exceeded in a given year (100-year **storm event**) until April 30, 2019; and
 - B. Based on a **watershed** specific release rate after and including May 1, 2019 as specified in Appendix B. The **watershed** specific release rate shall not be less than 0.15 cfs/acre of **development**.

Project Objective

Release rate selection objective:

Determine regulatory release rates that mitigate the impacts of development by maintaining the 1% annual-chance flood event elevations at or below current levels.

Watershed Specific Release Rate Study



Methodology

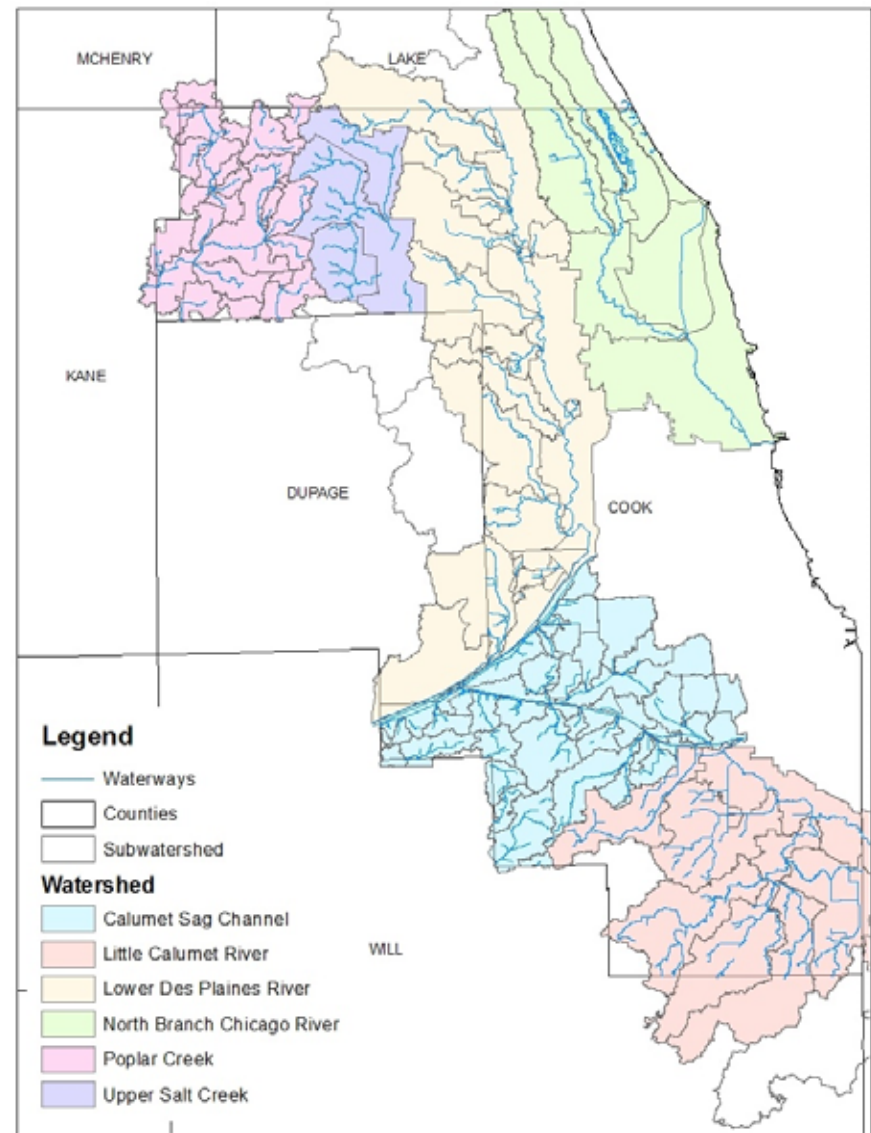
Methodology

• Phase I

- Evaluate two pilot study areas
- Develop streamlined methodology and set of assumptions
- Evaluate release rates for pilot study areas and garner technical feedback

Phase II

- Apply the methodology developed in Phase I in each Watershed Management Area
- Evaluate release rates for watersheds under WMO regulation



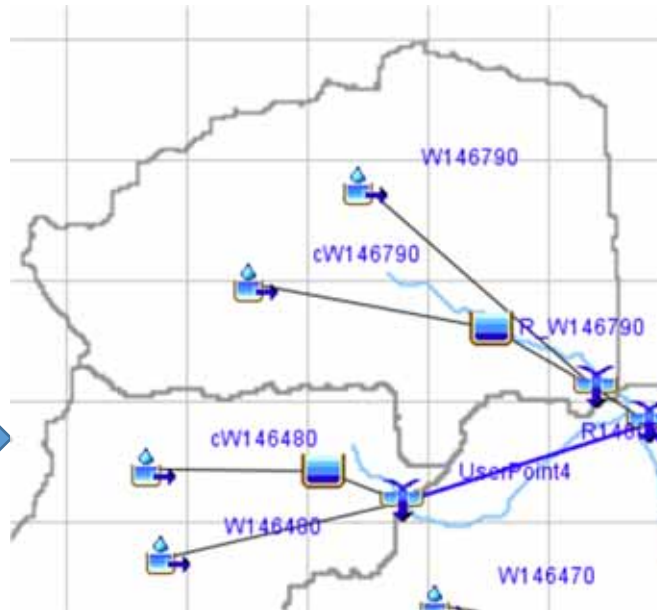
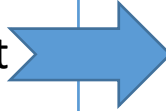
Basis of Methodology

Base Condition:

DWP H&H
with some updates

Future Condition:

Increased Development
WMO Requirement



Model Elements

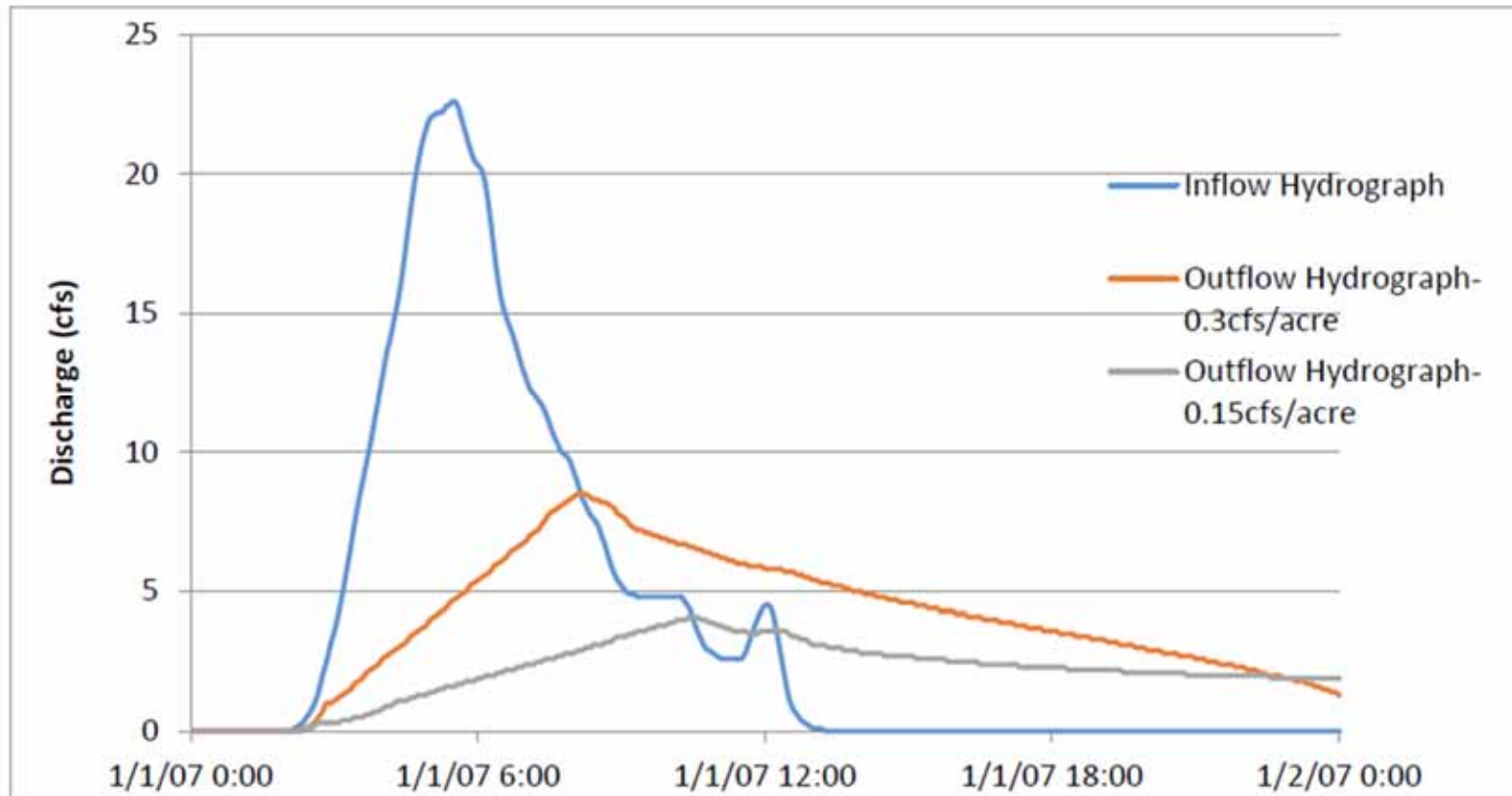
- Watershed
- Subwatershed
- Subbasin

Subwatershed Selection

- Identify key, selection controlling subwatersheds based on Phase 1 results
- Unnecessary to model every last acre

Watershed Specific Release Rate Study

Methodology Overview



Watershed Specific Release Rate Study

Assessing the Methodology

- Evaluate Assumptions & Validate Model
 - Sensitivity to critical duration
 - Sensitivity to future Curve Number selection
 - Sensitivity to transformation parameters
 - Validation of volume control modeling results
 - Validation of future detention volume
 - Validation of future development rates and patterns
- Efficient Application
 - Programming completed to apply future hydrology edits and run hydraulic modeling
 - Map and hydrograph products automated to assist with analysis

Landuse Evolution and impact Assessment Model (LEAM)

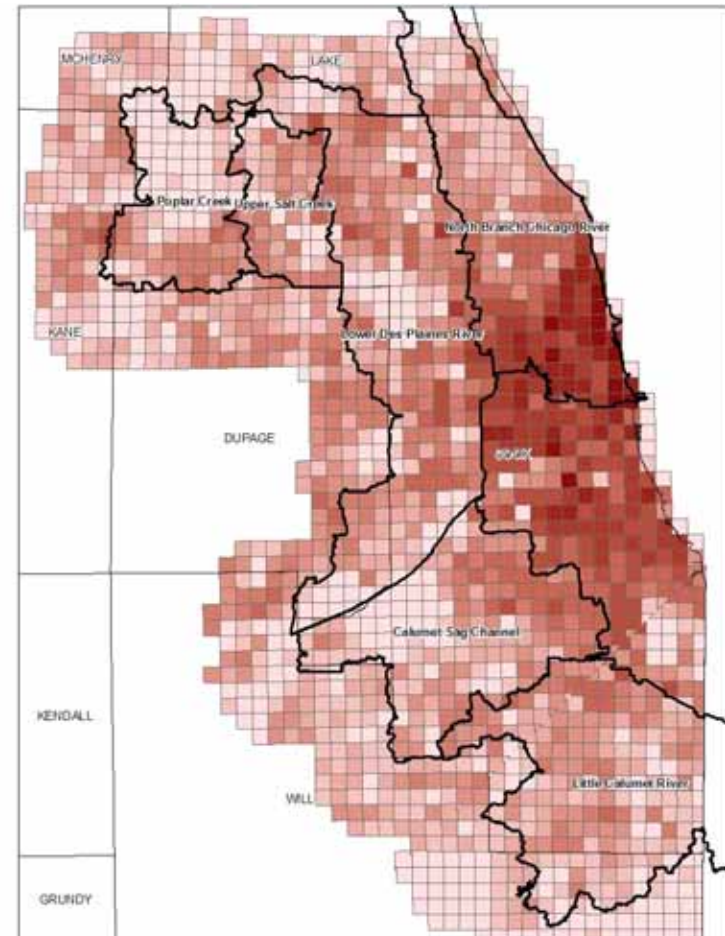
GOTO 2040 Agricultural Preservation Strategies

The University of Illinois at Urbana-Champaign LEAM Laboratory and the Chicago Metropolitan Agency for Planning

October 23, 2008

landuse **leam** model
impact assessment [HTTP://WWW.LEAM.UIUC.EDU](http://www.leam.uiuc.edu)

2050 Population Projection (in households)



Selected Methodology

- **Base Model**

- DWP Unsteady State HEC-HMS and HEC-RAS Models, analyzed at critical duration

- **Future Development**

- Uniform 40% Development/Redevelopment Meeting the WMO (with adjustments for preserve lands)

- **Detention**

- Modeled reservoirs meeting various Watershed Release Rates for the 100-year 24-hour storm with separate control volume

- **Release Rate**

- 0.15, 0.2, 0.25, and 0.3 cfs/acre were analyzed

- Updated for recent major stormwater projects

- Uniform development was selected to evaluate release rates. 40% was supported by land use change analysis

- Linear hydrograph modeled with storage-discharge functions.

- Outside of the WMO regulatory area the release rate of the adjoining jurisdiction was applied

Analysis of Release Rates

Watershed Specific Release Rate Analysis:
Calumet Sag Watershed

Base Model Summary

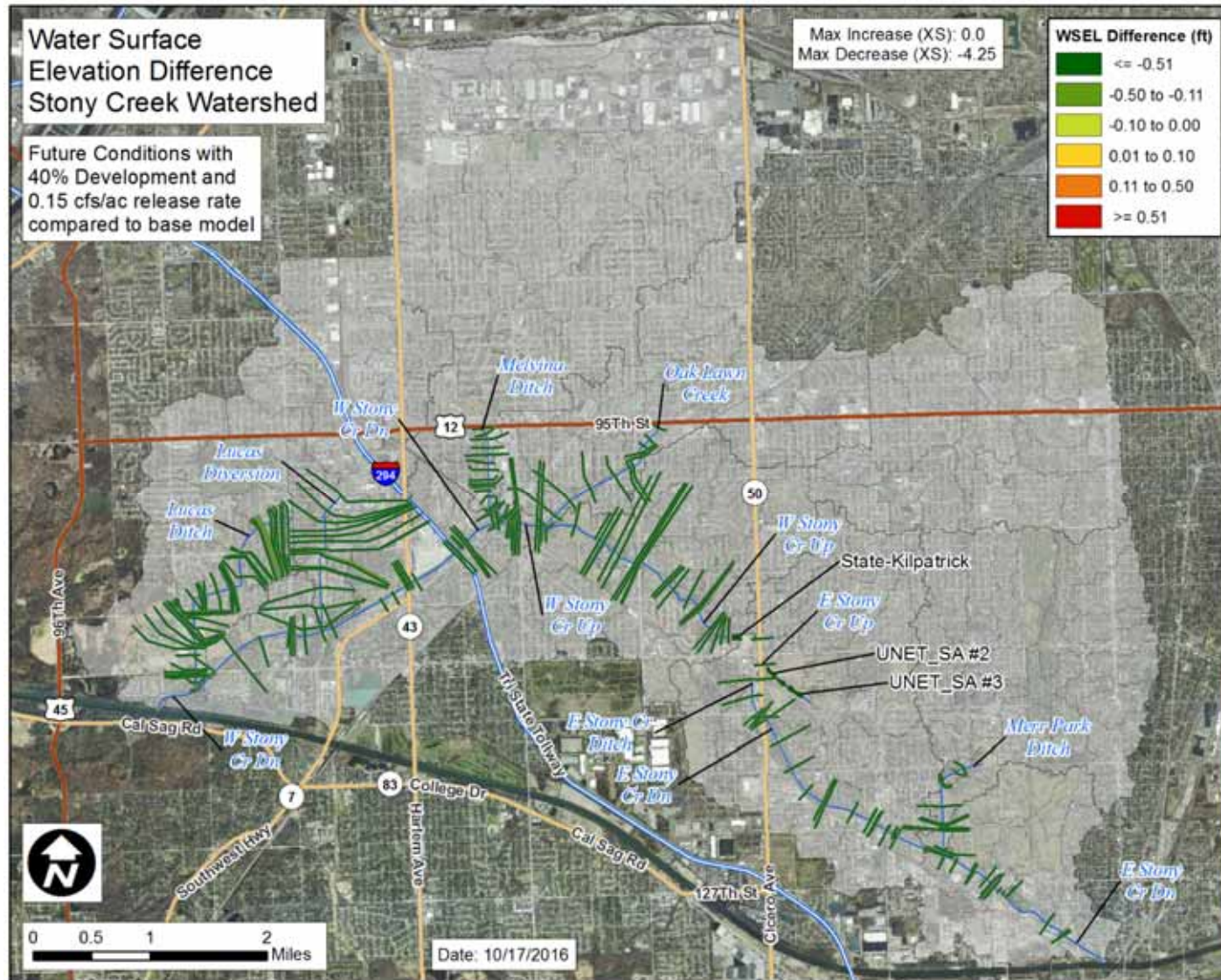
Modeled Subwatersheds

- Tinley Creek
- Stony Creek

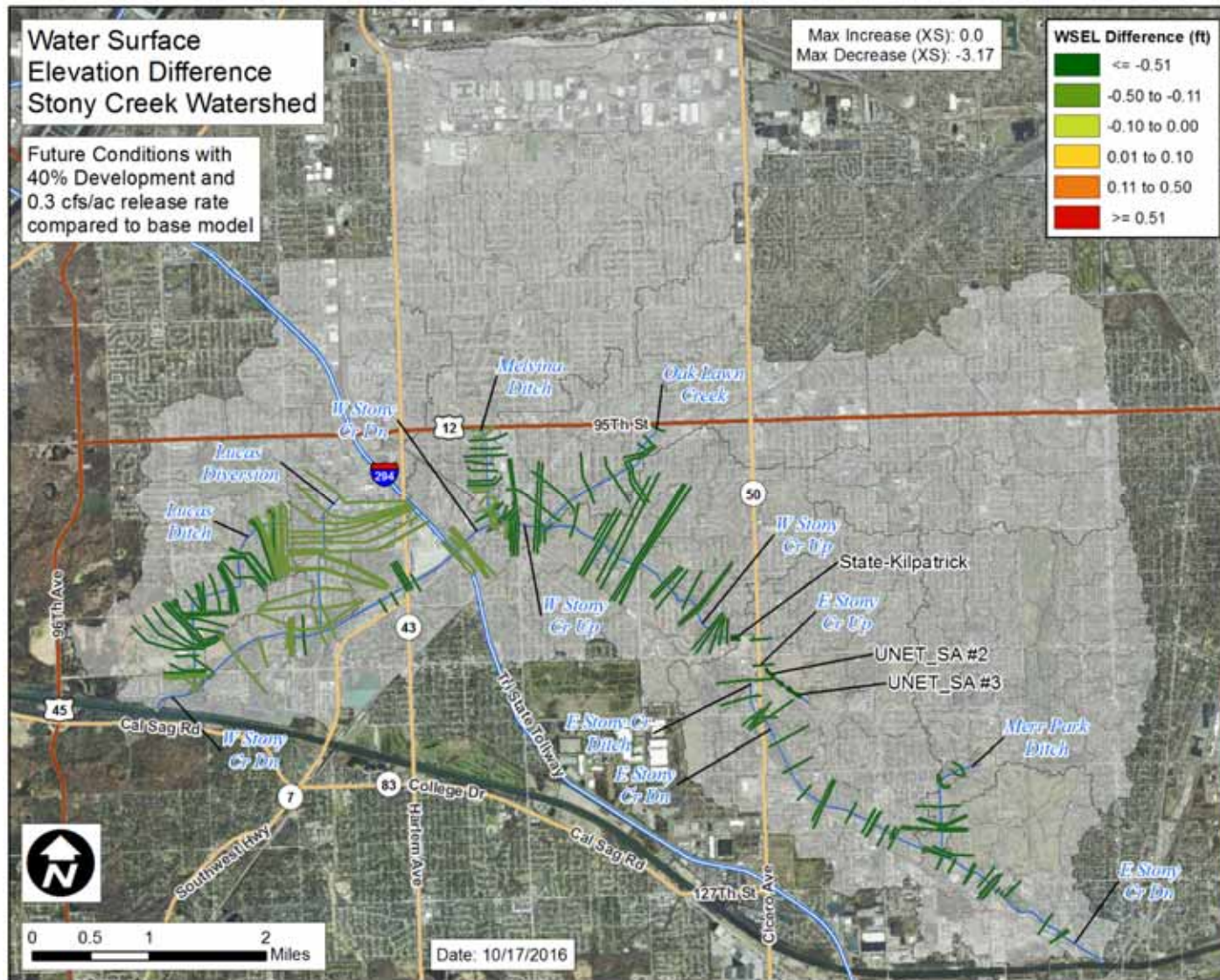
Base Runoff Rates

		Critical duration		
	Subwatershed	Average Base Conditions Peak Runoff Rate (cfs/acre)	Subbasin Base Conditions Peak Runoff Rate Range (cfs/acre)	Critical duration event
Calumet Sag	Stony Creek	0.69	0.35 - 0.94	12hr
	Lucas Ditch	0.66	0.45 - 0.80	12hr
	Lucas Diversion Ditch	0.77	0.62 - 0.93	12hr
	Melvina Ditch	0.77	0.64 - 0.97	12hr
	Merr Park Ditch	0.73	0.63 - 0.85	12hr
	Oak Lawn	0.78	0.62 - 0.87	12hr
	Tinley Creek	0.72	0.57 - 1.00	12hr

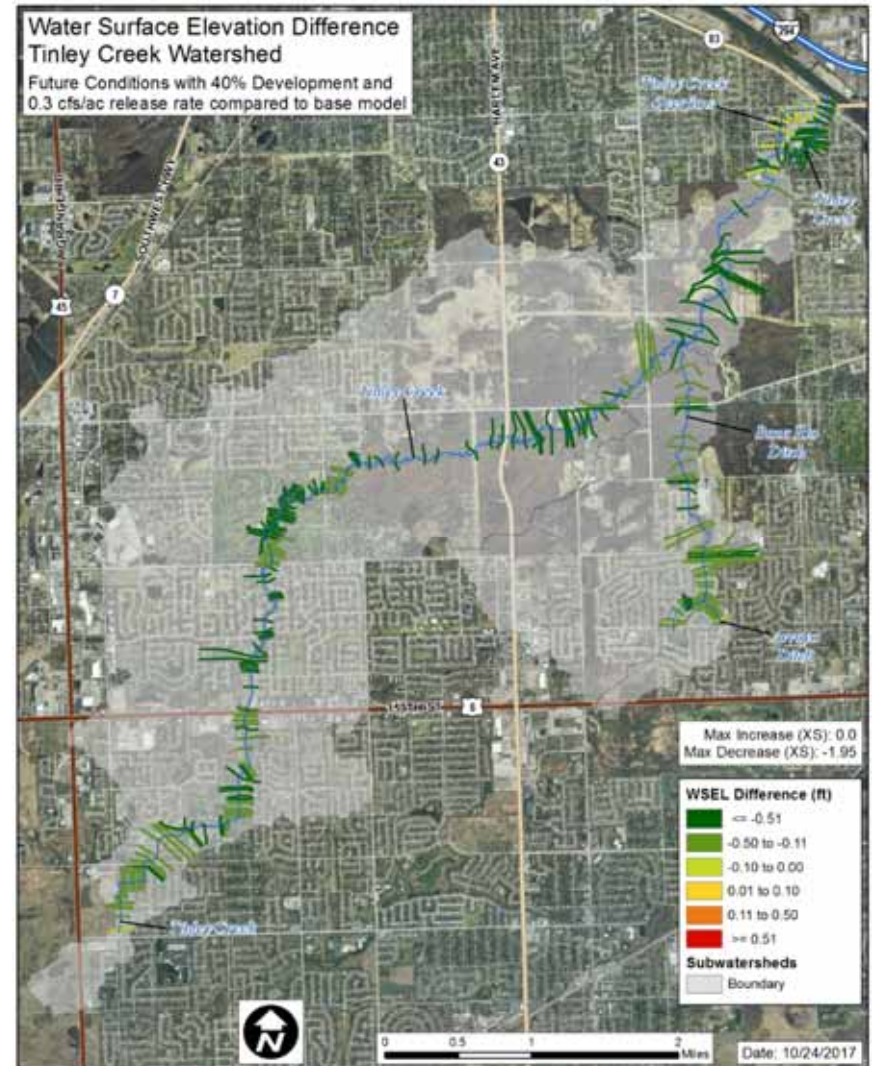
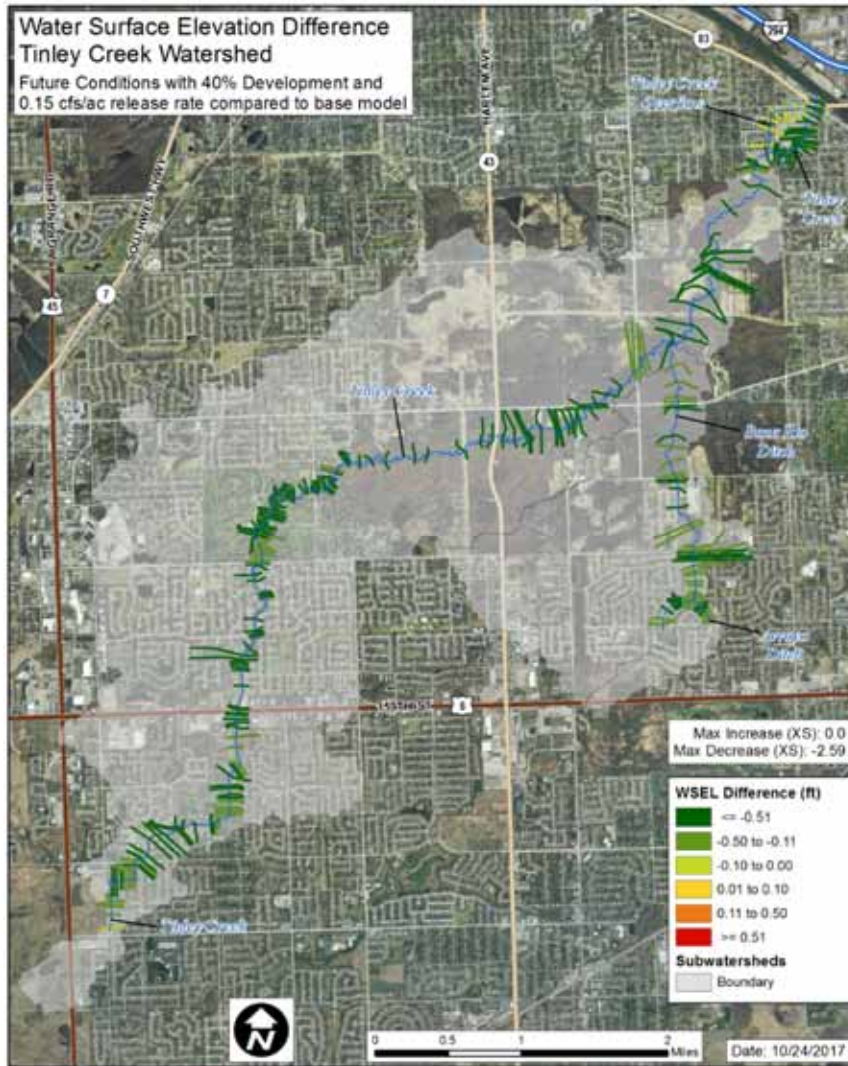
Future Model Results



Future Model Results



Future Model Results



Analysis of Effect of Release Rates

Stony Creek Subwatershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	0	0	0	0	75,359
	Stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	0.0%	0.0%	
	Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

Tinley Creek Subwatershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	0	0	0	0	90,668
	Stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	0.0%	0.0%	
	Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

Watershed Specific Release Rate Analysis:
Little Calumet River Watershed

Base Model Summary

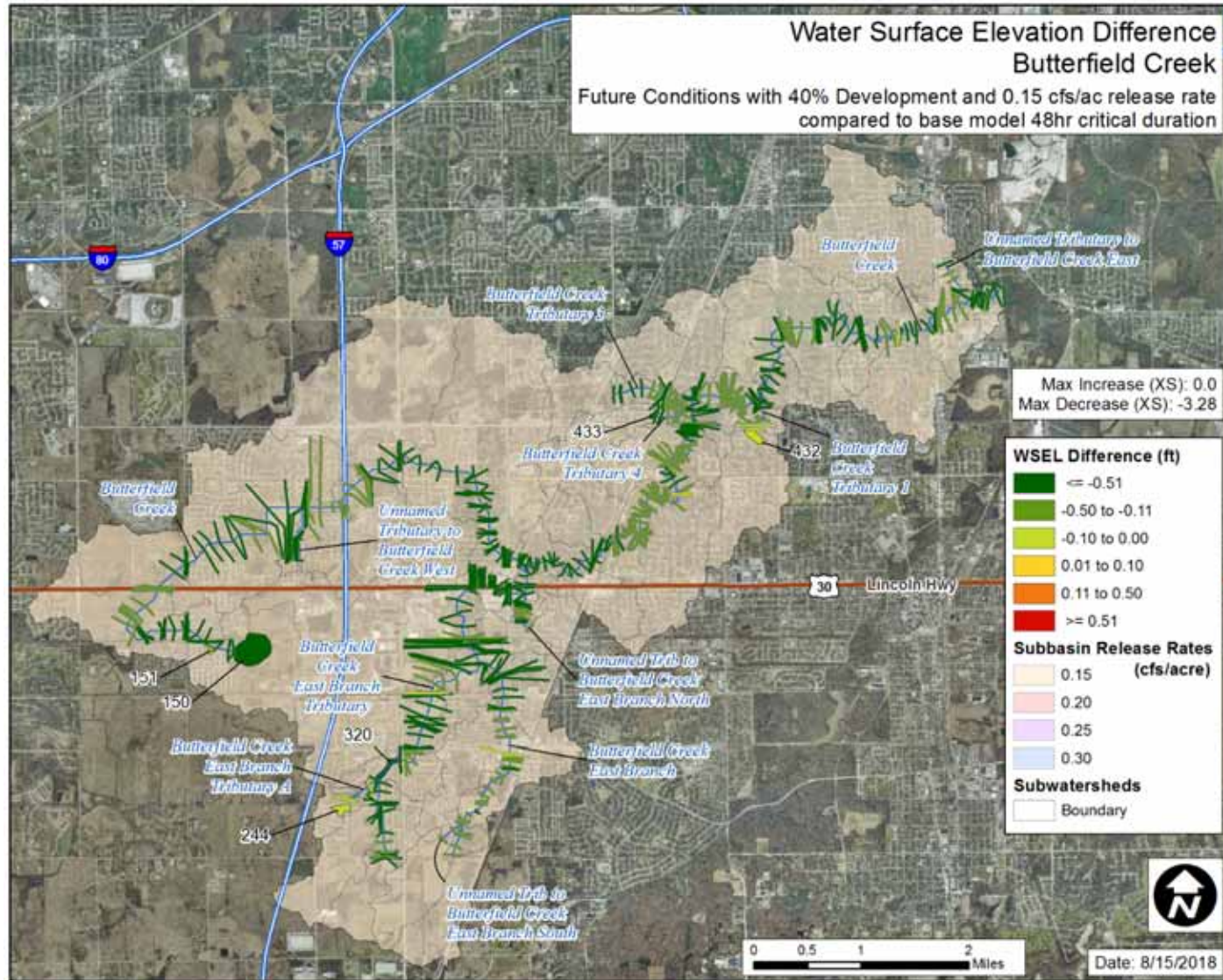
Modeled Subwatersheds:

- Butterfield Creek
- North Creek

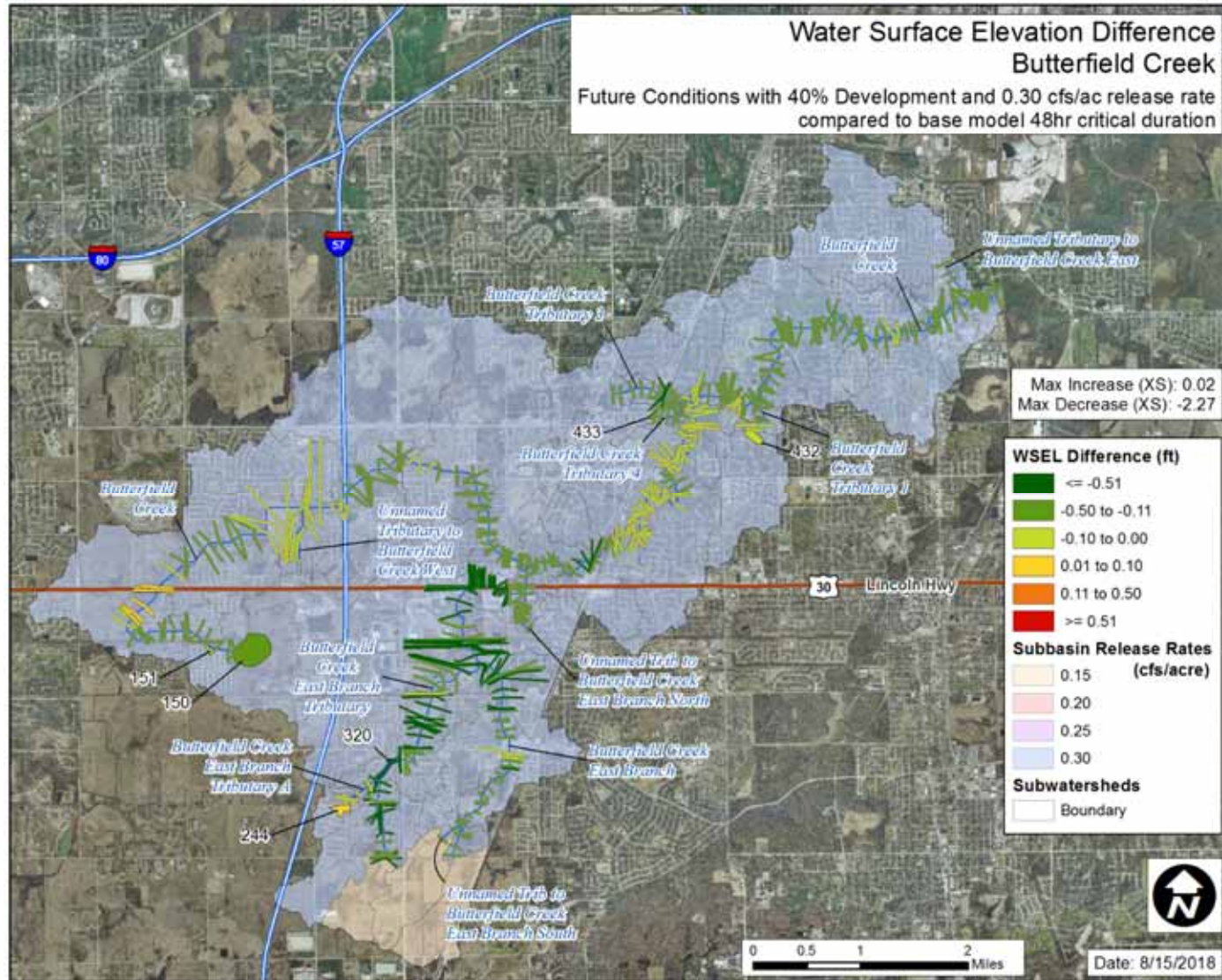
Base Runoff Rates

		Critical duration			
		Subwatershed	Average Base Conditions Peak Runoff Rate (cfs/acre)	Subbasin Base Conditions Peak Runoff Rate Range (cfs/acre)	Critical duration event
Little Calumet	Butterfield Creek		0.43	0.30 - 0.64	48 hr
	North Creek		0.35	0.20 - 0.52	48 hr

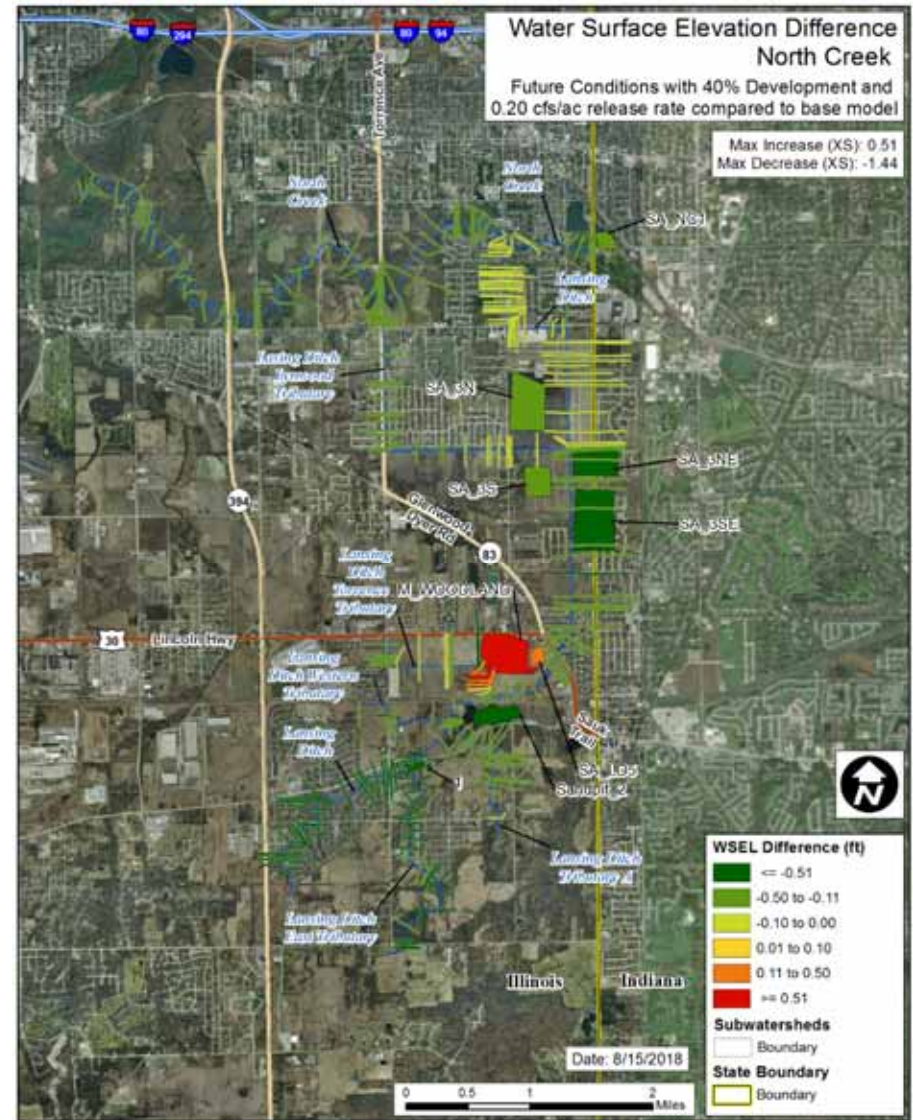
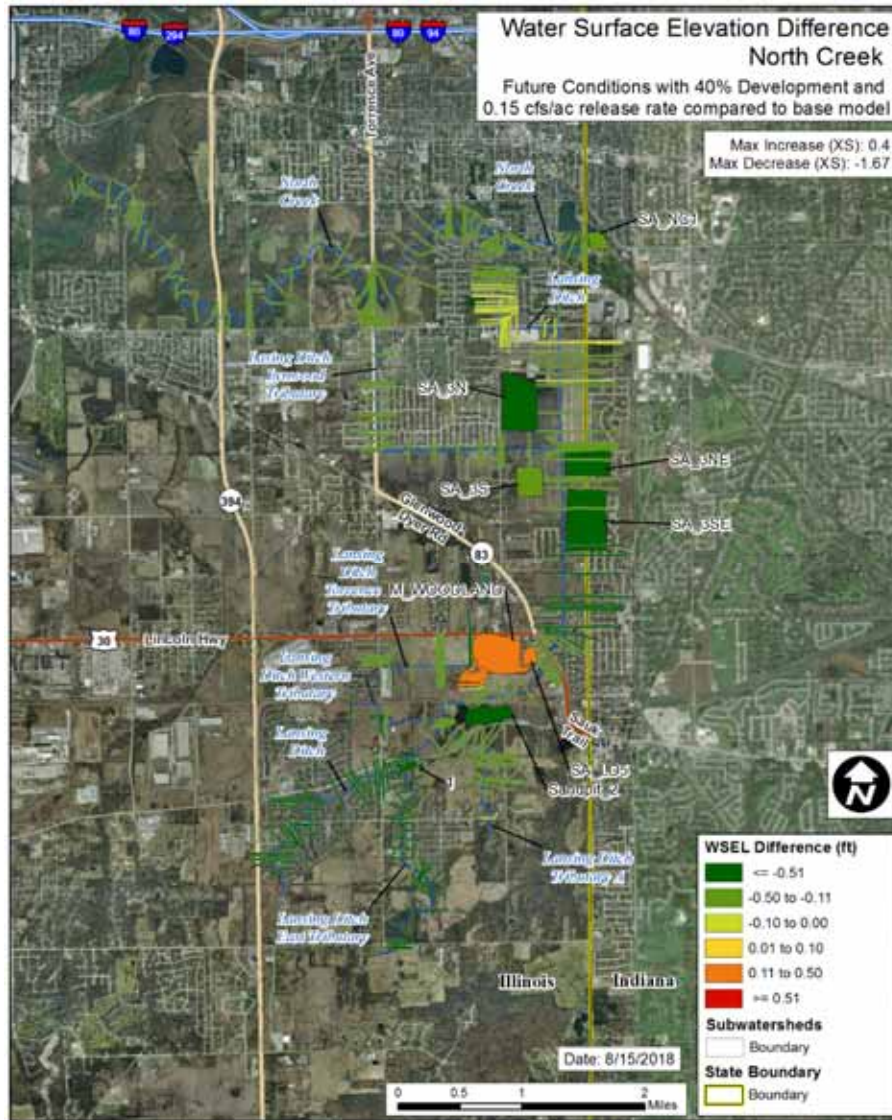
Future Model Results



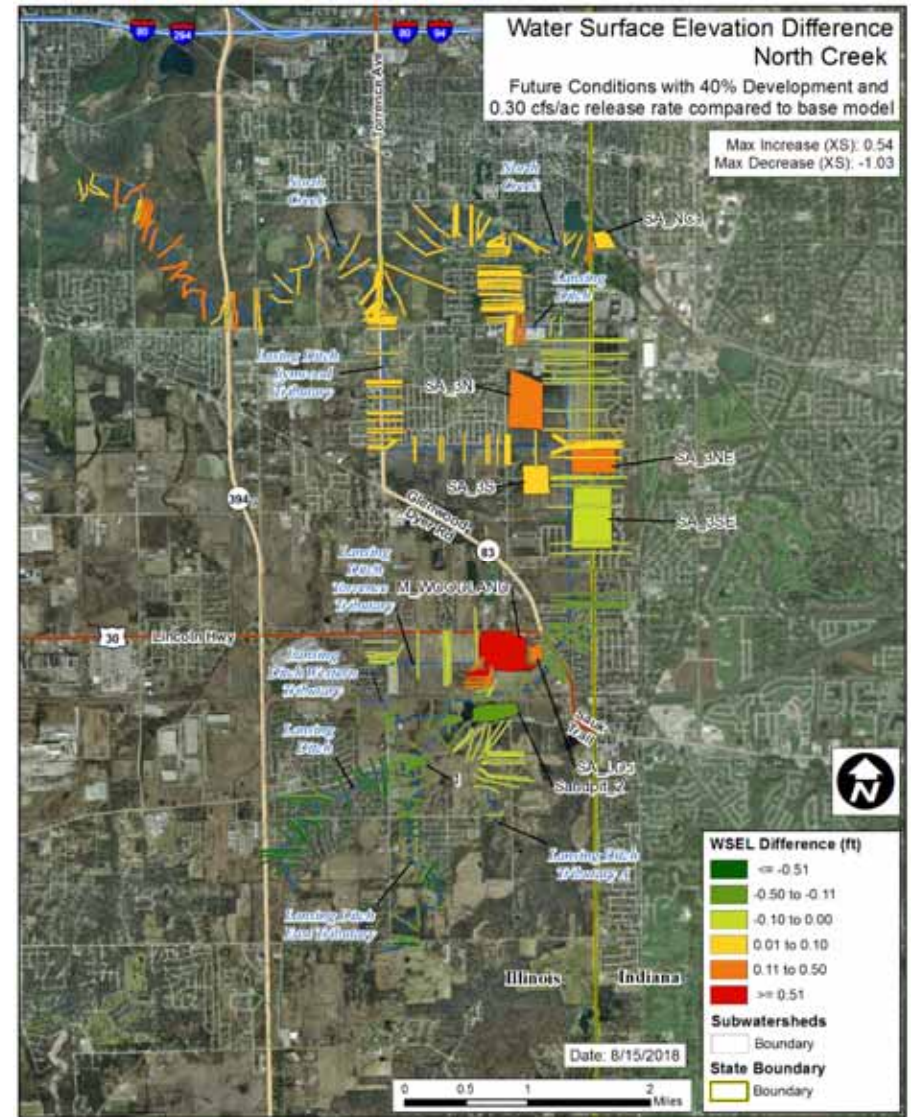
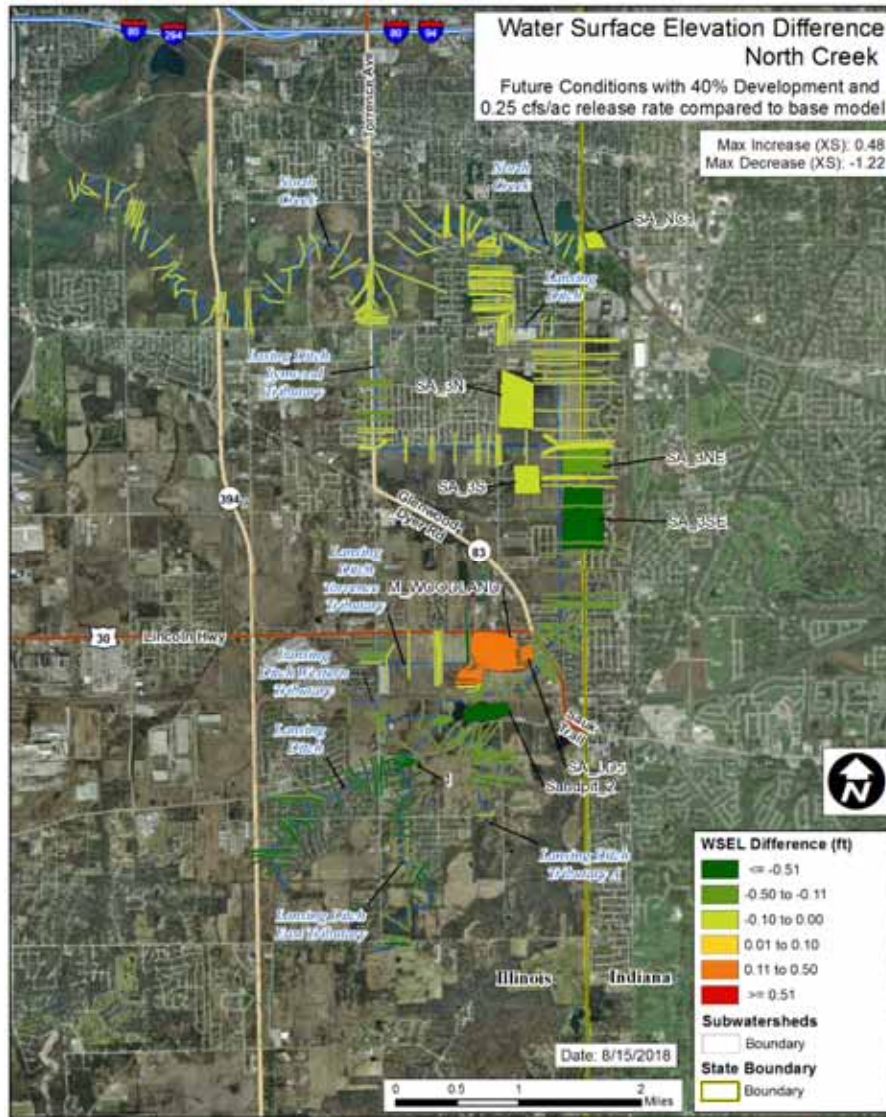
Future Model Results



Future Model Results



Future Model Results



Analysis of Effect of Release Rates

Butterfield Creek Subwatershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	0	0	0	0	136,447
	Stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	0.0%	0.0%	
	Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

North Creek Subwatershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	1,066	1,066	1,066	10,796	120,272
	Stream length with increase in peak WSEI > 0.1' (%)	0.9%	0.9%	0.9%	9.0%	
	Reservoirs in RAS model with increases > 0.5'	0	1	0	1	

Watershed Specific Release Rate Analysis:
Upper Salt Creek Watershed

Base Model Summary

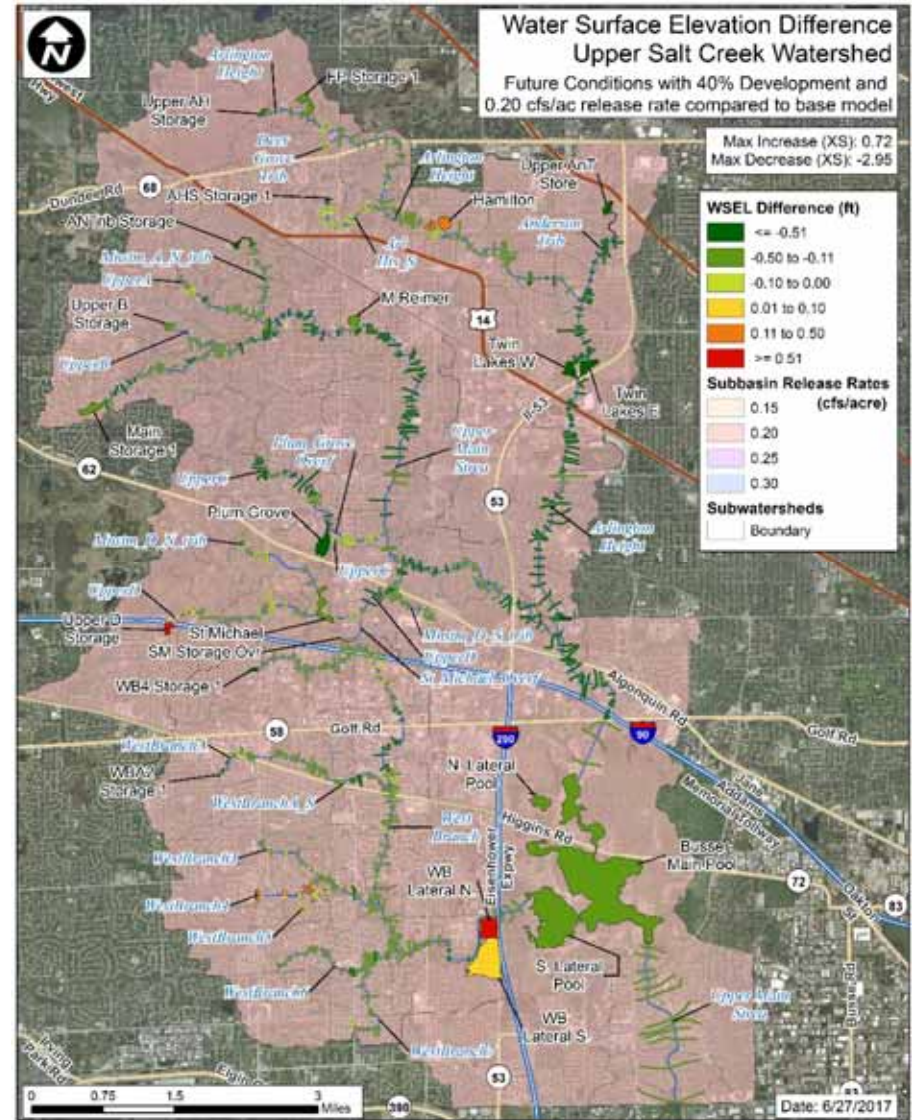
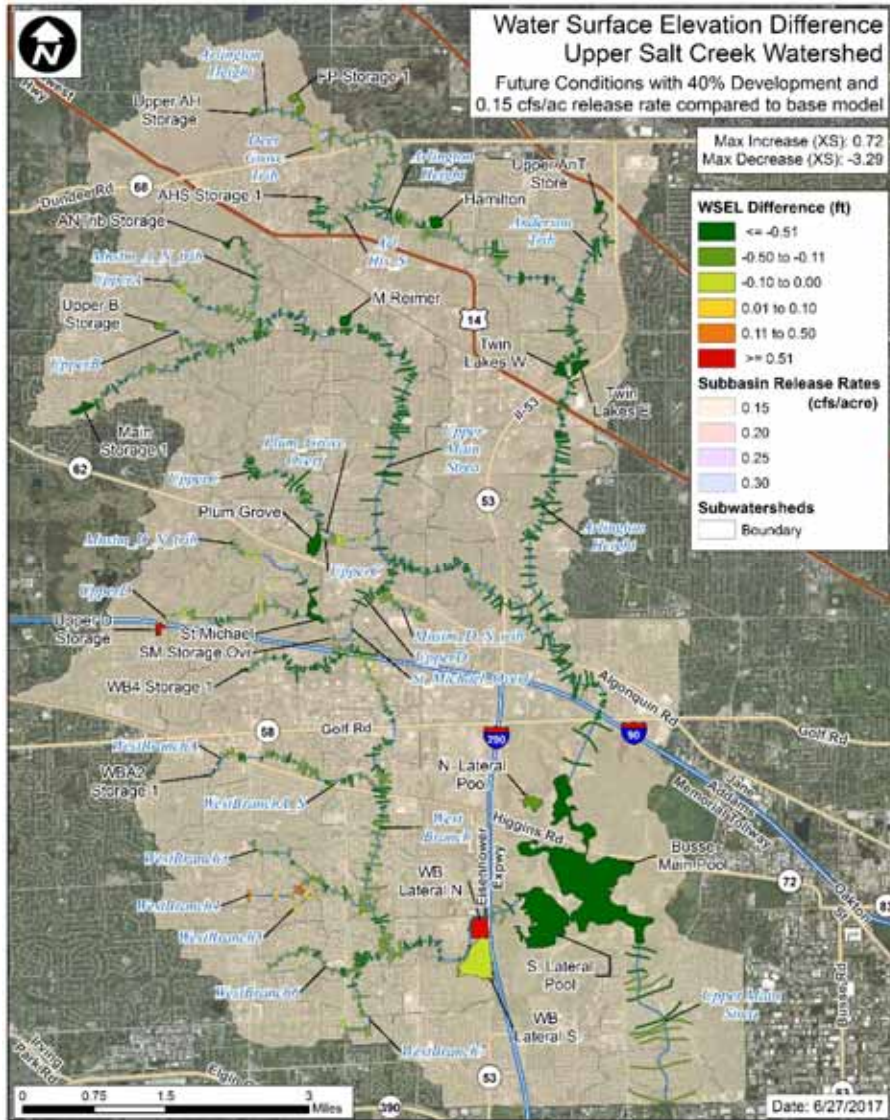
Modeled Subwatersheds:

- Upper Salt Creek Mainstem
- Upper Salt Creek West Branch
- Upper Salt Creek Arlington Heights Branch

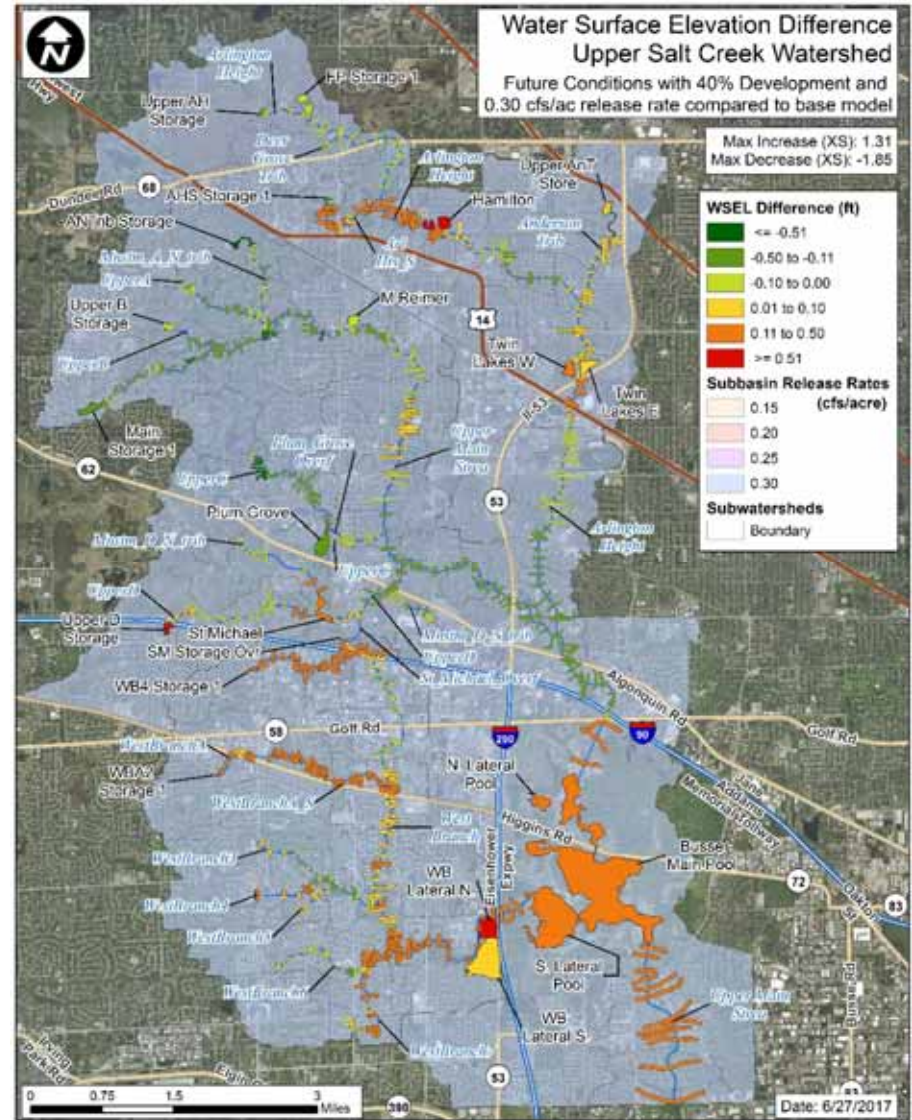
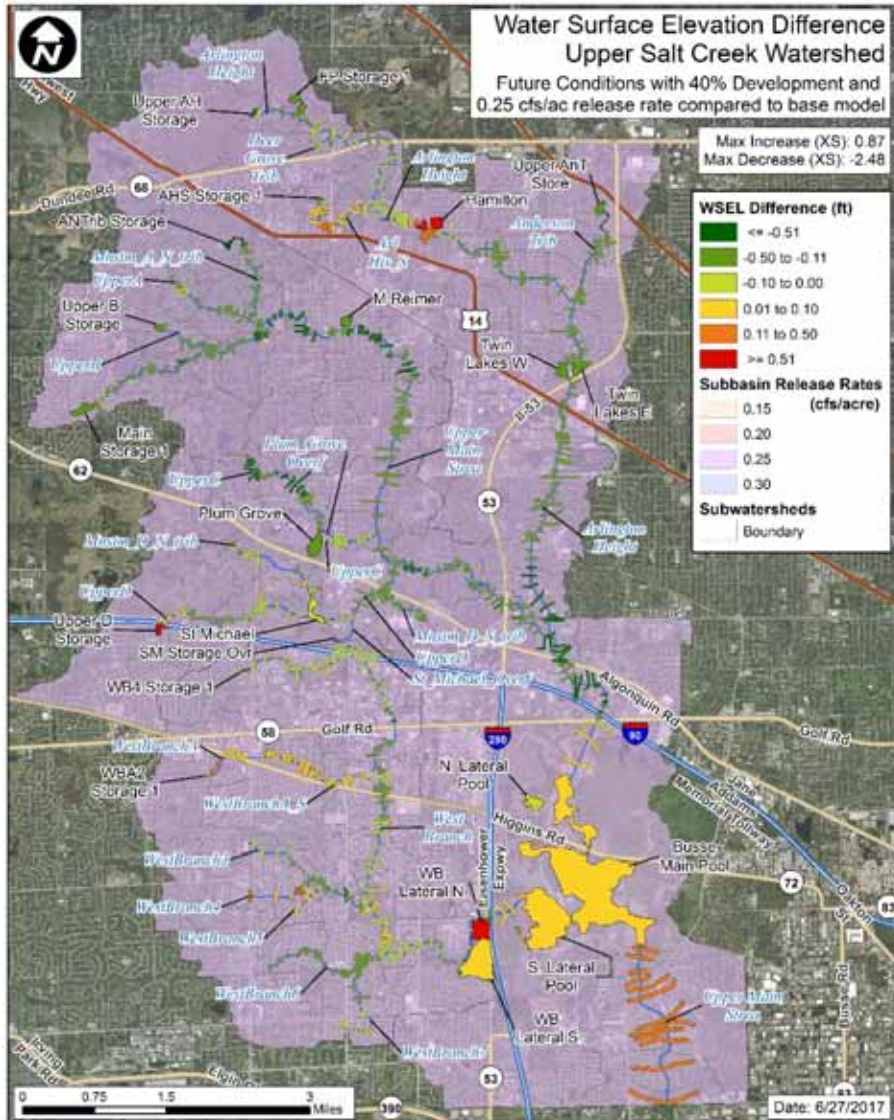
Base Runoff Rates

		24 hour			
		Subwatershed	Average Base Conditions Peak Runoff Rate (cfs/acre)	Subbasin Base Conditions Peak Runoff Rate Range (cfs/acre)	Critical duration event
Upper Salt Creek		Upper Salt Creek Mainstem	0.36	0.11 - 0.68	24 hr
		Arlington Heights Branch	0.35	0.14 - 0.63	24 hr
		West Branch	0.26	0.11 - 0.55	24 hr

Future Model Results



Future Model Results



Analysis of Effect of Release Rates

Upper Salt Creek	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	2,200	2,530	15,794	83,964	282,780
	Stream length with increase in peak WSEI > 0.1' (%)	0.8%	0.9%	5.6%	29.7%	
	Reservoirs in RAS model with increases > 0.5'	2	2	3	3	

Results:

Considerations for Watershed Specific
Release Rates

Analysis of Effect of Release Rates

Cal-Sag Watershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	0	0	0	0	166,027
	Stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	0.0%	0.0%	
	Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

North Branch Chicago River Watershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	0	108	108	0	286,663
	Stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	0.0%	0.0%	
	Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

Analysis of Effect of Release Rates

Poplar Creek Watershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	0	0	0	2,448	203,498
	Stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	0.0%	1.2%	
	Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

Little Calumet River Watershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	1,066	1,066	1,066	10,796	256,719
	Stream length with increase in peak WSEI > 0.1' (%)	0.4%	0.4%	0.4%	4.2%	
	Reservoirs in RAS model with increases > 0.5'	0	1	0	1	

Analysis of Effect of Release Rates

Upper Salt Creek Watershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Stream length with increase in peak WSEI > 0.1' (ft)	2,200	2,530	15,794	83,964	282,780
	Stream length with increase in peak WSEI > 0.1' (%)	0.8%	0.9%	5.6%	29.7%	
	Reservoirs in RAS model with increases > 0.5'	2	2	3	3	

Des Plaines River Watershed	Criteria	WMO release rate				Total Stream length
		0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	
	Tributary stream length with increase in peak WSEI > 0.1' (ft)	0	0	9,727	52,483	530,318
	Tributary stream length with increase in peak WSEI > 0.1' (%)	0.0%	0.0%	1.8%	9.9%	
	Reservoirs with increases > 0.5'	0	0	0	2	

Phase I and II Study Results

Contract Report 2019-06
March 2019

Watershed-Specific Release Rate Analysis: Cook County, Illinois

Amanda Flegel, Gregory Byard, Sally McConkey, Christopher Hanstad, Nicole Gaynor, Zoe Zaloudek

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Illinois State Water Survey-

- Delivered presentations to the MWRD Technical Advisory Committee, each of the Watershed Planning Councils, and two public meetings
- Released ISWS Contract Report 2019-06 in March 2019

MWRD Board of Commissioners-

- Took the study results under consideration and adopted Watershed Specific Release Rates consistent with the study results as part of the May 16, 2019 update to the WMO
- The adopted release rates became effective January 1, 2020
- The May 16, 2019 update also included provisions for additional future studies related to watershed specific release rates under WMO Article 208

<http://hdl.handle.net/2142/103416>

Phase III Study - ongoing

208. Study of Current Provisions of and Potential Amendments to this Ordinance

The District shall initiate a study of certain current provisions of and potential amendments to this Ordinance. This study will be initiated by the end of 2019 with a targeted completion date of May 2022. The study shall include the following areas:

1. A pilot study of a regional stormwater detention and volume control credit trading program;
2. Impacts of watershed specific release rates on disproportionately impacted communities;
3. Impacts of release rates under existing and future development scenarios in collar counties on watersheds in the District;
4. Impact of volume control and watershed specific release rates on stream erosion and related water quality effects such as turbidity and sedimentation; and
5. Board of Commissioners shall consider the study in May 2022.

Contact Information

Gregory Byard, P.E., CFM

byard@Illinois.edu



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