US Army Corps of Engineers®

Post Flood Survey Report: April 2013 Chicago Area Riverine and Basement Flooding

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Executive Summary

Heavy rainfall occurred in central and northern Illinois on April 18 and 19, 2013 causing major flooding along many rivers as well as widespread local drainage and urban flooding problems. During the two weeks preceding this event, the Chicago Metropolitan Area received 1 to nearly 3 inches of rain, increasing ground moisture and slightly elevating levels of area rivers and waterways. Beginning on April 18, 2013, rain gauges from Cook County and the U.S. Geological Survey (USGS) recorded 3.62 to 6.84 inches throughout a 24-hour period.

Within the U.S. Army Corps of Engineers (USACE) Chicago District boundary in Illinois, which includes Cook, DuPage, Kane, Lake, McHenry, and Will Counties, riverine flooding impacts were the greatest on the Des Plaines, Fox, East Branch DuPage and North Branch Chicago Rivers. Within the study area, identified as the "Chicago Area" for this study, the extreme rainfall resulted in major flood stages, and in some cases, record stages on the Des Plaines River, North Branch of the Chicago River, DuPage River, Fox River, and their respective tributaries.

The flooding impacted numerous homes, businesses, and roadways. A Federal Emergency Declaration (FEMA-4116-DR) was declared on May 10, 2013, allowing for federal assistance for 46 counties in the State of Illinois. Statewide, the Federal Emergency Management Agency (FEMA) dispersed approximately $169 million of Individual Assistance (IA) in 35 Counties, and $31 million in Public Assistance (PA) to 39 Counties. In the study area, nearly $152 million of IA and over $5 million of PA was distributed, representing nearly 90% and 17% of statewide disbursements, respectively. Additionally, US Department of Housing and Urban Development (HUD) awarded nearly $119 million of disaster recovery through their Community Development Block Grant (CDBG) program.

This post-flood survey and assessment report documents the meteorological conditions which led to flooding, documents the extent and impacts of flooding based on FEMA expenditures, and provides an analysis of post-flood survey responses. Documentation of this historic event can help local governments and municipal leaders have a better understanding of their risk to flooding and to better plan for and respond to future flood events.

Results of a USACE administered post-flood public survey are presented and discussed in this report. In total 1,829 riverine surveys were collected in 6 Counties. Nearly 49% reported flooding in April 2013 and 6% reported receiving some sort of official warning to alert them of possible flooding. An additional 1,361 surveys were collected for the Cook County basement-specific survey. Nearly 88% of respondents reported having flooded at some point while at their residence. Almost 58% reported having experienced a sewer backup into their basement at some point when they owned or lived in their property, with an average time at their residence of 5 years.

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1 Introduction

Between April 15th and 19th 2013, a slow-moving storm system resulted in record flooding across much of the State of Illinois. The storm included periods of intense rainfall, with depths of 3.62 to 6.84 inches being recorded over a 24-hour period in the Chicago Metropolitan Area. The rainfall led to widespread riverine and urban flooding across the State of Illinois. This study includes a review of the rainfall depths measured, the riverine stage response, and the impacts of flooding within the Illinois Counties of the USACE Chicago District area of responsibility: Cook, DuPage, Kane, Lake, McHenry, and Will Counties. The study area is highlighted in Figure 1.

Within this region, river impacts were the greatest on the Des Plaines, DuPage Fox, and North Branch of the Chicago Rivers and their major tributaries. Major flood stage was reached at several recording gages in each of these watersheds and new record stages were recorded at nearly 60% of the stream gages, including gages in each watershed in the study area.

In response to the event, The U.S. Army Corps Chicago District activated its Emergency Operations Center (EOC) beginning on April 18 and it remained in full activation or partial activation through April 26. EOC activities included technical assistance and direct assistance to local governments and site inspections.

Following the flood event, USACE conducted two separate surveys of businesses and residents. The first survey was a survey of all residents and businesses located within the floodplain of the most affected watersheds in the Chicago area in Illinois: the Des Plaines, DuPage, Fox River, and North Branch of the Chicago Rivers. The intent of the survey was to help describe and quantify the types of flood damage that occurred due to this historic flood event as well as to get a better understanding of the types of warnings that reached residents and actions that were taken as a result of those warning. The survey asked property owners about whether or not they were flooded, the nature of the flooding experienced, the extent of any damages, what actions were taken to prevent flood damages, and when and how they learned that the flooding would happen. Areas surveyed were defined by watershed and subwatershed, if appropriate. The surveyed watersheds and subwatersheds are shown in Figure 1 and listed in Table 1.

The second survey completed was a survey focused on residential basement flooding within the sewer service area of the Chicago-area Tunnel and Reservoir Plan (TARP). The Metropolitan Water Reclamation District of Greater Chicago (MWRD) and USACE is in the process of constructing the TARP to reduce flood risk within the metro-area. The plan consists of a series of large tunnels over three hundred feet below the city's surface that carry combined sewer overflows to two primary reservoirs, Thornton and McCook. The Thornton and McCook Reservoirs are large open quarries that are being converted to reservoirs in phases, as mining

operations continue. The subsurface tunnel system has largely been completed, and the Thornton Reservoir was put into operation in 2015. Stage I of the McCook Reservoir will be operational by the end of 2017 and the remainder of the McCook reservoir (Stage II) is expected to be operational by 2029. At the time of the flooding event in April 2013, only a transitional, temporary reservoir at Thornton was in operation.

The survey focused on the McCook service area. Nearly 40,000 postcards were mailed to a random selection of residential property owners in the designated survey area, encompassing 88 zip codes, predominantly in the City of Chicago. 1,361 survey responses were received; 645 responses were from within city limits and 716 were from surrounding communities. Figure 2 includes the spatial extents of the basement survey that was conducted.

This study was conducted through USACE's Floodplain Management Services (FPMS) Program, under the authority provided by Section 206 of the 1960 Flood Control Act (PL 86-645), as amended. The program provides a range of technical services and planning guidance that is needed to support effective floodplain management as well as providing assistance and guidance in the form of "special studies" on all aspects of floodplain management planning.

Table 1 – Riverine Survey: Summary of Surveyed Watersheds

Watershed	Subwatershed	Approximate Drainage Area (square miles)	Approximate Length of Waterway (miles)
North Branch of the Chicago River	Skokie River	30	19
	Middle Fork Chicago River	24	22
	West Fork Chicago River	29	15
	North Branch Chicago River	28	12
	Subtotal	*111*	*68*
Des Plaines River	Addison Creek	24	8
	Salt Creek	124	43
	Des Plaines River	235	67
	Subtotal	*383*	*118*
DuPage River	DuPage River	80	25
	East Branch DuPage River	126	35
	West Branch DuPage River	146	28
	Subtotal	*352*	*88*
Fox River	Fox River	339	75
	Subtotal	*339*	*75*
	TOTAL	***1,185***	***349***

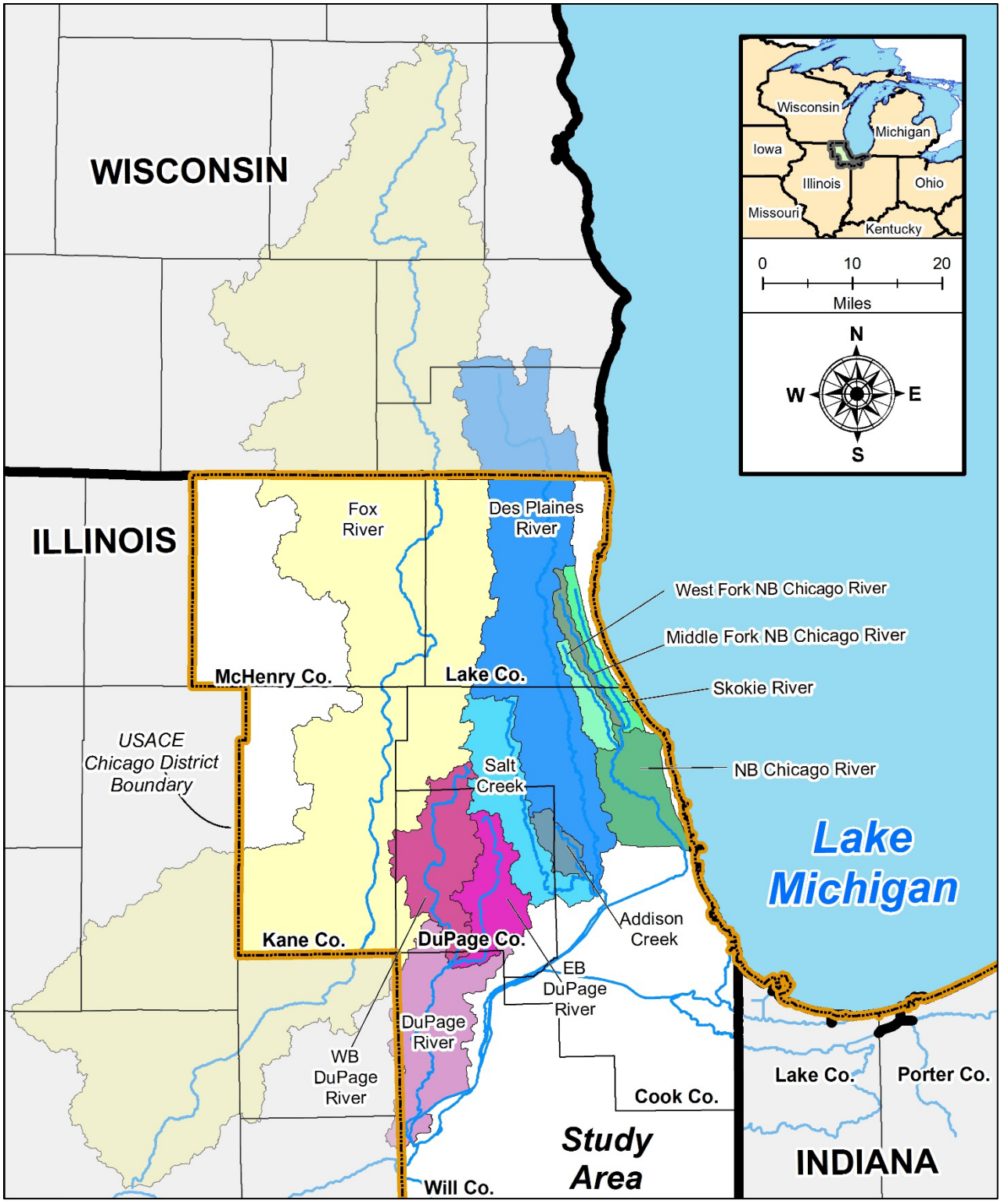

Figure 1 – Riverine Survey: Surveyed Watersheds and Subwatersheds

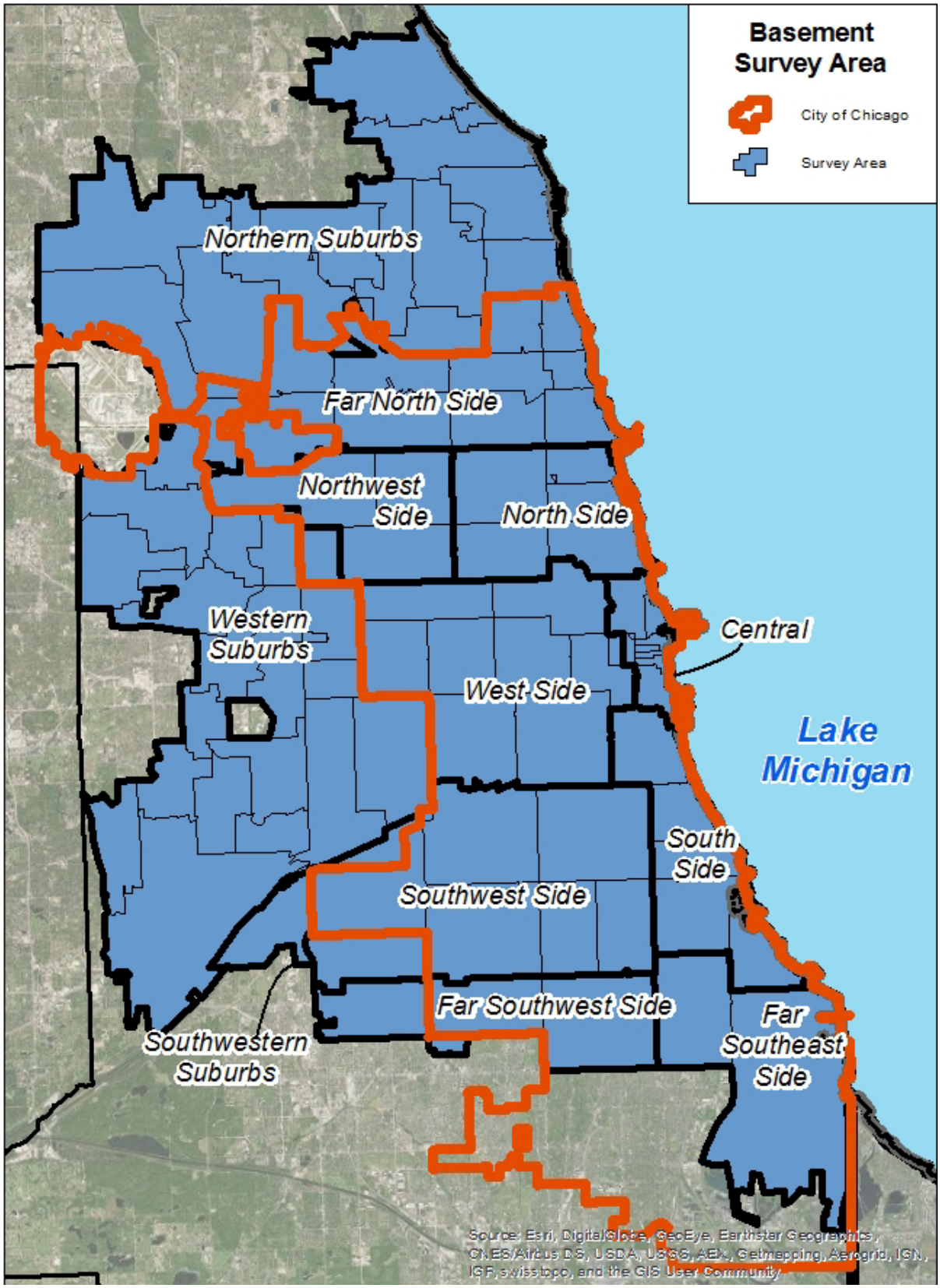

Figure 2 – Basement Survey: Spatial Extents of Survey Area

1.1 Purpose and Scope

The purpose of this report is to document the extent of flooding within the Chicago Metropolitan Area in April 2013. The report describes the meteorological conditions leading up to the flood, the recorded rainfall during the storm event which led to the flood, and the flood-peak gage heights and discharges with estimated annual exceedance probabilities at several USGS stream gages. The report also provides a review of the results of the public survey that the USACE completed to better quantify and locate damages inflicted by this historic event. The intent of the survey was to collect data to help USACE and other agencies better plan for and respond to future flood events.

Figure 3 – Flooding from the Des Plaines River in Des Plaines, IL (April 19, 2013)

2 Storm and Flood of April 2013 in Northeastern Illinois

The impacts of the rainfall event on the region's waterways are varied and dependent on

- The size of the area draining to the waterway (watershed size);
- The amount of rainfall that fell within the watershed and intensity of the rainfall;
- The upstream river hydraulics which impact the rate which water flows through the system; and
- The existing (antecedent) moisture conditions of the soil at the time of the rainfall event, which impact the rate of rainfall infiltration into the soil and the volume of stormwater runoff into the waterways.

The following summary includes a review of the antecedent conditions, amount of rainfall which fell over the region, and a review of the flood stages which were recorded by various river gages.

2.1 Flood Meteorology and Hydrology

The meteorological data reviewed for this storm event include 12 USGS rainfall gages and the 25 Cook County raingage network gages. A review of these gages was completed to gain a regional understanding of the nature of the antecedent conditions that were in place prior to the April 17–18 storm event, the spatial distribution of rainfall during the event, and the spatial distribution of rainfall that fell after the event that may have impacted flooding conditions.

2.1.1 Pre-event Soil Moisture Conditions

The Chicago Metropolitan Area received between 1 and 3 inches of rainfall in the 16 days preceding the event (April 1 – 16) and, of that, between 0.25 and 1 inch of rainfall fell in the 2 days preceding the event. This rainfall increased ground moisture and slightly elevated some the rivers prior to the event. Table 2 includes cumulative rainfall depths between April 1 and April 17. While many gages recorded greater than 2 inches of rain during this period, no significant rainfall was recorded within the 5-day period immediately prior to April 15.

Air and ground temperature did not impact antecedent soil conditions of the region at that time, as regional air temperatures were above freezing (32.2 °F) for at least 16 days prior to the storm event. Therefore, there was likely no or minimal frost line in the soil at the time of the event.

2.1.2 Precipitation

A heavy rainfall event started at about 8:00 AM on April 17 and continued through about 9:00 AM on April 18, with a total duration of about 24 hours. Most of the area received between 3.5 and 7 inches, with a maximum recorded precipitation value of 6.84 inches collected at Cook County Gage 5 in Franklin Park. Less than half an inch of additional rain was recorded at some gage locations on April 19, and another 0.5 - 1 inch fell on April 23 and overnight into April 24. Neither of the additional events had a significant impact on recorded stream stages. Figures 4

and 5 include the 17-day cumulative precipitation for the 5 days preceding and 11 days following the April 17-18 event at select USGS and Cook County rainfall gages. Figure 6 includes a rainfall depth grid that spatially presents the total rainfall depths which fell over the region between April 17 and 19 as recorded by regional weather radar.

Table 2 includes a detailed listing of cumulative precipitation at each rainfall gage identified on the map in Figure 6.

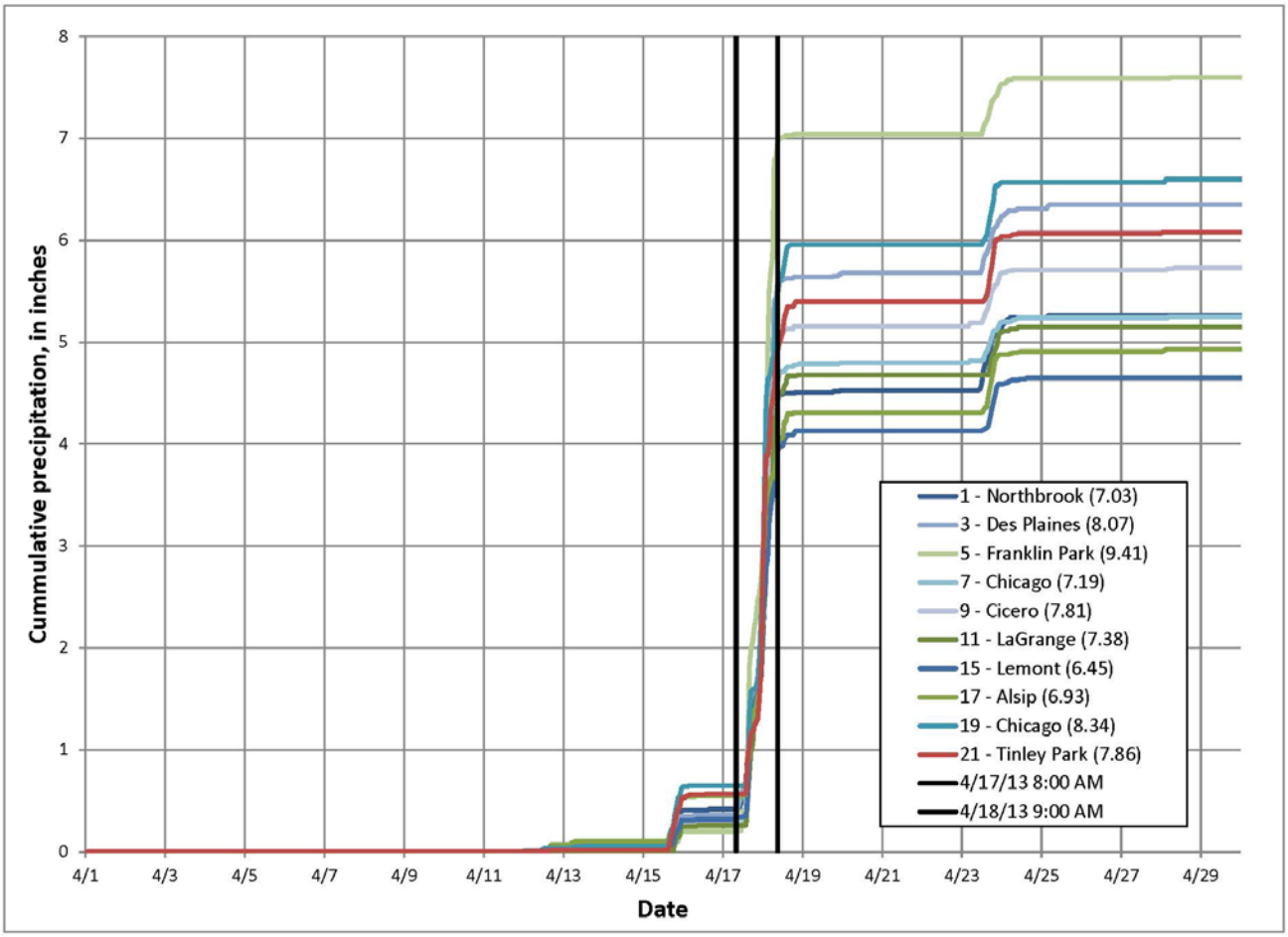

Figure 4 – Cumulative Precipitation for April 2013 - Select Cook County Rain Gages

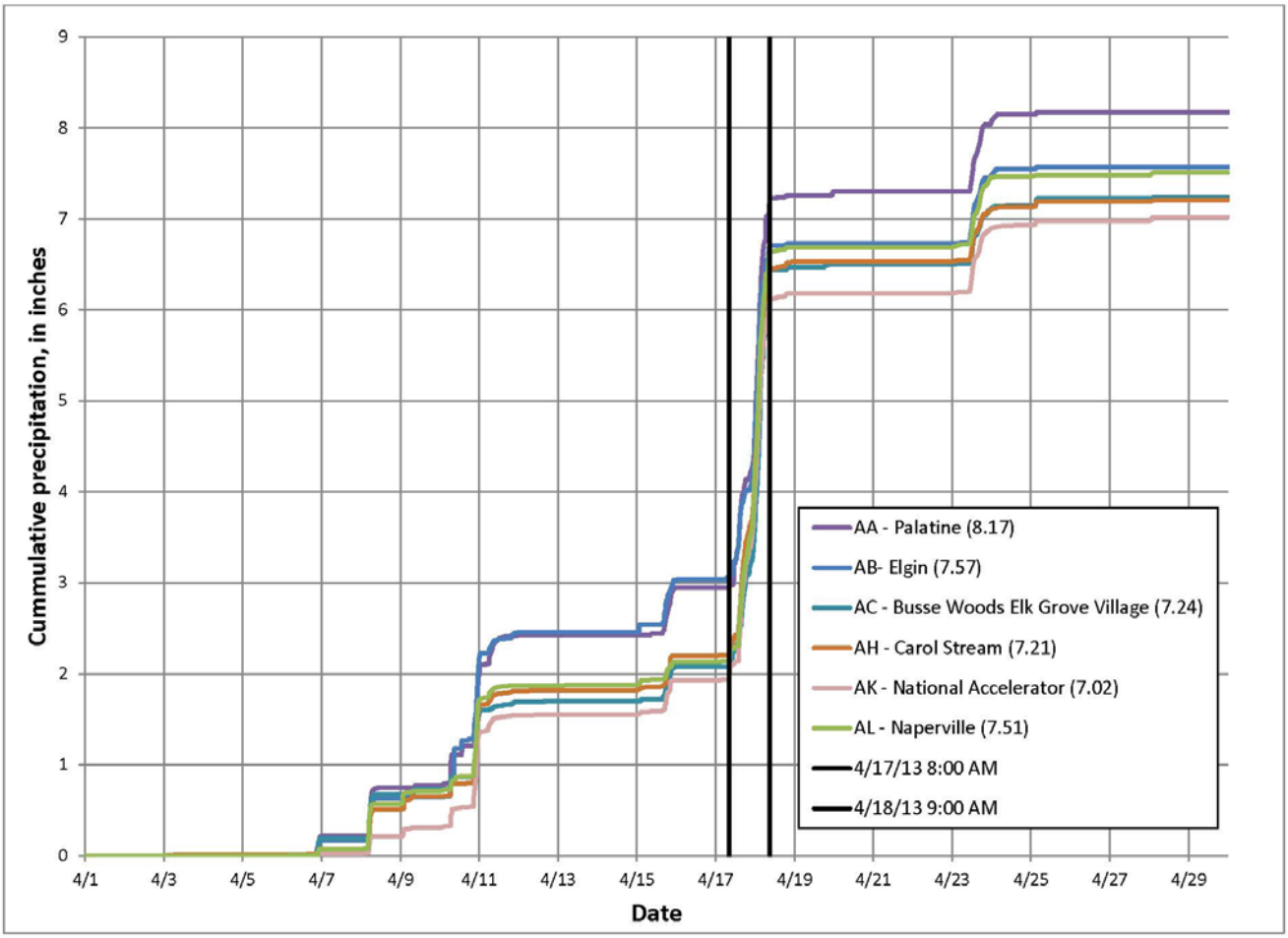

Figure 5 – Cumulative Precipitation for April 2013 - Select USGS Rain Gages

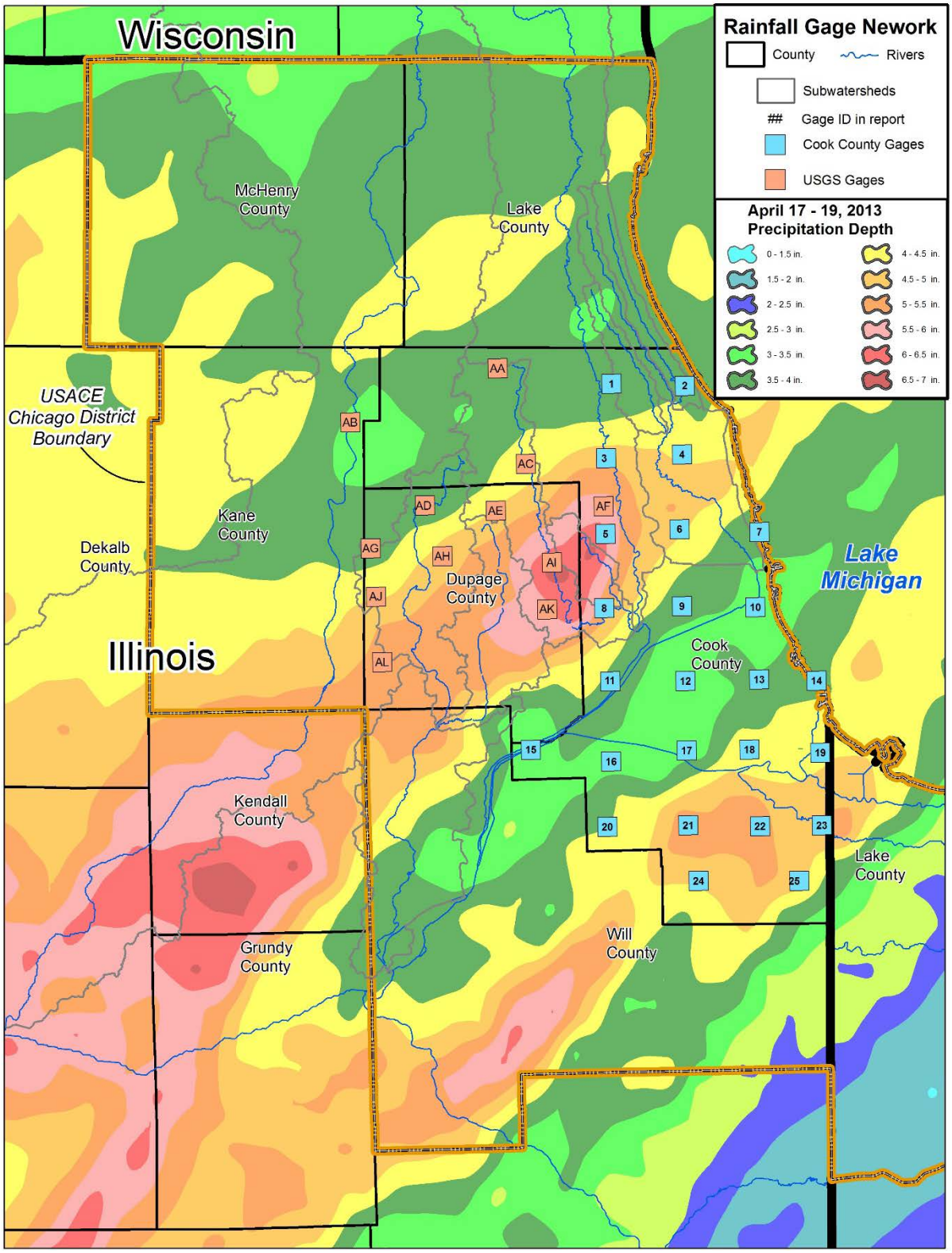

Figure 6 – Radar Derived Rainfall Depths and Rainfall Gage Network

Table 2 – Cumulative precipitation, by gage (inches)

ID on Map		Gage	April 1-16 (Pre-Event)	April 17-18 (Event)	April 19-30 (Post-Event)	April Total
USGS Gages	AA	Sundling Jr. High School at Palatine 420745088025901	2.95	4.31	0.91	8.17
	AB	Elgin Water Treatment Facility at Elgin 420354088170500	3.04	3.69	0.84	7.57
	AC	Busse Woods Near in Elk Grove Village 420057088001700	2.08	4.39	0.77	7.24
	AD	Bartlett WWTF near Bartlett, IL 415801088095700	1.38	*Incomplete Data*	0.86	*Incomplete Data*
	AE	Spring Creek Reservoir near Bloomingdale 415737088031100	*Incomplete Data*	3.92	0.75	*Incomplete Data*
	AF	O'Hare Airport at Chicago, IL 415755087525300	*Incomplete Data*	*Incomplete Data*	0.68	*Incomplete Data*
	AG	DuPage County Airport near St. Charles, IL 415457088150600	1.29	*Incomplete Data*	0.87	*Incomplete Data*
	AH	Carol Stream WWTF at Carol Stream 415423088081500	2.20	4.33	0.68	7.21
	AI	Elmhurst Quarry at Elmhurst 415356087575000	*Incomplete Data*	6.28	0.69	*Incomplete Data*
	AK	Oak Brook Well at Oak Brook, IL 415037087581700	1.19	*Incomplete Data*	0.62	*Incomplete Data*
	AK	National Accelerator Lab near West Chicago 415131088143600	1.93	4.25	0.84	7.02
	AL	Naperville Township Highway Division at Naperville 414652088133800	2.13	4.56	0.82	7.51
Cook County Gages	1	GAGE 1 – Northbrook	2.19	4.09	0.75	7.03
	2	GAGE 2 – Winnetka	1.81	4.77	0.49	7.07
	3	GAGE 3 - Des Plaines	2.08	5.28	0.71	8.07
	4	GAGE 4 – Skokie	2.09	5.86	0.64	8.59
	5	GAGE 5 - Franklin Park	2.01	6.84	0.56	9.41
	6	GAGE 6 - Chicago	2.27	6.47	0.61	9.35
	7	GAGE 7 - Chicago	2.23	4.50	0.46	7.19
	8	GAGE 8 - River Forest	2.45	5.52	0.38	8.35
	9	GAGE 9 - Cicero	2.38	4.86	0.57	7.81
	10	GAGE 10 – Chicago	2.20	3.62	0.52	6.34
	11	GAGE 11 - LaGrange	2.49	4.42	0.47	7.38
	12	GAGE 12 - Bedford Park	2.41	4.14	0.58	7.13
	13	GAGE 13 – Chicago	2.31	3.93	0.49	6.73
	14	GAGE 14 – Chicago	2.21	5.07	0.42	7.70
	15	GAGE 15 – Lemont	2.12	3.81	0.52	6.45
	16	GAGE 16 - Palos Park	2.60	4.17	0.53	7.30
	17	GAGE 17 – Alsip	2.55	3.76	0.62	6.93
	18	GAGE 18 – Chicago	2.68	4.98	0.68	8.34
	19	GAGE 19 – Chicago	2.39	5.31	0.64	8.34
	20	GAGE 20 - Tinley Park	2.52	4.23	0.59	7.34
	21	GAGE 21 - Tinley Park	2.35	4.83	0.68	7.86
	22	GAGE 22 - Harvey	2.87	5.03	0.74	8.64
	23	GAGE 23 - Lansing	2.84	5.15	0.59	8.58
	24	GAGE 24 - Matteson	2.83	4.09	0.64	7.56
	25	GAGE 25 - Chicago Heights	2.55	4.09	0.55	7.19
		Average	2.28	4.68	0.64	7.66
		Maximum	3.04	6.84	0.91	9.41
		Minimum	1.19	3.62	0.38	6.34

2.2 Riverine Impacts

Peak gage readings were recorded from available USGS stream gaging stations for the streams which are being reviewed for this flood assessment. The peak gage stage readings were then converted to the appropriate flood elevations using the specific datum unique to each gage. Peak stages were then compared to effective FEMA Flood Insurance Study (FIS) water surface profiles representing the 10, 2, 1 and 0.2 percent annual chance exceedance (ACE) events (i.e. 10, 50, 100, and 500-year recurrence interval). Based on this comparison, each gage was assigned a frequency indicating the relative severity of this event at each location. A summary of the 2013 peak stages at various river gages is included in Table 3.

For clarity, frequency of flood stages is reported using both recurrence interval and percent ACE terminology, because both are widely used. The following correlations are made between recurrent intervals and ACE.

- 10-year event → 10% Annual Chance of Exceedance
- 50-year event → 2% Annual Chance of Exceedance
- 100-year event → 1% Annual Chance of Exceedance
- 500-year event → 0.2% Annual Chance of Exceedance

Figure 7 includes the gage locations with an indication of the estimated frequency range each location experienced during the April 2013 flood event overlaid on the radar derived rainfall depth grid. This figure also indicates which gages have 25 years or greater period of record and, of those, highlights those for which the April 2013 event was the greatest event on record.

Each gage was also evaluated to determine the lag time between the middle of the rainfall event (assumed to be 10:00 PM on April 17) and the peak of recoded stage. This lag time helps to understand how quickly the waterways responded to the rainfall event and how much time the respective communities had to anticipate peak stages following the storm event. Note that rain continued to fall over the region approximately 13 hours after 10:00 PM on April 17. For a graphical demonstration of the lag time, refer to Figure 8, which includes a hydrograph presenting the river stage at the USGS gage on the Des Plaines River at Riverside. As the figure depicts, the peak stage at Riverside occurred approximately 28 hours after the middle of the event. The rainfall depths recorded over time at Franklin Park (ID# 5 in Table 2) is include in the figure, to demonstrate the rainfall depths recorded by a nearby gage within the same watershed.

Table 3 – Summary of 2013 Peak Staged at Various River Gages

	ID on Figure 7	Gage Name	Sub-Watershed	Relationship to established FIS Profile	Time of peak	Peak water level[1] (ft)	Time to peak stage[2] (hrs)	Years of gage record	Historical Peak Water Year[3] (stage)
North Branch Chicago River	1	West Fork of North Branch of the Chicago River at Northbrook	West Fork Chicago	Between the 2% and 1% (50yr and 100yr)	4/18 4:15 AM	8.47	8.25	61	1987 (10.10)
	2	North Branch of the Chicago River at Deerfield	Middle Fork Chicago	Between the 2% and 1% (50yr and 100yr)	4/18 7:00 AM	11.35	11.00	61	2002 (11.55)
	3	Skokie River at Lake Forest	Skokie	Below the 10% (10yr)	4/18 9:00 AM	7.70	13.00	62	1982 (8.35)
	4	Skokie River near Highland Park	Skokie	Between the 10% and 2% (10yr and 50yr)	4/18 9:00 AM	9.83	13.00	47	2002 (9.95)
	5	North Branch Chicago River at Niles	North Branch Chicago	Between the 10% and 2% (10yr and 50yr)	4/18 9:15 AM	12.12	13.25	63	2008 (12.13)
	6	North Branch Chicago River at Chicago Albany Ave	North Branch Chicago	Between the 2% and 1% (50yr and 100yr)	4/18 7:25 AM	8.81	11.42	23	2013
Des Plaines River	7	Buffalo Creek near Wheeling	Des Plaines (Tributary)	Between the 1% and 0.2% (100yr and 500yr)	4/18 4:15 AM	8.46	8.25	61	2013
	8	Des Plaines River at Russell	Des Plaines	Below the 10% (10yr)	4/19 9:15 PM	9.99	49.25	54	2004 (11.09)
	9	Des Plaines River near Gurnee	Des Plaines	Below the 10% (10yr)	4/20 8:15 AM	11.32	60.25	67	1986 (11.95)
	10	Des Plaines River at Lincolnshire	Des Plaines	Between the 10% and 2% (10yr and 50yr)	4/19 12:00 AM	16.36	28.00	5	2013
	11	Des Plaines River near Des Plaines	Des Plaines	Between the 10% and 2% (10yr and 50yr)	4/19 12:15 PM	10.93	40.25	74	2013
	12	Des Plaines River at Riverside	Des Plaines	Above the 0.2% (500yr)	4/18 11:45 PM	11.27	27.75	100	2013
	13	Addison Creek at Bellwood	Addison Creek	Between the 1% and 0.2% (100yr and 500yr)	4/19 12:00 AM	13.16	28.00	63	2010 (13.57)
	14	Salt Creek at Rolling Meadows	Salt Creek	Between the 10% and 2% (10yr and 50yr)	4/18 7:40 AM	11.40	11.67	40	1987 (14.03)
	15	Salt Creek at Wood Dale	Salt Creek	Between the 1% and 0.2% (100yr and 500yr)	4/18 9:15 PM	15.28	25.25	8	2008 (16.58)
	16	Salt Creek at Elmhurst	Salt Creek	Between the 2% and 1% (50yr and 100yr)	4/18 6:55 AM	13.90	10.92	50	2013
	17	Salt Creek at Western Springs	Salt Creek	Above the 0.2% (500yr)	4/18 2:20 PM	10.65	18.33	68	2013

[1] Relative to gage-specific datums
[2] From middle of storm (April 17, 10:00PM)
[3] Stage is listed if the historical peak water year is not 2013

Table 3 (cont.) – Summary of River Gages

	ID on Map	Gage Name	Sub-Watershed	Relationship to established FIS Profile	Time of peak	Peak water level[1] (ft)	Time to peak stage[2] (hrs)	Years of gage record	Historical Peak Water Year[3] (stage)
DuPage River	18	East Branch DuPage River near Downers Grove	East Branch DuPage	Between 1% and 0.2% (100yr and 500yr)	4/18 8:00 AM	17.79	12.00	40	2013
	19	East Branch DuPage River at Bollingbrook	East Branch DuPage	Above 0.2% (500yr)	4/18 8:45 PM	25.51	24.75	25	2013
	20	West Branch DuPage River near West Chicago	West Branch DuPage	Between 2% and 1% (50yr and 100yr)	4/18 12:50 PM	11.12	16.83	53	2008 (12.28)
	21	Kress Creek at West Chicago	West Branch DuPage (Trib.)	Below 10% (10yr)	4/18 1:15 PM	7.19	17.25	48	2008 (9.37)
	22	West Branch DuPage River near Warrenville	West Branch DuPage	Between 1% and 0.2% (100yr and 500yr)	4/18 9:30 PM	17.08	25.50	45	2013
	23	West Branch DuPage River near Naperville	West Branch DuPage	Above 0.2% (500yr)	4/19 12:15 AM	12.47	28.25	25	1996 (14.31)
	24	DuPage River near Naperville	DuPage	Between 1% and 0.2% (100yr and 500yr)	4/19 3:00 AM	16.57	31.00	3	2013
	25	DuPage River at Shorewood	DuPage	Between 2% and 1% (50yr and 100yr)	4/19 10:00 AM	11.54	38.00	73	1996 (14.03)
Fox River	26	Channel Lake Near Antioch	Fox	Between 2% and 1% (50yr and 100yr)	4/22 4:30 AM	8.09	104.50	20	2013
	27	Fox River near Lake VIlla	Fox	Between 2% and 1% (50yr and 100yr)	4/22 10:00 AM	7.91	110.00	20	2013
	28	Nippersink Lake at Fox Lake	Fox	Between 10% and 2% (10yr and 50yr)	4/22 2:45 PM	7.86	114.75	20	2013
	29	Fox River at Johnsburg	Fox	Between 2% and 1% (50yr and 100yr)	4/22 3:00 PM	7.47	115.00	20	2013
	30	Fox River near McHenry	Fox	Between 10% and 2% (10yr and 50yr)	4/22 6:15 PM	5.38	118.25	26	2013
	31	Fox River near McHenry (Tailwater)	Fox	Between 10% and 2% (10yr and 50yr)	4/23 6:15 PM	7.46	142.25	12	2013
	32	Fox River at Algonquin	Fox	Between 10% and 2% (10yr and 50yr)	4/23 7:30 PM	4.03	143.50	94	1916 (4.5)
	33	Fox River at Algonquin (Tailwater)	Fox	Between 2% and 1% (50yr and 100yr)	4/23 9:15 PM	12.70	145.25	4	2013
	34	Fox River at South Elgin	Fox	Below 10% (10yr)	4/18 10:45 AM	15.04	14.75	13	2013
	35	Fox River at South Elgin (Tailwater)	Fox	Below 10% (10yr)	4/18 3:00 PM	10.26	19.00	4	2013
	36	Fox River at Montgomery	Fox	Between 10% and 2% (10yr and 50yr)	4/18 9:30 AM	15.14	13.50	11	2013

[1] Relative to gage-specific datums
[2] From middle of storm (April 17, 10:00PM)
[3] Stage is listed if the historical peak water year is not 2013

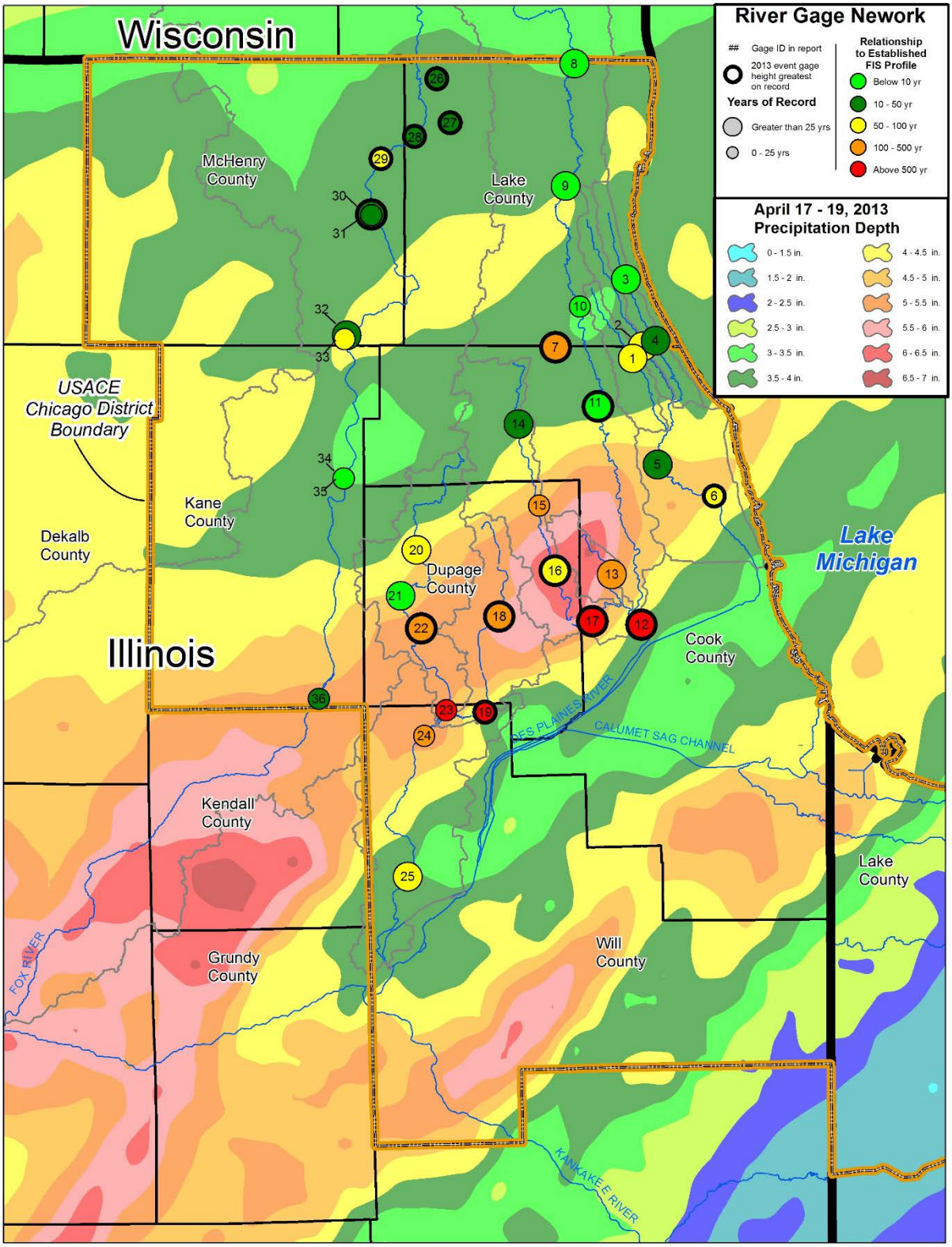

Figure 7 – April 2013 Flood Event Compared to FEMA Flood Frequency Profiles

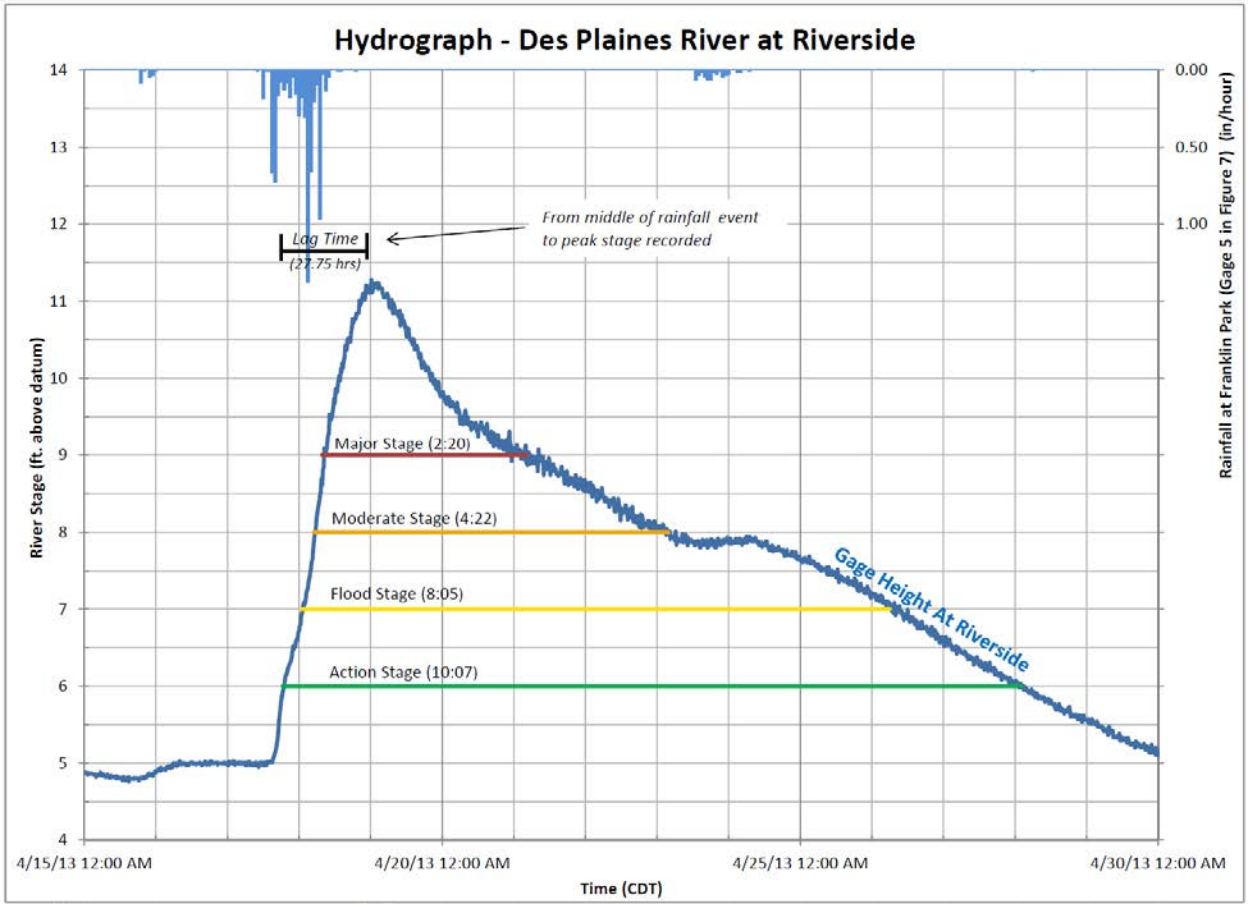

Figure 8 – Sample Stage Hydrograph and Rainfall Hyetograph

2.2.1 Stage Analysis

The National Weather Service (NWS) has defined flood stages (Action, Minor, Moderate, and Major) for eleven (11) of the river gages in the study area and has defined an action stage for an additional gage.

The NWS defines these stages as:

- **Action Stage** - the stage which when reached by a rising stream, lake, or reservoir represents the level where the NWS or a partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity.

- **Flood Stage** - minimal or no property damage, but possibly some public threat.

- **Moderate Stage** - some inundation of structures and roads near stream. Some evacuations of people and/or transfer of property to higher elevations.

- **Major Stage** - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

As an example, Figure 8 above displays each of the NWS defined flood stages for the *Des Plaines River at Riverside* gage. As depicted, the river was elevated above action stage for over 10 days and above major flood stage for over 2 days at this location.

All but two of the eleven gages reached Major Flood stage during this event. Table 4 below summarizes the gages for which these flood stages have been defined by the NWS and the duration that each of these gages exceeded the defined stages.

Table 4 – Time Above Flood Stages Various River Gages

ID on Figure 7	Watershed	Gages with identified Flood Warning Stages	Action	Flood	Moderate	Major
5	North Branch of the Chicago River	North Branch Chicago River at Niles	6 days (144 hrs)	*Not defined*	*Not defined*	*Not defined*
6		North Branch Chicago River at Chicago Albany Ave	4 days (97 hrs)	1.4 days (34.7 hrs)	1.1 days (25.5 hrs)	0.5 days (11.8 hrs)
8	Des Plaines River	Des Plaines River at Russell	16.2 days (388.3 hrs)	14 days (335 hrs)	2.9 days (70 hrs)	*Did not reach*
9		Des Plaines River near Gurnee	17 days (408.8 hrs)	15.6 days (373.3 hrs)	6.7 days (161.3 hrs)	2.5 days (59.5 hrs)
10		Des Plaines River at Lincolnshire	15.3 days (368.3 hrs)	9.3 days (224 hrs)	7.2 days (173.3 hrs)	4.2 days (101 hrs)
11		Des Plaines River near Des Plaines	13.3 days (320 hrs)	9.6 days (229.7 hrs)	6.5 days (155 hrs)	4.9 days (117.2 hrs)
12		Des Plaines River at Riverside	10.3 days (247.5 hrs)	8.2 days (197.3 hrs)	4.9 days (118.7 hrs)	2.9 days (68.8 hrs)
19	DuPage River	East Branch DuPage River at Bolingbrook	5 days (119.8 hrs)	3.8 days (91.5 hrs)	2.7 days (64.3 hrs)	1.7 days (40.3 hrs)
22		West Branch DuPage River near Warrenville	3.3 days (79.3 hrs)	3 days (72 hrs)	1.7 days (40.7 hrs)	*Did not reach*
24		DuPage River near Naperville (Plainfield)	4.4 days (105.3 hrs)	2.7 days (64 hrs)	1.8 days (42 hrs)	1.3 days (30.5 hrs)
25		DuPage River at Shorewood	3.9 days (92.8 hrs)	3.4 days (82.5 hrs)	2.6 days (63 hrs)	1.6 days (39.3 hrs)
32	Fox River	Fox River at Algonquin	24.4 days (585 hrs)	12.1 days (290.7 hrs)	10.2 days (244.5 hrs)	0.7 days (17 hrs)
33		Fox River at Algonquin (Tailwater)	26 days (623.5 hrs)	22.2 days (533.5 hrs)	16.2 days (389.5 hrs)	9.2 days (220.5 hrs)
36		Fox River at Montgomery	28 days (672.8 hrs)	17.3 days (414 hrs)	2.7 days (65 hrs)	0.3 days (8 hrs)

2.2.2 Watershed Response

As summarized above, many factors influence the hydrologic response of a watershed to rainfall events. Watershed-size as well as watershed-wide land cover, land slope, soil type, antecedent moisture conditions, stormwater management practices, and hydraulic features all impact the amount of runoff (volume) that reaches major waterways as well as the time that it takes for that water to reach those major waterways. Generally, the watershed response time is longer for larger watersheds and smaller (faster) for smaller watersheds, meaning that residents located within smaller watersheds typically have much shorter warning times to prepare for rising flood waters and/or evacuate from flood risk areas.

A summary of watershed response times and summary notes of riverine gage recordings for the April 2013 flood event is included below.

North Branch of the Chicago River Watershed:

- The average lag time of the Chicago River and its tributaries was approximately 12 hours, with the West Fork of the North Branch of the Chicago River reaching its peak only about 8 hours after the middle of the rainfall event.
- Major flood stage was reached on the North Branch of the Chicago River at Albany Avenue in the City of Chicago.
- A new record stage was reached on the North Branch of the Chicago River at Albany Avenue in the City of Chicago.

Des Plaines River Watershed:

- The average lag time of the main branch of the Des Plaines River was approximately 41 hours while the gages on the tributaries had a much faster response time. Buffalo Creek at Wheeling experienced a peak elevation approximately 8 hours following the middle of the rainfall event, which is of note because this gage was determined to reach a greater than 0.2% ACE (500 year) elevation. The average lag time of Salt Creek was approximately 16 hours.
- Major flood stage was reached along the Des Plaines between the Illinois-Wisconsin Stateline and Lemont.
- New record stages were reached at Des Plaines and Riverside as well as on Buffalo Creek near Wheeling.
- New record stages were reached on Salt Creek at Elmhurst and Western Springs.

DuPage River Watershed:

- The average lag time of the DuPage River was approximately 25 hours, with the East Branch responding first – as quickly as 12 hours after the peak of the rainfall event –

and the DuPage mainstem responding at least 30 hours after the middle of the rainfall event.

- Major flood stage was reached at Plainfield and Shorewood as well as on the East Branch of the DuPage River at Bolingbrook. Moderate flood stage was reached at the West Branch of the DuPage River near Warrenville.
- Record stage was reached on the DuPage River near Naperville as well as on the East Branch DuPage River at Bolingbrook and Downers Grove and on the West Branch DuPage River near Warrenville. Additionally, record stage was recorded on the St Joseph Creek, a tributary to the East Branch, at Lisle.

Fox River Watershed:

- The Fox River gages typically had a much longer response time to the rainfall event than other gages in the region. The average lag time of gages on the Fox River was approximately 89 hours (3.7 days). The response time for the southern portion of the watershed, at the South Elgin and Montgomery gages, was much faster, likely due to the operation of the Algonquin Dam to manage floodwaters.
- Major flood stage was reached at Algonquin and Montgomery while flood stage was reached at McHenry.
- New record stages were reached at Johnsburg, McHenry, Algonquin, and South Elgin as well as on Channel Lake near Antioch, Fox Lake near Lake Villa, and Nippersink Lake at Fox Lake.

2.3 Federal Emergency Management Agency Response

Illinois Governor Pat Quinn requested a major disaster declaration on May 8, 2013 in response to flooding, straight-line winds, and severe storms during the period April 16 to May 5, 2013. President Barack H. Obama subsequently declared a Federal Disaster (FEMA-4116-DR) on May 10, 2013. The declaration allowed for Individual and or Public Assistance for 46 counties in the State of Illinois. The Federal Emergency Management Agency (FEMA) dispersed $169,345,000 in Individual Assistance (IA) across 62,413 approved applications in 35 Counties and $30,736,000 in Public Assistance (PA) to 39 Counties. Figure 9 defines the Counties which were eligible for FEMA disaster assistance through this declaration.

Individual Assistance is provided by FEMA to individuals and families who have sustained losses due to declared disasters. Individual disaster assistance may include grants to help pay for temporary housing, emergency home repairs, uninsured and underinsured personal property losses, and medical, dental and funeral expenses caused by the disaster, along with other serious disaster-related expenses.

FEMA's Public Assistance Program provides grants to state, local, and federally recognized tribal governments and certain private non-profit entities to assist them with the response to and recovery from disasters. Specifically, the program provides assistance for debris removal, emergency protective measures, and permanent restoration of infrastructure damaged by the declared disaster.

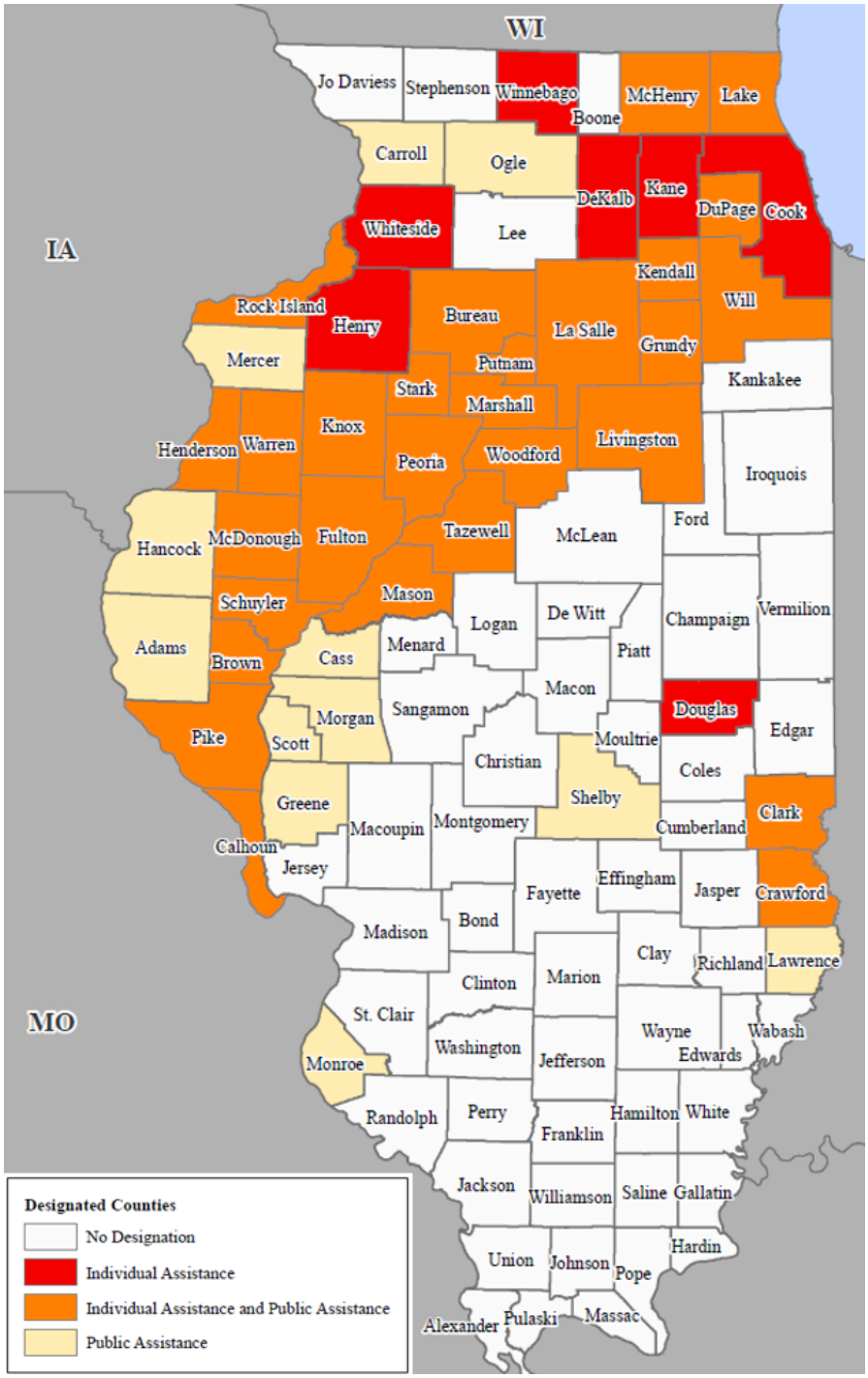

Figure 9 – FEMA-4116-DR Declared Designated Counties

FEMA Region 5 provided Individual and Public Assistance values, aggregated by zip code, for analysis. Table 5 includes a summary of Federal IA and PA expenditures within the focus area. Figures 10 and 11 include this data mapped geographically by zip code.

Table 5 – FEMA-4116-DR - Federal Disaster Assistance

County	Individual Assistance		Public Assistance	
	Number Assisted	Sum of Award Value	Number Assisted	Sum of Award Value
Cook	49,908	$127,582,746	*--Not eligible--*	
DuPage	3,968	$14,830,952	101	$2,038,905
Kane	345	$1,738,538	*--Not eligible--*	
Lake	1,159	$2,711,092	170	$1,289,569
McHenry	197	$419,797	42	$452,682
Will	1,691	$4,384,752	73	$1,490,713
Grand Total	**57,577**	**$151,667,876**	**386**	**$5,271,868**

In addition to FEMA IA and PA funding being provided, as a result of the disaster declaration additional recovery funding was made available through the US Department of Housing and Urban Development (HUD) and the US Small Business Administration (SBA).

HUD provides flexible grants to help cities, counties, and States recover from presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. In response to presidentially declared disasters, Congress may appropriate additional funding for the Community Development Block Grant (CDBG) program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process.

While this funding was made available as a result of the April 2013 flooding event, a comprehensive summary of expenditures as part of the CDBG Disaster Recovery Program and SBA loans was not completed as part of this report. At the date of this report the City of Chicago has received $63.1 million, Cook County has received $13.9 million, DuPage County has received $31.5 million, and the State of Illinois has received $10.4 million in CDBG funding as a result of the event, totaling nearly $119 million distributed within the State of Illinois.

SBA provides low-interest, long-term loans for physical and economic damage caused by a declared disaster. Disaster related loan categories include:

- Home and Personal Property Loans
- Business Physical Disaster Loans
- Economic Injury Disaster Loans

No analysis of the amount of funding loaned through the SBA low interest loan program was completed as part of this study.

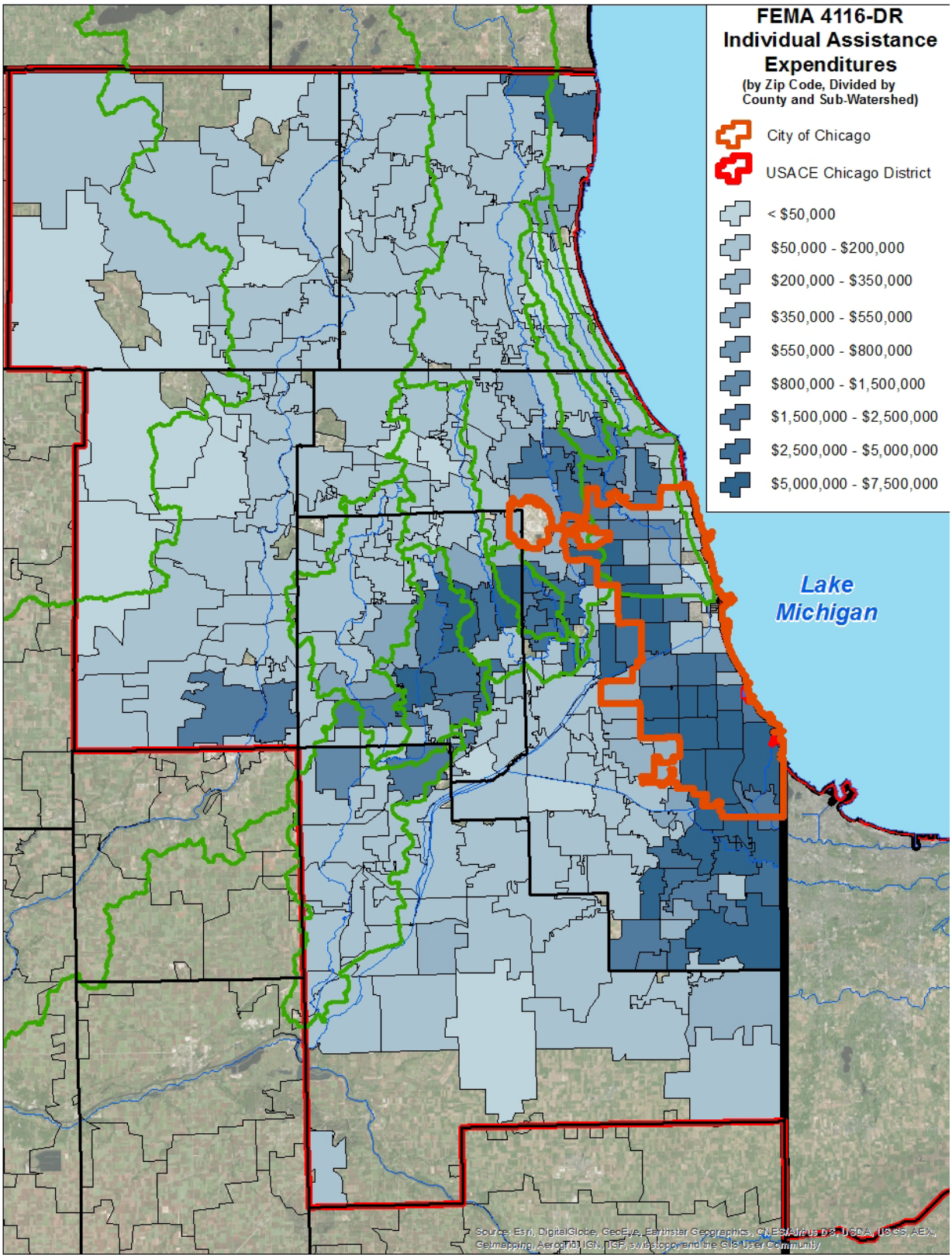

Figure 10 – FEMA-4116-DR Individual Assistance Expenditures

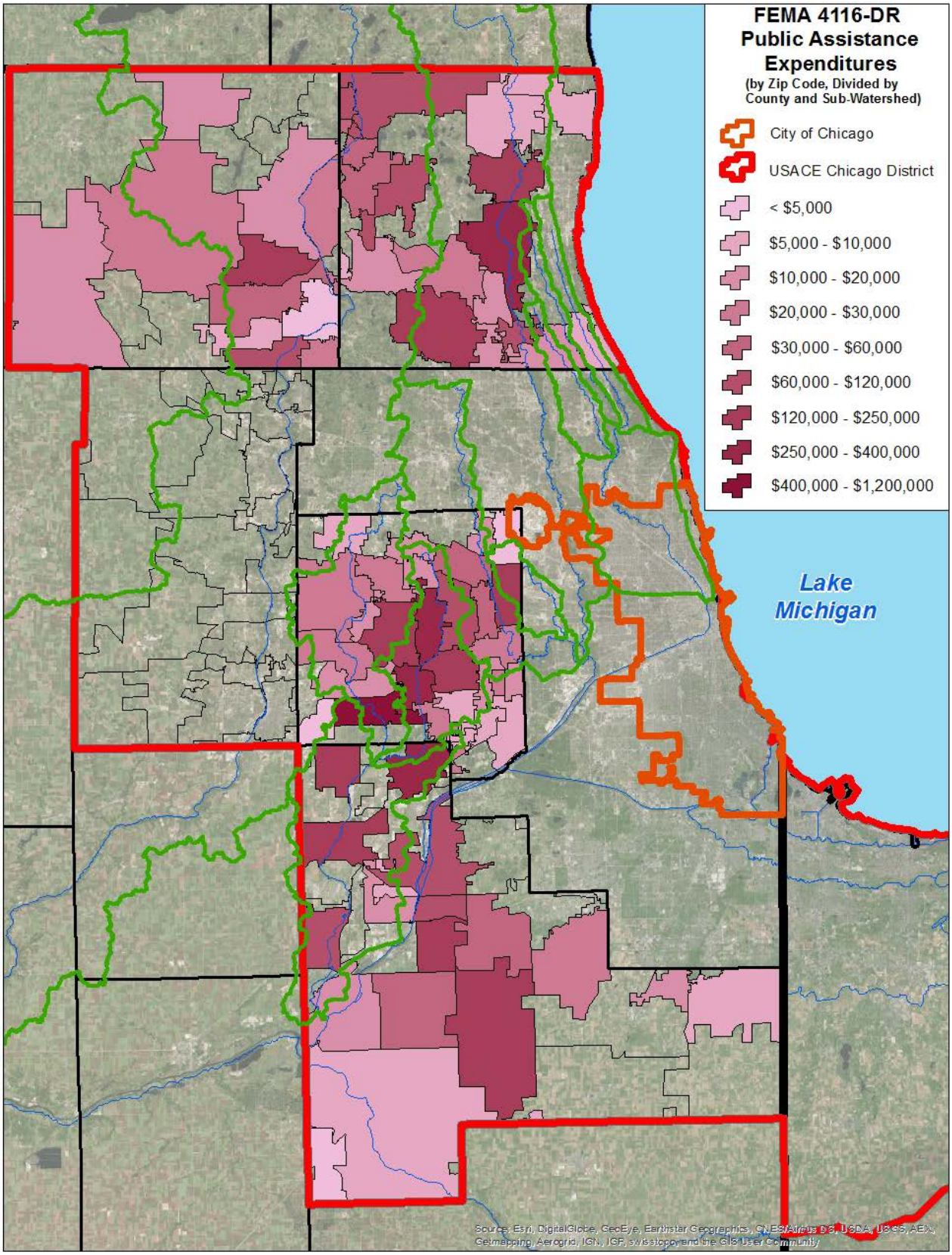

Figure 11 – FEMA-4116-DR Public Assistance Expenditures

3 Riverine Survey

A flood damage survey was conducted to better understand the impact riverine flooding had on residents and businesses within the DuPage, Des Plaines, Fox River, and North Branch of the Chicago River Watersheds during the April 2013 event. Surveys were limited to residents and business owners within the USACE Chicago District Boundary in Illinois, which consist of Cook, DuPage, Will, Lake, McHenry, and Kane Counties.

3.1 Methodology

Nearly 40,000 postcards were mailed to both residential and non-residential structures property owners assumed to be in flood-prone areas of affected watersheds. Approximately 1,800 responded. Flood-prone parcels were identified based on the FEMA floodplain boundaries. While it is recognized that flooding is not confined to these regulatory floodplain boundaries, these areas were used to focus the survey mailings to areas identified to be at higher risk of riverine flooding based on FEMA's regulatory mapping process.

Potential participants for the area-wide survey were notified of the survey through a postcard survey invitation. Figure 12 includes an image of the postcards mailed. The postcard offered four options for participation:

- Log on to take the survey at a website
- Print a blank questionnaire from the website, fill it out, and return it by mail
- Call a toll-free number to a reach a live interviewer to administer the questionnaire
- Call a toll-free number to request a hard copy questionnaire with a self-addressed, postage-paid envelope mailed to the respondent

As shown in Table 6, the response rates from each watershed varied between 2% and 7%, with an overall response rate of 5%. This response rate met the target for the survey effort, as this rate is considered reasonable and acceptable for public surveys based on industry standards. The majority of the responses were from residential property owners. In all, approximately 94% of responses were residential. The breakdown of respondents is in Table 7. Note that the summary statistics provided in Tables 6 and 7 include the response rate based on initial screening of the data. Some survey responses were removed from analysis due to duplications of submittals, incomplete location data, and responses located outside of designated flood-prone areas.

The number of survey responses is mapped geographically by zip code in Figure 13.

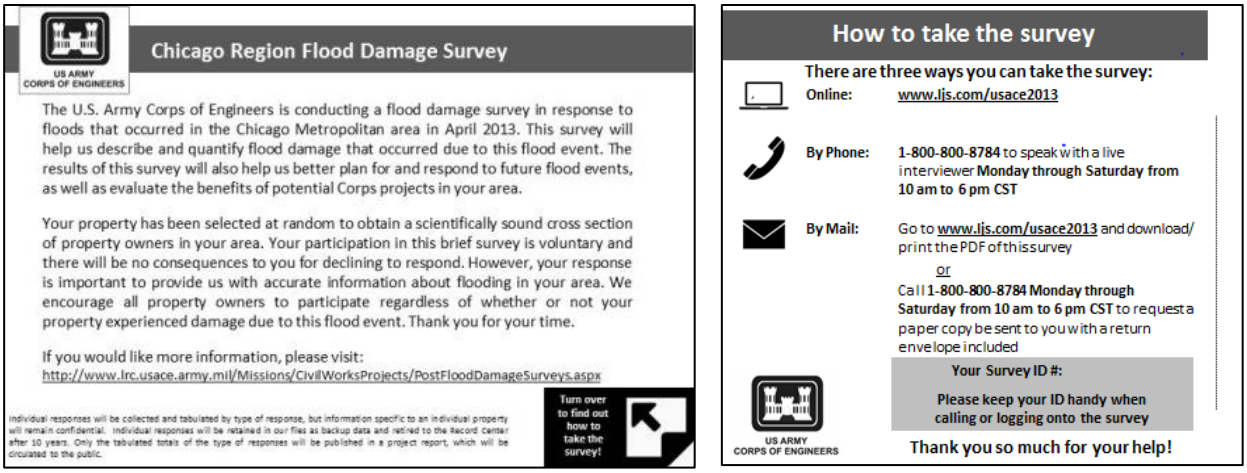

Figure 12 – Riverine Survey Postcard Mailing – Front and Back

Table 6 – Riverine Survey: Summary of Submitted Surveys

Watershed	Subwatershed	Mailed to	Responses	Response Rate (%)
North Branch of the Chicago River	Skokie River	557	34	6%
	Middle Fork Chicago River	830	58	7%
	West Fork Chicago River	3,749	93	2%
	North Branch Chicago River	109	4	4%
	Subtotal	*5,245*	*189*	*4%*
Des Plaines River	Addison Creek	3,412	102	3%
	Salt Creek	2,762	144	5%
	Des Plaines River	10,128	592	6%
	Subtotal	*16,302*	*838*	*5%*
DuPage River	DuPage River	2,272	125	6%
	East Branch DuPage River	2,731	124	5%
	West Branch DuPage River	1,612	84	5%
	Subtotal	*6,615*	*333*	*5%*
Fox River	Fox River	10,347	469	5%
	Subtotal	*10,347*	*469*	*5%*
	TOTAL	38,509	1,829	5%

Table 7 – Riverine Survey: Summary of Submitted Surveys

	Watershed/County	Residential	Non-Residential	Total
North Branch of the Chicago River	**Skokie River**			
	Lake Co.	16	1	17
	Cook Co.	16	1	17
	Total	32	2	34
	Middle Fork Chicago River			
	Lake Co.	38	0	38
	Cook Co.	20	0	20
	Total	58	0	58
	West Fork Chicago River			
	Lake Co.	30	0	30
	Cook Co.	62	1	63
	Total	92	1	93
	North Branch Chicago River			
	Cook Co.	4	0	4
	Total	4	0	4
	Watershed Total	186	3	189
Des Plaines River	**Addison Creek**			
	Cook Co.	85	17	102
	Total	85	17	102
	Salt Creek			
	Cook Co.	67	2	69
	DuPage Co.	69	6	75
	Total	136	8	144
	Des Plaines River			
	Lake Co.	110	26	136
	Cook Co.	421	35	456
	Total	531	61	592
	Watershed Total	752	86	838
DuPage River	**East Branch DuPage River**			
	DuPage Co.	118	6	124
	Will Co.	0	0	0
	Total	118	6	124
	West Branch DuPage River			
	Cook Co.	12	0	12
	DuPage Co.	66	4	70
	Will Co.	2	0	2
	Total	80	4	84
	DuPage River			
	Will Co.	124	1	125
	Total	124	1	125
	Watershed Total	322	11	333
Fox River	Lake Co.	140	2	142
	McHenry Co.	250	1	251
	Kane Co.	71	5	76
	Watershed Total	461	8	469
	TOTAL	**1,721**	**108**	**1,829**

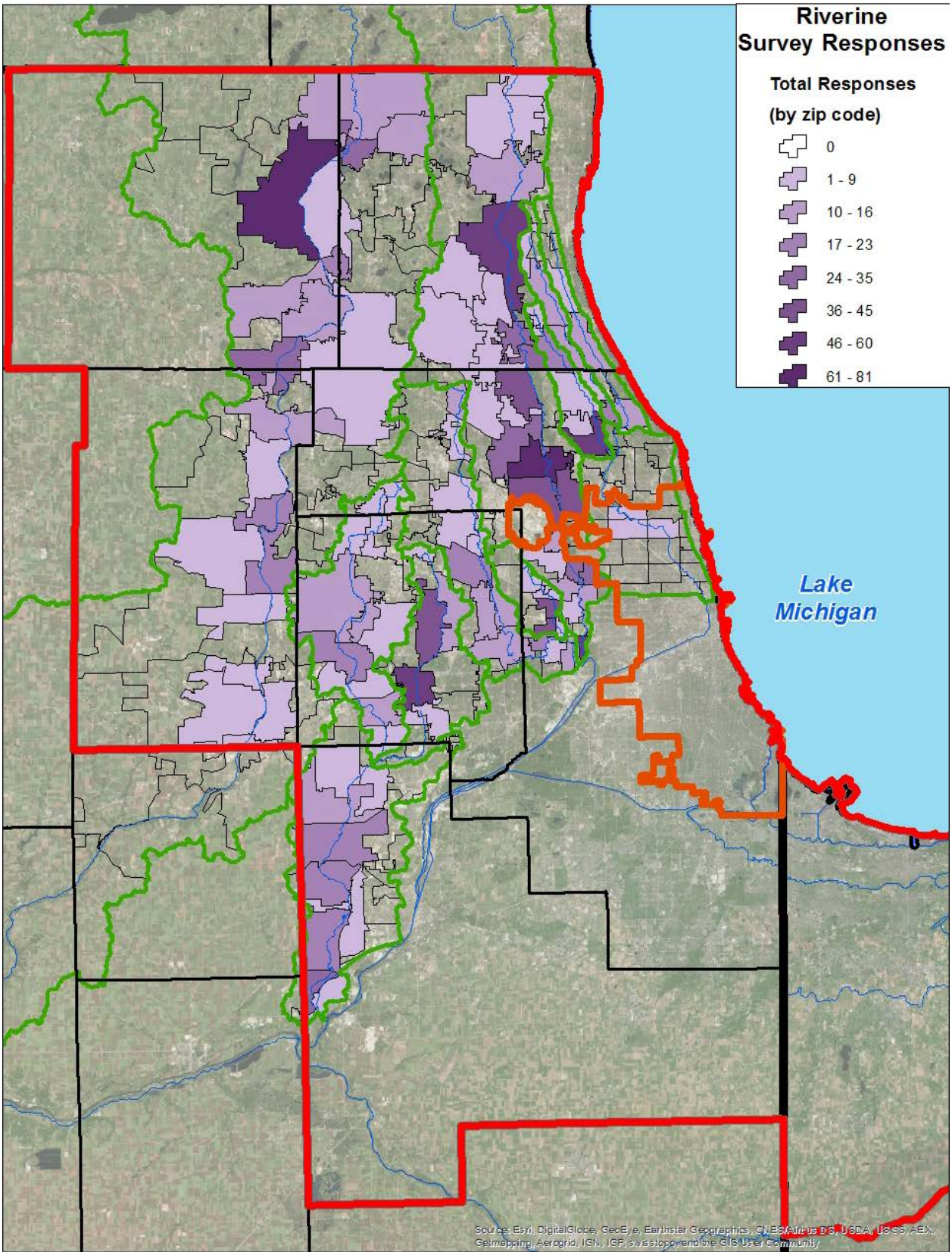

Figure 13 – Riverine Survey: Total Responses

3.2 Survey Questions

Separate surveys were developed for residential and non-residential property owners. Both surveys covered the same general topics: whether and how often flooding occurs at the property, the estimated value of the structure and its contents, the extent of flood damages caused by the April 2013 flood event, ways in which the property owners learned of potential flooding, and actions taken to prevent flooding and/or damages.

The residential survey included three parts: general property information, flood emergency response, as well as costs and damages. The non-residential survey included two parts: business data and individual building data. The full list of questions from each survey can be found in Appendix A and Appendix B.

Information about property value and property damages is not summarized here. Review of survey responses suggested the survey respondents may have interpreted these questions differently than intended, due to the broad range of responses. This, in addition to a low response rate to the questions regarding damages, led to the decision to remove it from consideration in this report. Instead, this summary focuses on the reported frequency of flooding, duration of the event, how property owners were notified of possible flooding, and how they responded.

4 Riverine Survey Results – Summary Statistics

The survey results were reviewed and summarized, checking for reasonable results. The results were divided into three sub-categories: general flooding information, flood warning, and flood response. For each question, only responses with reasonable and complete entries were included, as described below.

The overall number of survey responses was higher than the minimum goal set for the surveying efforts. Property owners were assumed to be more likely to respond if they did experience flooding in April 2013 or if they have a history of flooding or an awareness of flooding in their neighborhoods. Therefore, the survey results are likely skewed towards higher flooding incidents. It is inappropriate, therefore, to extrapolate survey results out for entire watersheds or subwatersheds (i.e. 50% of respondents in a particular watershed's floodplains indicating flooding in April 2013 does not correlate to 50% of structures in flood prone areas within that watershed experiencing flooding in April 2013).

4.1 General Flooding Information

The following four tables (Tables 8-11) examine rates and severity of flooding. First, each of the respondents indicated whether or not they were flooded as a result of the April 2013 rain event and whether or not they had flooded in the past (Table 8 and Figure 14). The results were based on question 2a in the residential survey and question 6a in the non-residential survey. The Des Plaines River Watershed had the highest response rate for flooding (54%) followed by the DuPage River (49%), the Fox River (47%), and the North Branch of the Chicago River (34%). Two areas of Cook County reported the highest rate of flooding along the Skokie River and Addison Creek (76% and 70% respectively). Table 8 also includes statistics of the number of respondents who flooded that reported that April 2013 was the first time that they had flooded. This data is mapped in Figure 15.

Respondents were then asked how often they flood, whether it was in April 2013 or in any previous instance during the time they have lived in their home (Table 9 and Figure 16). The results for Table 9 are based on questions 1 and 3 in the residential survey as well as questions 1 and 6a in the non-residential survey. Amongst the four watersheds, the Des Plaines River had the highest percentage (63%) of respondents who reported flooding in April 2013 or prior, followed by DuPage River (55%), North Branch of the Chicago River (49%), and the Fox River (48%). An average frequency of flooding was derived utilizing the survey input of average number of times flooded and average number of years at their residence. Eliminating outliers in the data, the frequency ranged from 3.6 to 8.6 years. At the subwatershed level, respondents in the Middle Fork of the Chicago River reported the most frequent flooding at an average of once every 2.6 years. Similarly, it was the North Branch of the Chicago River in which respondents reported the most frequent flooding of any watershed at an average of every 4.3 years. The average number of years at the respondent's residence was 23.2 years for the North Branch of the Chicago River, 27.4 years for the Des Plaines River, 26.5 years for the DuPage River, and

24.1 years for the Fox River. The North Branch of the Chicago River, therefore, had the most frequent flooding reported and the shortest average number of years at one's residence. The average frequency of reported flooding across all subwatersheds surveyed indicate that chronic repetitive flooding is widespread within the study area.

To examine severity of flooding, respondents were asked about the highest level of flooding within their home or building that they experienced in April 2013 (Table 10). Not every respondent who reported flooding responded to this question (i.e. 15% of respondents in the Des Plaines River Watershed who reported flooding did not respond). In this question, respondents were able to select first floor or basement flooding, but not both. Note that most respondents reporting first floor flooding either reported that they did not have a basement or did not answer the question about whether or not they did have a basement. It is presumed that first floor flooding indicates more severe flooding than basement flooding because first floors are more likely to be utilized as living space. Utilizing this presumption, respondents within the Fox River Watershed experienced the most severe flooding, with 30% of respondents reporting first floor flooding compared to DuPage (20%), Des Plaines (13%), and North Branch of the Chicago River Watersheds (11%).

The duration of flooding was also examined and reported in Table 11 and mapped in Figure 17. Residents living in the Des Plaines River Watershed had the highest response rate to this question (81%) followed by the DuPage River (77%) and the North Branch of the Chicago River (72%). The Fox River has a response rate of 136%, which means more people responded to this question than reported property flooding in April 2013. Those respondents likely answered the question about duration of flooding based on the duration of street or yard flooding near their property. Respondents in the Fox River Watershed reported the highest average flood duration at 185 hours (about seven and a half days). Only responses considered to include reasonable flood durations were included. Reasonable durations were identified by reviewing recorded gage height hydrographs for this event within each watershed to determine the amount of time that each waterway generally remained elevated above typical high water stages. Responses up to 3 days longer than the average duration of above flood stage were considered reasonable. Responses longer than this are likely to indicate the time that it took residents to clean up and dewater their basements from the event, while the intention of this survey question was to focus on the length of time that riverine flood waters remained elevated in their neighborhood.

Table 8 – Riverine Survey: Did your property flood as a result of the April 2013 rain event?

Watershed/County		Total Survey Responses	Flooded April 2013		Did Not Flood April 2013		% of Respondents Flooded
			Total	Prior Flooding	Total	Prior Flooding	
North Branch of the Chicago River	**Skokie River**						
	Lake Co.	17	2	1	15	0	12%
	Cook Co.	17	13	12	4	2	76%
	Total	34	15	13	19	2	44%
	Middle Fork Chicago River						
	Lake Co.	38	8	2	30	5	21%
	Cook Co.	20	8	7	12	0	40%
	Total	58	16	9	42	5	28%
	West Fork Chicago River						
	Lake Co.	30	4	2	26	9	13%
	Cook Co.	63	27	22	36	13	43%
	Total	93	31	24	62	22	33%
	North Branch Chicago River						
	Cook Co.	4	2	2	2	0	50%
	Total	4	2	2	2	0	50%
	Watershed Total	189	64	48	125	29	34%
Des Plaines River	**Addison Creek**						
	Cook Co.	102	71	64	31	8	70%
	Total	102	71	64	31	8	70%
	Salt Creek						
	Cook Co.	69	33	28	36	10	48%
	DuPage Co.	75	44	35	31	9	59%
	Total	144	77	63	67	19	53%
	Des Plaines River						
	Lake Co.	136	40	20	96	7	29%
	Cook Co.	456	261	197	195	47	57%
	Total	592	301	217	291	54	51%
	Watershed Total	838	449	344	389	81	54%
DuPage River	**East Branch DuPage River**						
	DuPage Co.	124	76	29	48	4	61%
	Will Co.	0	0	0	0	0	N/A
	Total	124	76	29	48	4	61%
	West Branch DuPage River						
	Cook Co.	12	0	0	12	4	0%
	DuPage Co.	70	32	23	38	4	46%
	Will Co.	2	1	1	1	0	50%
	Total	84	33	24	51	8	39%
	DuPage River						
	Will Co.	125	53	39	72	9	42%
	Total	125	53	39	72	9	42%
	Watershed Total	333	162	92	171	21	49%
Fox River	Lake Co.	142	80	37	62	1	56%
	McHenry Co.	251	109	40	142	3	43%
	Kane Co.	76	31	23	45	2	41%
	Watershed Total	469	220	100	249	6	47%

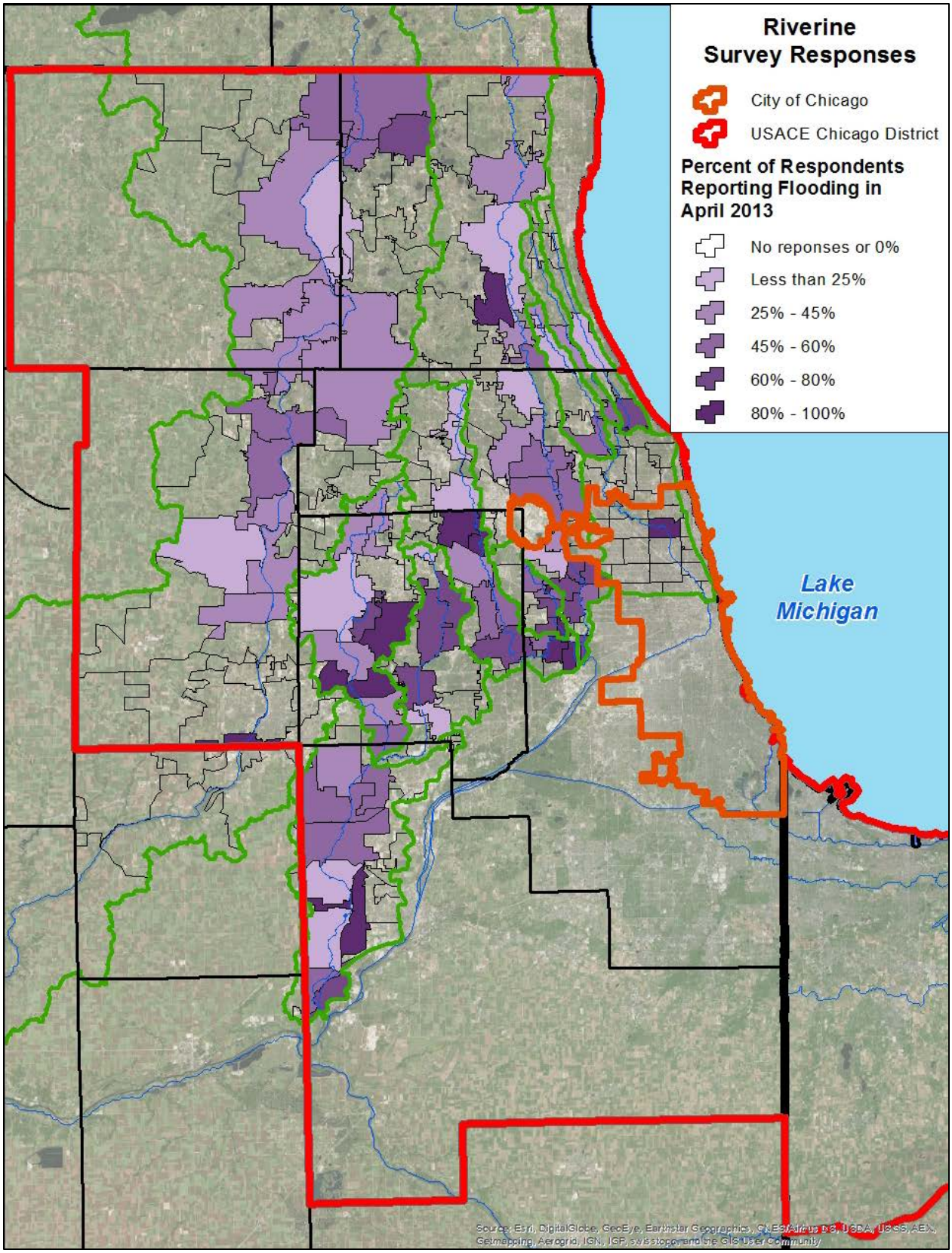

Figure 14 – Riverine Survey: Percent of Respondents Reporting Flooding in April 2013

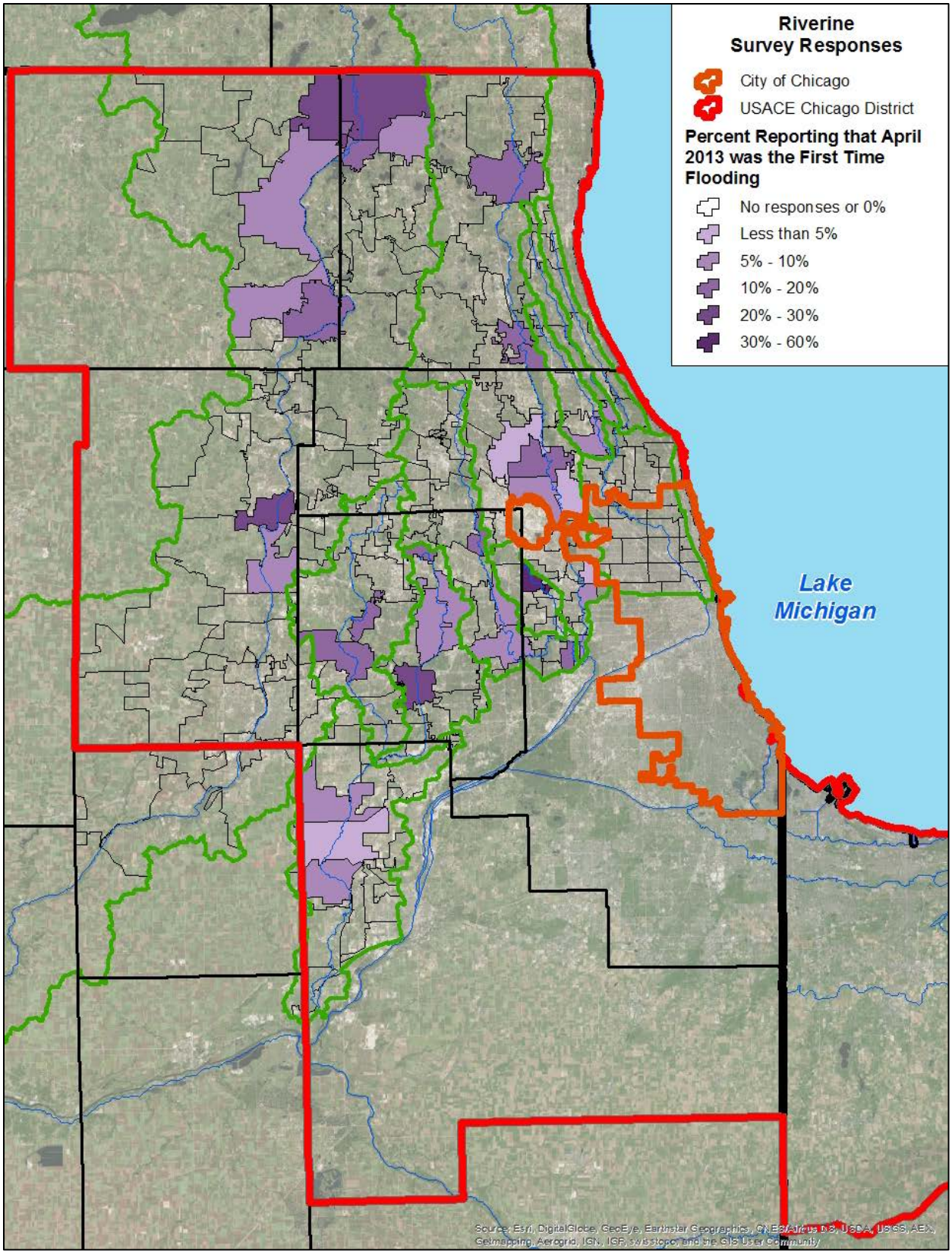

Figure 15 – Riverine Survey: April 2013 Was the First Time Flooding

Table 9 – Riverine Survey: How often have you experienced flooding?

Watershed/ County		Number of Respondents Reporting Flooding (in April 2013 or another event)	Average Number of Times Flooded	Average Number of Years at Location	Average Frequency of Flooding (years)
North Branch of the Chicago River	**Skokie River**				
	Lake Co.	2	3.0	11.0	5.0
	Cook Co.	15	4.4	21.7	3.4
	Total	17	4.3	21.0	3.5
	Middle Fork Chicago River				
	Lake Co.	13	1.7	21.6	3.4
	Cook Co.	8	6.1	18.4	1.9
	Total	21	3.9	20.0	2.6
	West Fork Chicago River				
	Lake Co.	13	2.8	29.3	11.8
	Cook Co.	40	3.3	21.3	5.5
	Total	53	3.2	23.2	6.3
	North Branch Chicago River				
	Cook Co.	2	5.5	22.5	3.9
	Total	2	5.5	22.5	3.9
	Watershed Total	93	3.6	22.2	4.3
Des Plaines River	**Addison Creek**				
	Cook Co.	79	4.5	25.9	5.1
	Total	79	4.5	25.9	5.1
	Salt Creek				
	Cook Co.	43	3.3	23.6	4.3
	DuPage Co.	53	3.3	28.7	7.2
	Total	96	3.3	26.3	5.6
	Des Plaines River				
	Lake Co.	47	3.6	35.3	6.3
	Cook Co.	308	4.5	27.3	5.5
	Total	355	4.4	28.1	5.6
	Watershed Total	530	4.2	27.4	5.5
DuPage River	**East DuPage River**				
	DuPage Co.	80	4.1	26.7	7.1
	Total	80	4.1	26.7	7.1
	West DuPage River				
	Cook Co.	4	1.3	29.5	19.0
	DuPage Co.	36	6.5	25.9	4.3
	Will Co.	1	10.0	11.0	1.1
	Total	41	6.0	25.9	4.4
	DuPage River				
	Will Co.	62	2.5	26.8	8.3
	Total	62	2.5	26.8	8.3
	Watershed Total	183	4.0	26.5	6.5
Fox River	Lake Co.	81	4.3	21.4	5.3
	McHenry Co.	112	4.8	25.7	6.1
	Kane Co.	33	3.8	25.4	5.1
	Watershed Total	226	4.4	24.1	5.6

Note: Respondents who did not provide an entry were removed from this summary. Each individual respondent indicated the number of floods and the length of time at the surveyed address. The totals reflect the average of the individual responses.

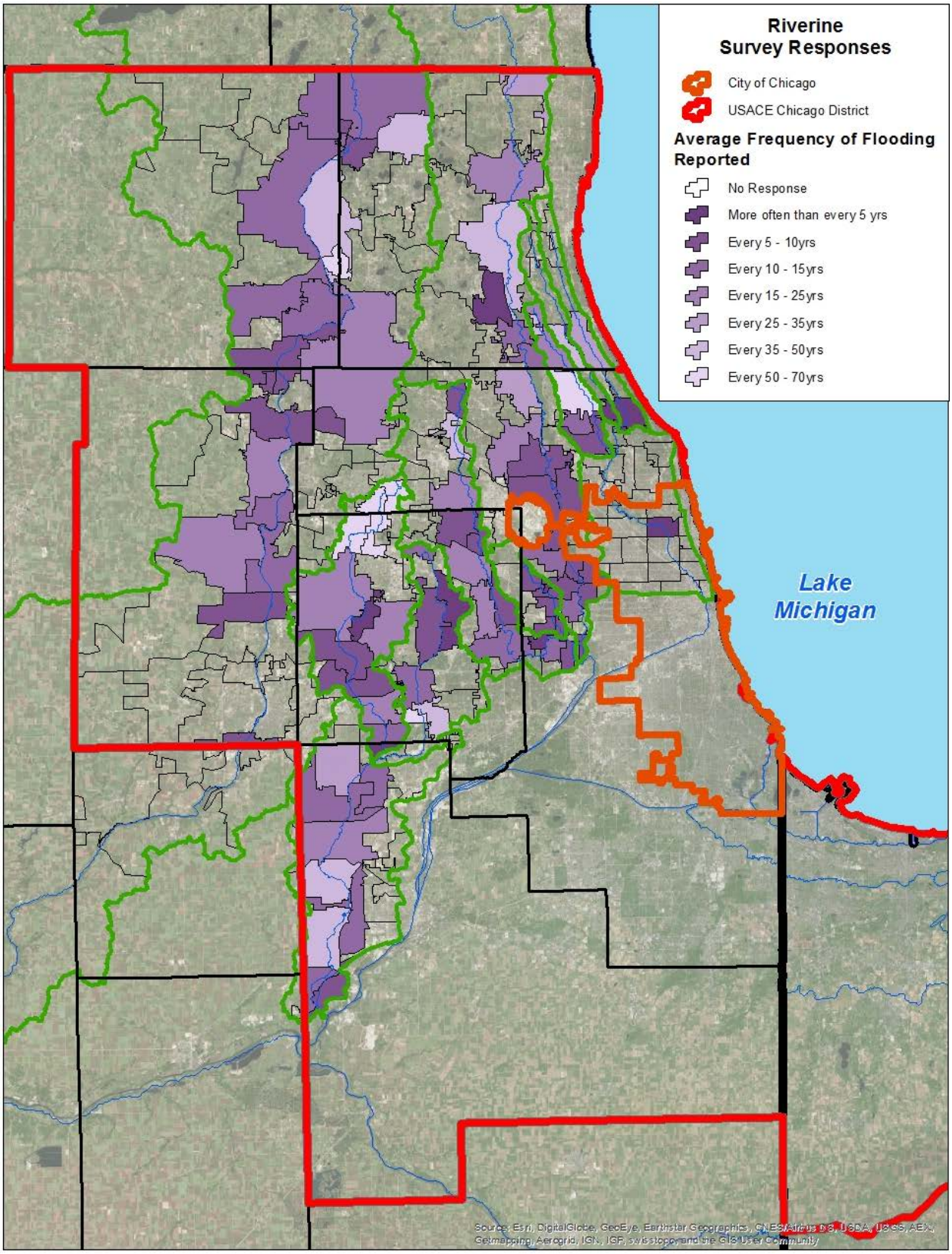

Figure 16 – Riverine Survey: Average Frequency of Flooding Reported

Table 10 – Riverine Survey: If your property flooded, what was the highest flooded level?

Watershed/ County		Number of Respondents Reporting Flooding	Basement Flooded	First Floor Flooded
North Branch of the Chicago River	**Skokie River**			
	Lake Co.	2	2	0
	Cook Co.	10	10	0
	Total	12	12	0
	Middle Fork Chicago River			
	Lake Co.	8	7	1 (13%)
	Cook Co.	6	5	1 (17%)
	Total	14	12	2 (14%)
	West Fork Chicago River			
	Lake Co.	4	4	0
	Cook Co.	23	19	4 (17%)
	Total	27	23	4 (15%)
	North Branch Chicago River			
	Cook Co.	2	2	0
	Total	2	2	0
	Watershed Total	55	49	6 (11%)
Des Plaines River	**Addison Creek**			
	Cook Co.	55	49	6 (11%)
	Total	55	49	6 (11%)
	Salt Creek			
	Cook Co.	29	27	2 (7%)
	DuPage Co.	38	30	8 (21%)
	Total	67	57	10 (15%)
	Des Plaines River			
	Lake Co.	30	19	11 (37%)
	Cook Co.	231	209	22 (10%)
	Total	261	228	33 (13%)
	Watershed Total	383	334	49 (13%)
DuPage River	**East DuPage River**			
	DuPage Co.	69	49	20 (29%)
	Total	69	49	20 (29%)
	West DuPage River			
	Cook Co.	0	0	0
	DuPage Co.	27	23	4 (15%)
	Will Co.	0	0	0
	Total	27	23	4 (0%)
	DuPage River			
	Will Co.	45	41	4 (9%)
	Total	45	41	4 (9%)
	Watershed Total	141	113	28 (20%)
Fox River	Lake Co.	61	40	21 (34%)
	McHenry Co.	92	64	28 (30%)
	Kane Co.	28	22	6 (21%)
	Watershed Total	181	126	55 (30%)

Note: Respondents who did not provide an entry were removed from this summary.

Table 11 – Riverine Survey: If your property flooded, how long did the flooding persist?

Watershed/ County		Total Responses	Minimum (hrs)	Average (hrs)	Maximum (hrs)
North Branch of the Chicago River	**Skokie River**				
	Lake Co.	2	36	42	48
	Cook Co.	10	6	16	48
	Total	12	6	20	48
	Middle Fork Chicago River				
	Lake Co.	4	12	>48 hrs (2.6 days)	>48 hrs (5 days)
	Cook Co.	6	4	20	48
	Total	10	4	37	>48 hrs (5 days)
	West Fork Chicago River				
	Lake Co.	2	12	>48 hrs (2.8 days)	>48 hrs (5 days)
	Cook Co.	20	2	13	>48 hrs (2 days)
	Total	22	2	17	>48 hrs (5 days)
	North Branch Chicago River				
	Cook Co.	2	4	38	>48 hrs (3 days)
	Total	2	4	38	>48 hrs (3 days)
	Watershed Total	46	2	23	>48 hrs (5 days)
Des Plaines River	**Addison Creek**				
	Cook Co.	69	1	37	>48 hrs (7.2 days)
	Total	69	1	37	>48 hrs (7.2 days)
	Salt Creek				
	Cook Co.	51	4	46	>48 hrs (7 days)
	DuPage Co.	53	1	29	>48 hrs (3 days)
	Total	104	1	37	>48 hrs (7 days)
	Des Plaines River				
	Lake Co.	70	2	>48 hrs (3.8 days)	>48 hrs (8 days)
	Cook Co.	305	1	>48 hrs (2.2 days)	>48 hrs (8 days)
	Total	242	1	>48 hrs (2.4 days)	>48 hrs (8 days)
	Watershed Total	362	1	>48 hrs (2.1 days)	>48 hrs (8 days)
DuPage River	**East DuPage River**				
	DuPage Co.	89	3	>48 hrs (2.3 days)	>48 hrs (7 days)
	Total	89	3	>48 hrs (2.3 days)	>48 hrs (7 days)
	West DuPage River				
	Cook Co.	7	N/A	N/A	N/A
	DuPage Co.	51	0	42	>48 hrs (5 days)
	Will Co.	2	N/A	N/A	N/A
	Total	60	3	>48 hrs (7.7 days)	>48 hrs (21 days)
	DuPage River				
	Will Co.	94	3	>48 hrs (2.1 days)	>48 hrs (6 days)
	Total	94	3	>48 hrs (2.1 days)	>48 hrs (6 days)
	Watershed Total	124	3	>48 hrs (2.1 days)	>48 hrs (7 days)
Fox River	Lake Co.	93	2	>48 hrs (9 days)	>48 hrs (21 days)
	McHenry Co.	148	1	>48 hrs (7.6 days)	>48 hrs (21 days)
	Kane Co.	59	20	>48 hrs (5.3 days)	>48 hrs (14 days)
	Watershed Total	300	1	>48 hrs (7.7 days)	>48 hrs (21 days)

Note: Respondents who did not provide an entry were removed from this summary.

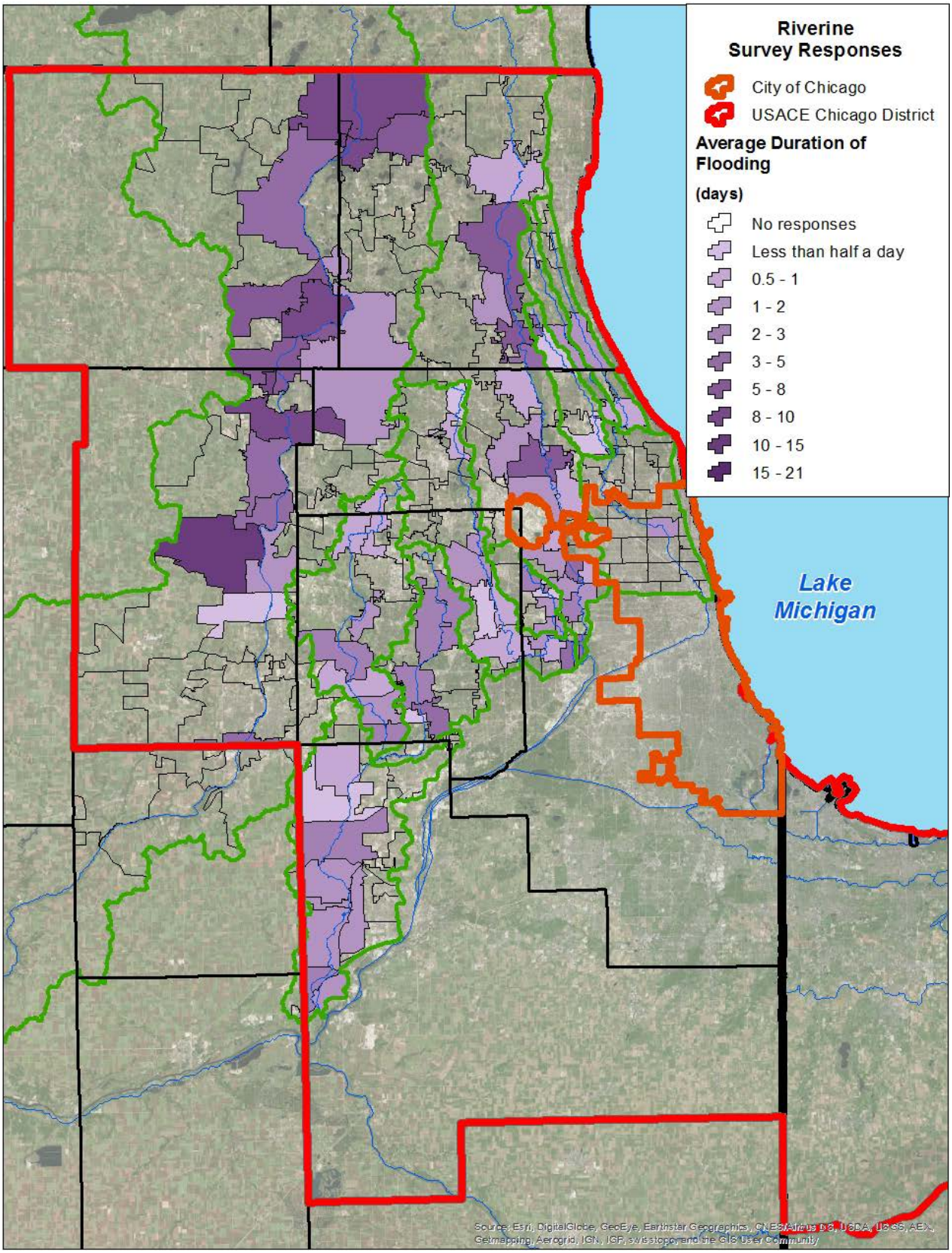

Figure 17 – Riverine Survey: Average Duration of Flooding

4.2 Flood Warning

For the flood warning category respondents were asked how they learned of potential flooding. While there was no option to indicate that no warning was received, some respondents selected "Other" and noted that they did not receive a warning or that their only warning was the inundation of their homes. Table 12 summarizes the total number of respondents who indicated that that they were not warned. The results of this table come from question 11 in the residential survey and question 8a in the non-residential survey. The results represent whether the respondent indicated they took any of the actions listed or none at all. Of the 1,780 respondents, nearly 95% indicated that they received warning in one way or another. The response rate for this question ranged from 95% to 98%. This data is mapped in Figure 18.

The survey also asked how respondents were warned and the responses are summarized in Table 13. This table expands on the results shown in Table 12 using the same questions from both surveys with the specific results respondents took. Types of warning that respondents were able to select were grouped into the following categories: observing water levels, official notification (by public, emergency, or other personnel), general news media, neighbor (or other person), or other. Respondents were able to select multiple warning types, so the number of responses based on the warning types may be more than the total number of responses for each subwatershed. Official notifications include notifications by public or emergency workers (face to face or over the phone), text messages, loudspeaker, or siren. Warnings by neighbors or another person include both face to face and phone calls. General news media included television, radio, C.B., ham radio, police scanner, and newspaper. It should be noted that notification from media is not always separate from public notice, as media sources deliver warning messages that government departments release. While the media releases of this information appeared to successfully reach a large number of people, the deployment of warnings in this manner are not necessarily targeted to specific high risk areas.

A large portion of respondents, specifically within the DuPage and Fox River Watersheds, indicated they were warned only by observing water levels. Based on the descriptions provided for this response, it appears that many respondents did not receive a formal warning, were either watching for potential flooding issues or only became aware of potential flooding when they observed it. The Fox River Watershed had the highest rate of response for warning by observing water levels (61%).

It should be noted that respondents may have perceived the option of "observing the river water levels" on the survey to include seeking information from sources such as NWS or USGS as many respondents are accustomed to monitoring riparian water levels due to the location of their home and proximity to gaged waterways. It is assumed, however, that most respondents reporting that they were warned by observing water levels only because they physically observed the water rising outside of their structure.

The highest reported rate of warning through an official notification came from the Des Plaines Watershed (11 %). The North Branch of the Chicago River and Skokie River had the highest rate of warning through news/media outlets (76%). While warning by neighbor or other person was noticeably low in all areas, respondents in Cook County living near the Des Plaines River reported 7% did receive notice by this means. The low rates in many of these categories and the high rate of simple observation present an opportunity for communities to improve communication and education regarding flooding. While notifications by public or emergency officials or other official types of notifications such as text alerts, sirens, or telephone messages was not widespread, the survey results did highlight several communities which successfully reached out to and contacted residents directly. Table 14 highlights communities with notable amounts of respondents who reported receiving official warning for potential flooding. These results were taken by referencing questions 11 and 8a in the residential and non-residential surveys, respectively, with background information of the address provided by the respondent.

Respondents were asked to report how much time they had between when they first became aware of potential flooding and when flooding actually occurred. This data is summarized in Table 15. These results are based on question 11a in the residential survey and 8b in the non-residential survey. All non-responses were removed from analysis. Additionally, warning times significantly greater than the typical lag times in each watershed were removed from analysis to eliminate responses indicating that respondents were made aware of the impending storm via local weather forecasts. Although weather forecasts provide a valuable service in preparing residents for severe weather and other hazards, the intent of this survey question was to identify the time it took after the rainfall occurred for it to become clear that flooding was likely to occur. Responses were limited to less than 24 hours for the Chicago River Watershed; less than 36 hours for the Addison Creek, Salt Creek, and East and West Branches of the DuPage River Watersheds; less than 48 hours for the DuPage River Watershed; less than 72 hours for the Des Plaines River Watershed; and less than 168 hours (7days) for the Fox River Watershed, based on the lag time analysis completed in Section 2.

Table 12 – Riverine Survey: Were you warned about possible flooding?

	Watershed/County	Total Responses	Warned	Not Warned
North Branch of the Chicago River	**Skokie River**			
	Lake Co.	16	15	1
	Cook Co.	16	14	2
	Total	32	29	3
	Middle Fork Chicago River			
	Lake Co.	35	35	0
	Cook Co.	20	18	2
	Total	55	53	2
	West Fork Chicago River			
	Lake Co.	28	26	2
	Cook Co.	62	59	3
	Total	90	85	5
	North Branch Chicago River			
	Cook Co.	4	4	0
	Total	4	4	0
	Watershed Total	181	171	10
Des Plaines River	**Addison Creek**			
	Cook Co.	100	90	10
	Total	100	90	10
	Salt Creek			
	Cook Co.	66	61	5
	DuPage Co.	75	69	6
	Total	141	130	11
	Des Plaines River			
	Lake Co.	133	125	8
	Cook Co.	445	419	26
	Total	578	544	34
	Watershed Total	819	764	55
DuPage River	**East Branch DuPage River**			
	DuPage Co.	122	108	14
	Total	122	108	14
	West Branch DuPage River			
	Cook Co.	12	12	0
	DuPage Co.	65	62	3
	Will Co.	2	2	0
	Total	79	76	3
	DuPage River			
	Will Co.	119	117	2
	Total	119	117	2
	Watershed Total	320	301	19
Fox River	Lake Co.	141	138	3
	McHenry Co.	246	239	7
	Kane Co.	73	73	0
	Watershed Total	460	450	10

Note: Respondents who did not provide an entry were removed from this summary.

Table 13 – Riverine Survey: How did you learn of potential flooding?

Watershed/County		Total Responses	Warning Type				
			Observing Water Levels (only) (%)	Public, Emergency Worker, or Other Official Notifications (%)	General News Media (%)	Neighbor or Other Person (%)	Other (%)
North Branch of the Chicago River	**Skokie River**						
	Lake Co.	15	4 (27%)	0 (0%)	11 (73%)	0 (0%)	0 (0%)
	Cook Co.	14	2 (14%)	0 (0%)	11 (79%)	1 (7%)	1 (7%)
	Total	29	6 (21%)	0 (0%)	22 (76%)	1 (3%)	1 (3%)
	Middle Fork Chicago River						
	Lake Co.	35	6 (17%)	0 (0%)	27 (77%)	0 (0%)	2 (6%)
	Cook Co.	18	7 (39%)	0 (0%)	11 (61%)	0 (0%)	0 (0%)
	Total	53	13 (25%)	0 (0%)	38 (72%)	0 (0%)	2 (4%)
	West Fork Chicago River						
	Lake Co.	26	7 (27%)	1 (4%)	18 (69%)	0 (0%)	0 (0%)
	Cook Co.	59	29 (49%)	9 (15%)	20 (34%)	0 (0%)	2 (3%)
	Total	85	36 (42%)	10 (12%)	38 (45%)	0 (0%)	2 (2%)
	North Branch Chicago River						
	Cook Co.	4	1 (25%)	0 (0%)	3 (75%)	0 (0%)	0 (0%)
	Total	4	1 (25%)	0 (0%)	3 (75%)	0 (0%)	0 (0%)
	Watershed Total	171	56 (33%)	10 (6%)	101 (59%)	1 (1%)	5 (3%)
Des Plaines River	**Addison Creek**						
	Cook Co.	90	38 (42%)	8 (9%)	40 (44%)	2 (2%)	2 (2%)
	Total	90	38 (42%)	8 (9%)	40 (44%)	2 (2%)	2 (2%)
	Salt Creek						
	Cook Co.	61	25 (41%)	5 (8%)	25 (41%)	2 (3%)	3 (5%)
	DuPage Co.	69	20 (29%)	7 (10%)	35 (51%)	2 (3%)	4 (6%)
	Total	130	45 (35%)	12 (9%)	60 (46%)	4 (3%)	7 (5%)
	Des Plaines River						
	Lake Co.	125	49 (39%)	18 (14%)	50 (40%)	4 (3%)	6 (5%)
	Cook Co.	419	124 (30%)	44 (11%)	196 (47%)	28 (7%)	26 (6%)
	Total	544	173 (32%)	62 (11%)	246 (45%)	32 (6%)	32 (6%)
	Watershed Total	764	256 (34%)	82 (11%)	346 (45%)	38 (5%)	41 (5%)
DuPage River	**East DuPage River**						
	DuPage Co.	108	55 (51%)	6 (6%)	41 (38%)	4 (4%)	3 (3%)
	Total	108	55 (51%)	6 (6%)	41 (38%)	4 (4%)	3 (3%)
	West DuPage River						
	Cook Co.	12	2 (17%)	1 (8%)	9 (75%)	0 (0%)	0 (0%)
	DuPage Co.	62	26 (42%)	1 (2%)	31 (50%)	1 (2%)	3 (5%)
	Will Co.	2	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
	Total	76	28 (37%)	2 (3%)	42 (55%)	1 (1%)	3 (4%)
	DuPage River						
	Will Co.	117	56 (48%)	1 (1%)	49 (42%)	4 (3%)	7 (6%)
	Total	117	56 (48%)	1 (1%)	49 (42%)	4 (3%)	7 (6%)
	Watershed Total	301	139 (46%)	9 (3%)	132 (44%)	9 (3%)	13 (4%)
Fox River	Lake Co.	138	92 (67%)	2 (1%)	38 (28%)	4 (3%)	1 (1%)
	McHenry Co.	239	144 (60%)	3 (1%)	83 (35%)	3 (1%)	6 (3%)
	Kane Co.	73	40 (55%)	2 (3%)	26 (36%)	1 (1%)	3 (4%)
	Watershed Total	450	276 (61%)	7 (2%)	147 (33%)	8 (2%)	10 (2%)

Note: Respondents who did not provide an entry were removed from this summary. Additionally, respondents were able to indicate more than one possible warning type.

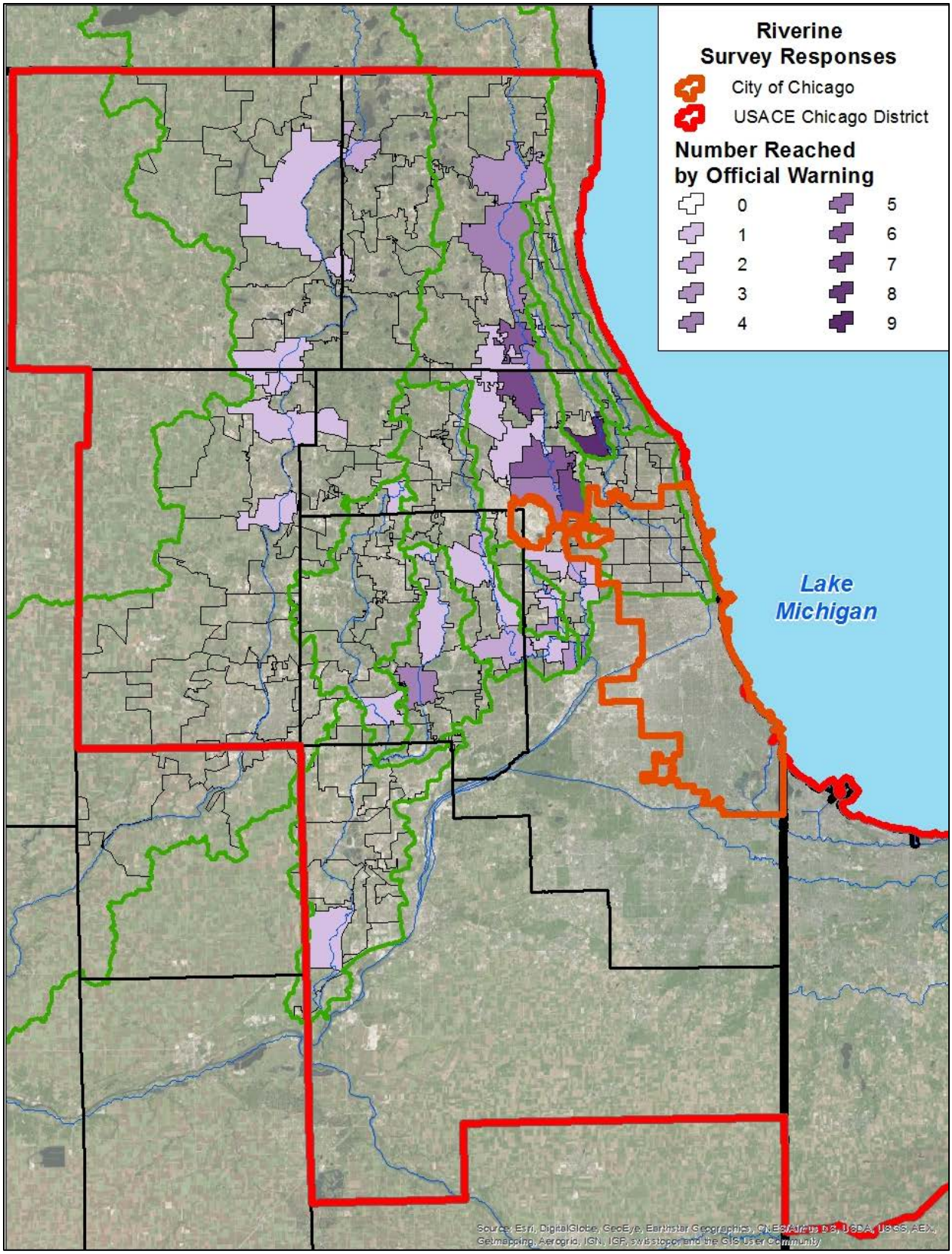

Figure 18 – Riverine Survey: Number reached by Official Warning

Table 14 – Riverine Survey: Notable Communities Providing Official Notification

Community	County	Watersheds	Total Surveys	Total Flooded	Total Warned by Public Official or Official Notification (%)	Total who Flooded and were Warned by Public Official or Official Notification (%)
Brookfield	Cook	Des Plaines River & Salt Creek	15	12 (80%)	4 (27%)	2 (17%)
Des Plaines	Cook	Des Plaines River	124	72 (58%)	10 (8%)	2 (3%)
Forest View	Cook	Des Plaines River	38	37 (97%)	7 (18%)	6 (16%)
Glenview	Cook	West Fork Chicago River	62	27 (44%)	9 (15%)	4 (15%)
Gurnee	Lake	Des Plaines River	16	6 (38%)	3 (19%)	1 (17%)
Libertyville	Lake	Des Plaines River & Middle Fork Chicago River	53	7 (13%)	4 (8%)	0 (0%)
Lincolnshire	Lake	Des Plaines River & West Fork Chicago River	36	14 (39%)	7 (19%)	3 (21%)
Lisle	DuPage	East Branch DuPage River	56	38 (68%)	4 (7%)	3 (8%)
Oak Brook	DuPage	Salt Creek	12	8 (67%)	2 (17%)	2 (25%)
Park Ridge	Cook	Des Plaines River	43	25 (58%)	6 (14%)	4 (16%)
River Grove	Cook	Des Plaines River	30	24 (80%)	2 (7%)	2 (8%)
Riverside	Cook	Des Plaines River	50	33 (66%)	5 (10%)	4 (12%)
Riverwoods	Lake	Des Plaines River & West Fork Chicago River	20	7 (35%)	4 (20%)	1 (14%)
Stone Park	Cook	Addison Creek	5	5 (100%)	3 (60%)	3 (60%)
Westchester	Cook	Addison Creek & Salt Creek	60	37 (62%)	4 (7%)	1 (3%)
Wheeling	Cook & Lake	Des Plaines River	41	8 (20%)	7 (17%)	3 (38%)
Wood Dale	DuPage	Salt Creek	8	7 (88%)	2 (25%)	2 (29%)

Table 15 – Riverine Survey: If warned, how much time passed before flooding reached you?

Watershed/ County		Total Responses	Minimum (hrs)	Average (hrs)	Maximum (hrs)
North Branch of the Chicago River	**Skokie River**				
	Lake Co.	6	5	8	12
	Cook Co.	11	1	8	24
	Total	17	1	8	24
	Middle Fork Chicago River				
	Lake Co.	17	2	11	24
	Cook Co.	15	2	9	24
	Total	32	2	10	24
	West Fork Chicago River				
	Lake Co.	16	2	15	24
	Cook Co.	48	1	7	24
	Total	64	1	9	24
	North Branch Chicago River				
	Cook Co.	4	1	12	24
	Total	4	1	12	24
	Watershed Total	117	1	9	24
Des Plaines River	**Addison Creek**				
	Cook Co.	68	1	7	24
	Total	68	1	7	24
	Salt Creek				
	Cook Co.	50	1	7	24
	DuPage Co.	51	1	8	24
	Total	101	1	8	24
	Des Plaines River				
	Lake Co.	76	2	26	72
	Cook Co.	313	1	12	72
	Total	389	1	15	72
	Watershed Total	558	1	13	72
DuPage River	**East DuPage River**				
	DuPage Co.	87	1	7	36
	Total	87	1	7	36
	West DuPage River				
	Cook Co.	7	1	5	12
	DuPage Co.	49	1	10	36
	Will Co.	1	12	12	12
	Total	57	1	9	36
	DuPage River				
	Will Co.	92	1	12	48
	Total	92	1	12	48
	Watershed Total	236	1	9	48
Fox River	Lake Co.	111	1	43	144
	McHenry Co.	181	1	41	144
	Kane Co.	59	1	22	72
	Watershed Total	351	1	38	144

Note: Respondents who did not provide an entry were removed from this summary. Additionally, to ensure reasonable responses, the possible range was limited, as described in Section 4.2

4.3 Flood Response

The final category for the survey summary focuses on how respondents reacted to potential flooding.

Flood response varied across the surveyed watersheds. Table 16 examines whether or not respondents took action in response to potential or actual flooding. This table references results from question 12 in the residential survey and question 9 in the non-residential survey. The table summarizes if a respondent took any of the actions listed or none of them. In each watershed studied, nearly all respondents answered this question. In the North Branch of the Chicago River, while 34% of respondents experienced flooding, 47% took action. Similar results occurred in the Des Plaines River (54% actually flooded versus 58% took action), the DuPage River (49% actually flooded versus 55% took action), and the Fox River (47% actually flooded versus 49% took action). The data demonstrates a positive finding that more respondents are preparing than are being flooded.

Respondents were then asked what specific actions they took in preparation for potential flooding (Table 17). These results were tabulated from question 12 in the residential survey and question 9 in the non-residential survey, the same as Table 16. The action most often taken was moving or elevating contents. In this category, 83% of the respondents in the Des Plaines River Watershed moved contents in their home — the highest rate. The average rate of shutting off electrical equipment was 23%. The Fox River had the highest rate (43%) of sandbagging or creating other temporary barriers, while the North Branch of the Chicago River had the lowest (25%).

Actions taken can be correlated to the warning time respondents reported in their respective watersheds. Those in the Fox River Watershed reported an average warning time of 38 hours allowing for more time to prepare for potential flooding, as opposed to the North Branch of the Chicago River reported an average warning time of 9 hours. This is due to the hydrologic nature of each watershed. The Chicago River Watershed is much more urban than the Fox River Watershed, meaning that more of the land area is covered by impervious surfaces and served by sewers which may directly discharge water into the River and its tributaries. Higher impervious surfaces result in the water running off of the land into the waterways more quickly resulting in less warning time for flooding. Additionally, the Chicago River Watershed is much smaller than the Fox River Watershed, meaning that rainfall has less overland distance to travel once it has reached the land surface so that flow peaks on the waterways occur sooner for smaller watersheds than for larger ones.

Table 16 – Riverine Survey: Did you take any action(s) as a result of possible flooding?

Watershed/ County		Total Responses	Took Action	No Action Taken
North Branch of the Chicago River	**Skokie River**			
	Lake Co.	17	3	14
	Cook Co.	16	13	3
	Total	33	16	17
	Middle Fork Chicago River			
	Lake Co.	38	10	28
	Cook Co.	20	7	13
	Total	58	17	41
	West Fork Chicago River			
	Lake Co.	30	12	18
	Cook Co.	63	42	21
	Total	93	54	39
	North Branch Chicago River			
	Cook Co.	4	2	2
	Total	4	2	2
	Watershed Total	188	89	99
Des Plaines River	**Addison Creek**			
	Cook Co.	101	64	37
	Total	101	64	37
	Salt Creek			
	Cook Co.	69	48	21
	DuPage Co.	74	48	26
	Total	143	96	47
	Des Plaines River			
	Lake Co.	136	49	87
	Cook Co.	454	273	182
	Total	590	322	246
	Watershed Total	834	482	353
DuPage River	**East Branch DuPage River**			
	DuPage Co.	123	71	52
	Total	123	71	52
	West Branch DuPage River			
	Cook Co.	12	3	9
	DuPage Co.	70	37	33
	Will Co.	2	0	2
	Total	84	40	44
	DuPage River			
	Will Co.	124	72	52
	Total	124	72	52
	Watershed Total	331	183	148
Fox River	Lake Co.	142	75	67
	McHenry Co.	251	119	132
	Kane Co.	76	37	39
	Watershed Total	469	231	238

Note: Respondents who did not provide an entry were removed from this summary.

Table 17 – Riverine Survey: What action(s) did you take in response to the flood?

Watershed/ County		Total Responses	Total who took action	Total who took no action	Average Number of Actions per Respondent	Action Type			
						Moved or Elevated Contents (%)	Shut off Electrical Equipment (%)	Sandbagged or other Temporary Barrier (%)	Other (%)
North Branch of the Chicago River	**Skokie River**								
	Lake Co.	17	3	14	1.3	1	0	1	2
	Cook Co.	16	13	3	1.4	11	1	3	3
	Total	*33*	*16*	*17*	*1.4*	*12 (75%)*	*1 (6%)*	*4 (25%)*	*5 (31%)*
	Middle Fork Chicago River								
	Lake Co.	38	10	28	1.2	7	0	0	5
	Cook Co.	20	7	13	2.0	6	1	4	3
	Total	*58*	*17*	*41*	*1.5*	*13 (76%)*	*1 (6%)*	*4 (24%)*	*8 (47%)*
	West Fork Chicago River								
	Lake Co.	30	12	18	1.5	8	1	0	9
	Cook Co.	63	42	21	1.6	36	5	14	11
	Total	*93*	*54*	*39*	*1.6*	*44 (81%)*	*6 (11%)*	*14 (26%)*	*20 (37%)*
	North Branch Chicago River								
	Cook Co.	4	2	2	2.0	2	1	0	1
	Total	*4*	*2*	*2*	*2.0*	*2*	*1*	*0*	*1*
	Watershed Total	*188*	*89*	*99*	*1.4*	*71 (80%)*	*(0%)*	*22 (25%)*	*34 (38%)*
Des Plaines River	**Addison Creek**								
	Cook Co.	101	64	37	1.9	58	24	20	21
	Total	*101*	*64*	*37*	*1.9*	*58 (91%)*	*24 (38%)*	*20 (31%)*	*21 (33%)*
	Salt Creek								
	Cook Co.	69	48	21	1.8	45	10	23	10
	DuPage Co.	74	48	26	1.8	44	9	16	18
	Total	*143*	*96*	*47*	*1.8*	*89 (93%)*	*19 (20%)*	*39 (41%)*	*28 (29%)*
	Des Plaines River								
	Lake Co.	136	49	87	2.0	31	10	36	21
	Cook Co.	455	273	182	1.7	224	57	82	109
	Total	*591*	*322*	*269*	*1.8*	*255 (79%)*	*67 (21%)*	*118 (37%)*	*130 (40%)*
	Watershed Total	*835*	*482*	*353*	*1.8*	*402 (83%)*	*110 (23%)*	*177 (37%)*	*179 (37%)*
DuPage River	**East Branch DuPage River**								
	DuPage Co.	123	71	52	1.7	51	23	9	35
	Total	123	71	52	1.7	51 (72%)	23 (32%)	9 (13%)	35 (49%)
	West Branch DuPage River								
	Cook Co.	12	3	9	1.3	2	0	0	2
	DuPage Co.	70	37	33	1.8	26	9	14	19
	Will Co.	2	0	2	N/A	N/A	N/A	N/A	N/A
	Total	*84*	*40*	*44*	*1.8*	*28 (70%)*	*9 (23%)*	*14 (35%)*	*21 (53%)*
	DuPage River								
	Will Co.	118	71	47	1.5	48	10	19	29
	Total	*118*	*71*	*47*	*1.5*	*48 (68%)*	*10 (14%)*	*19 (27%)*	*29 (41%)*
	Watershed Total	*325*	*182*	*143*	*1.6*	*127 (70%)*	*42 (23%)*	*42 (23%)*	*85 (47%)*
Fox River	Lake Co.	139	75	64	1.8	58	23	35	19
	McHenry Co.	229	114	115	1.7	73	21	53	44
	Kane Co.	76	37	39	1.6	27	9	8	14
	Watershed Total	*444*	*226*	*218*	*1.7*	*158 (70%)*	*53 (23%)*	*96 (42%)*	*77 (34%)*

Note: Respondents who did not provide an entry were removed from this summary. Additionally, respondent were able to indicate more than one possible action type.

5 Basement Survey

In addition to the riverine flood damage survey, a basement survey was conducted within Cook County to better understand the impact of the April 2013 flooding on residents who were not necessarily impacted by riverine flooding. The survey focused on the McCook Reservoir service area, which is part of the Tunnel and Reservoir Plan (TARP) system.

The Metropolitan Water Reclamation District of Greater Chicago (MWRD) and the U.S. Army Corps of Engineers (USACE) is in the process of constructing the TARP to reduce flood risk within the metro-area. The plan consists of a series of large tunnels over three hundred feet below the city's surface that carry combined sewer overflows to two primary reservoirs, Thornton and McCook. The Thornton and McCook Reservoirs are large open quarries that are being converted to reservoirs in phases, as mining operations continue. The subsurface tunnel system has largely been completed, and the Thornton Reservoir was put into operation in 2015. Stage I of the McCook Reservoir will be operational by the end of 2017 and the remainder of the McCook reservoir (Stage II) is expected to be operational by 2029. At the time of the flooding event in April 2013, only a transitional temporary reservoir at Thornton was in operation.

During the April 2013 event, the excessive rainfall that entered the sewer system within the McCook Reservoir service area could not flow fast enough to a wastewater treatment plant or a combined sewer outfall. As sewer water rose above drain openings that were below street grade, water backed up into homes and other buildings. Basement flooding occurred region wide. The City of Chicago reported receiving over 2,500 "water in basement" calls from residents in 49 of the 50 wards.

5.1 Survey Methodology

Nearly 40,000 postcards were mailed to a randomly selected set of residential property owners in the designated survey area, encompassing 88 zip codes, predominantly in the City of Chicago. 1,361 survey responses were received; 645 responses were from within city limits and 716 were from surrounding communities.

Due to the complex nature of the sewer and TARP systems, survey areas were divided by zip codes, instead of watersheds. To provide a meaningful reference for these boundaries, each zip code was assigned to a designated 'Community Area.' These areas provide a common reference point to summarize understand the location of aggregated survey results. Community Areas are labeled on the survey result summary maps in the next section.

The survey focused specifically on basement flooding and the source of that flooding (sewer backup, seepage, ponding, or through windows and doors). Residents were also asked to indicate when their most severe flooding experience was (month and year) and to report the approximate dollar amount of damage as a result of that event. Respondents were also asked

to indicate whether or not they experienced driving delays as a result of flooded roads during their most significant flooding experiences. The full list of questions from the survey can be found in Appendix C.

Table 18 includes a summary of total residential units compared to survey responses within each community area. Figure 19 includes a map of survey response per zip code for the survey area.

Results of the several of the survey questions area presented and analyzed in Section 5.2.

Table 18 – Basement Survey: Summary of Submitted Surveys

Community Area	Single Family Parcels	Surveys Sent	Responses	Response Rate	% of Population
Central	1,492	84	7	8%	0.5%
West Side	22,275	3,125	48	2%	0.2%
Southwest Side	58,641	5,072	97	2%	0.2%
North Side	17,617	2,986	105	4%	0.6%
South Side	9,536	1,411	38	3%	0.4%
Far Southeast Side	7,412	927	19	2%	0.3%
Far Southwest Side	19,377	1,415	40	3%	0.2%
Far North Side	46,498	4,815	215	4%	0.5%
Northwest Side	31,731	3,022	76	3%	0.2%
Northern Suburbs	59,446	4,926	289	6%	0.5%
Western Suburbs	85,500	7,738	421	5%	0.5%
Southwestern Suburbs	3,343	174	6	3%	0.2%
Total McCook Service Area	**362,868**	**35,695**	**1,361**	**4%**	**0.4%**

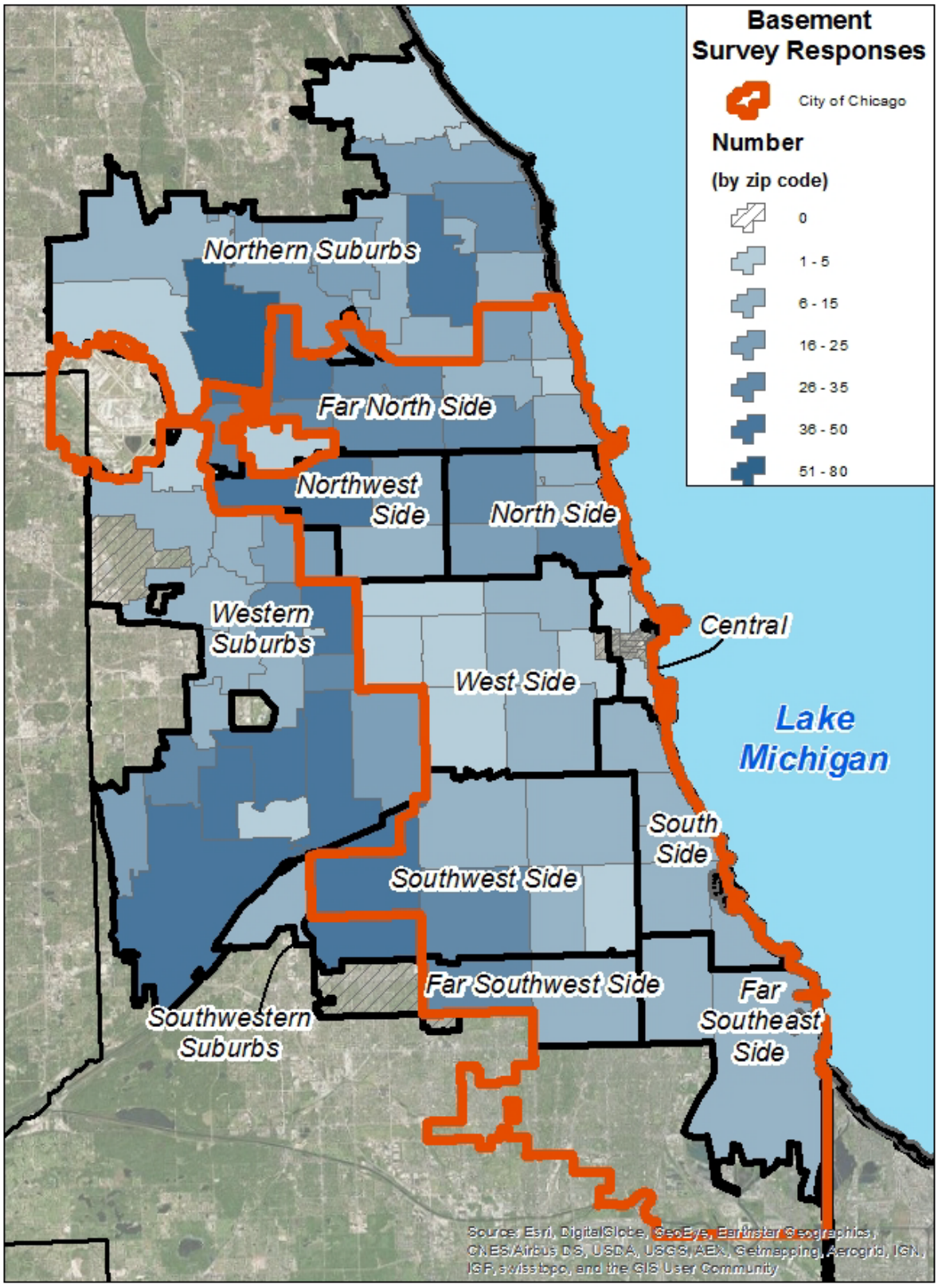

Figure 19 – Basement Survey: Total Responses

5.2 Survey Results

The survey results were reviewed and summarized, checking for reasonable results. The results for each 'Community Area' are summarized in Table 19. Only 10% of survey respondents reported that they experienced their worst flooding in April 2013 as the survey asked in Question 5 for the month and year of their worst flooding and not every occurrence of flooding. The average time respondents lived in their residence was 5 years. This data is mapped in Figure 20. Note that the survey asked respondents to report when they experienced their worst flooding, but did not specifically ask whether or not they flooded during April 2013. The low number of respondents indicating April 2013 as their worst flooding does not necessarily indicate that there was a low occurrence of basement flooding in this area, as respondents may have flooded in April 2013, but responded that their worst flooding occurred at a different time. Those responses indicating worst flooding in April 2013 were reported mostly in the Northern and Western Suburbs, which correlates with higher rainfall depths being recorded in those areas, as displayed in Figure 6.

Nearly 90% of respondents reported having experienced basement flooding at some point since they resided in the residence (Figure 21) and nearly 60% of respondents reported that they have experienced basement backup through connecting sewer lines (Figure 22). These results were tabulated from question 7a in the basement survey. Responses were relatively uniform across the survey area, indicating that basement flooding and sewer backup in particular are widespread and are experienced by residents all over the Chicago Metropolitan Area.

Respondents were also asked to estimate the dollar amount that they spent on clean up following their worst flooding experience. This was tabulated from question 7c. Many respondents did not provide an answer to this question, as they likely did not have the ability to provide a reasonable estimate or because they performed cleanup work themselves. The average cost of cleanup reported was $2,275 per resident and no spatial correlation to cleanup costs was identified (Figure 23).

Finally, respondents were asked to estimate the drive time increase that they experienced flooding during the time of their worst flood. While driving delays did not necessarily occur with the same zip code as the reporter's residence, average drive time increases were summarized based on the zip code of the response. Eliminating non-responses or response indicating no travel delays, the average drive time increase was 1.3 hours. This was tabulated from question 8b in the basement survey. Figure 24 includes a map of drive time delays. The most significant reported delays occurred on the Southwest side of Chicago, which is adjacent to Interstate 55.

Table 19 – Basement Survey: Flood Responses

Community Area	Number of responses	Number of Respondents Reporting Flooding	Number of Respondents Reporting Sewer Backup in Basement	Number of Respondents Reporting Worst Flooding in April 2013	Average Cost of Cleanup	Average increase in drive time (hr)
Central	7	6 (86%)	4 (57%)	0	$775	-
Far North Side	217	202 (93%)	139 (64%)	28 (13%)	$2878	1
Far Southeast Side	19	17 (89%)	14 (74%)	1 (5%)	$810	1
Far Southwest Side	40	34 (85%)	24 (60%)	0 (0%)	$791	1
North Side	105	83 (79%)	54 (51%)	7 (7%)	$2826	0.9
Northern Suburbs	287	255 (89%)	168 (59%)	40 (14%)	$2941	1.3
Northwest Side	76	73 (96%)	47 (62%)	11 (14%)	$2185	1.1
South Side	38	27 (71%)	21 (55%)	1 (3%)	$2334	3.3
Southwest Side	97	87 (90%)	62 (64%)	4 (4%)	$1772	1.9
Southwestern Suburbs	6	6 (100%)	6 (100%)	0 (0%)	$3600	1
West Side	48	42 (88%)	28 (58%)	1 (2%)	$2802	1.3
Western Suburbs	421	368 (87%)	220 (52%)	38 (9%)	$1683	1.2
Total	***1361***	***1,200 (88%)***	***787 (58%)***	***131 (10%)***	***$2275***	***1.3***

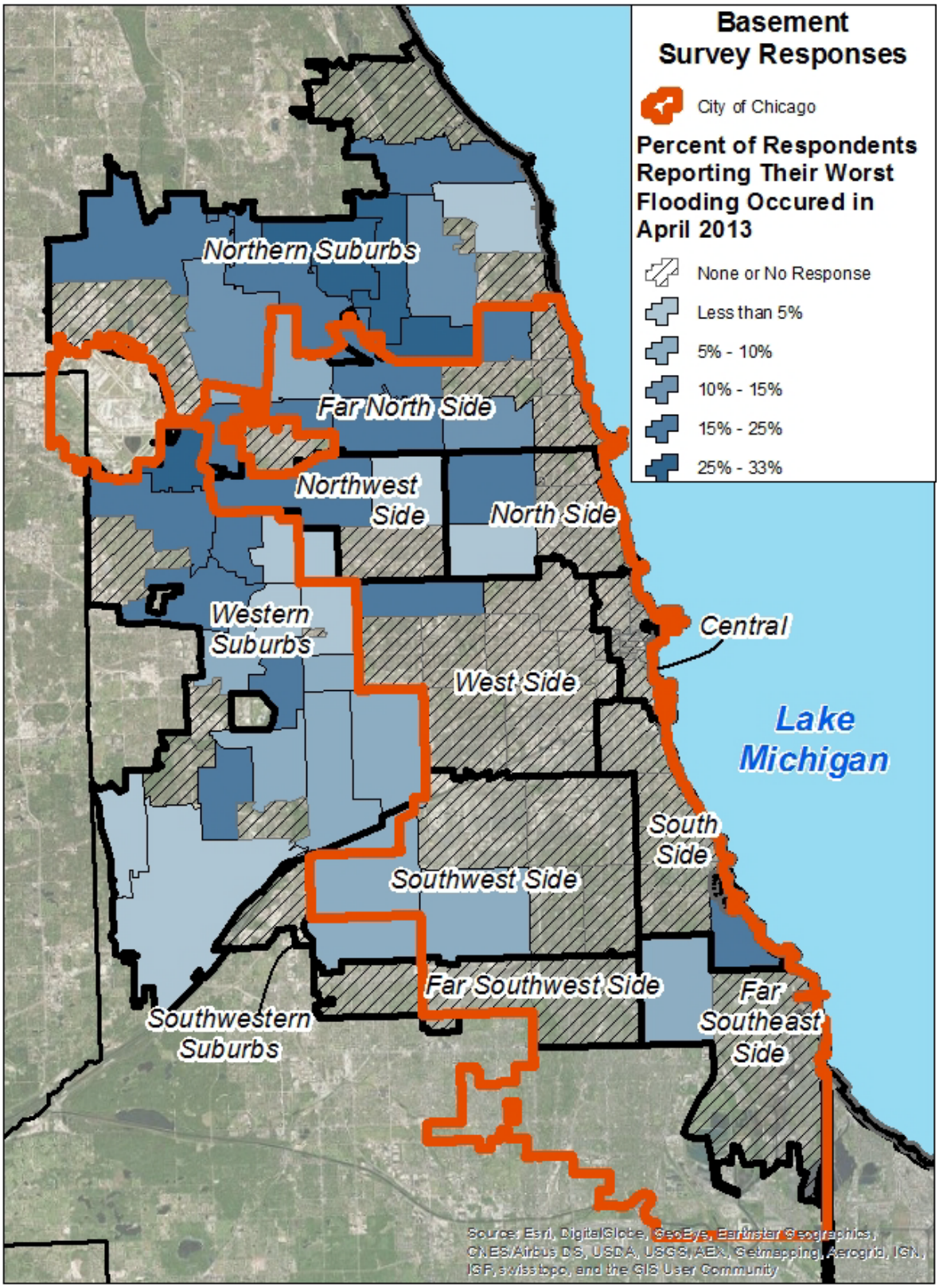

Figure 20 – Basement Survey: Percent of Respondents Reporting Their Worst Flooding in April 2013

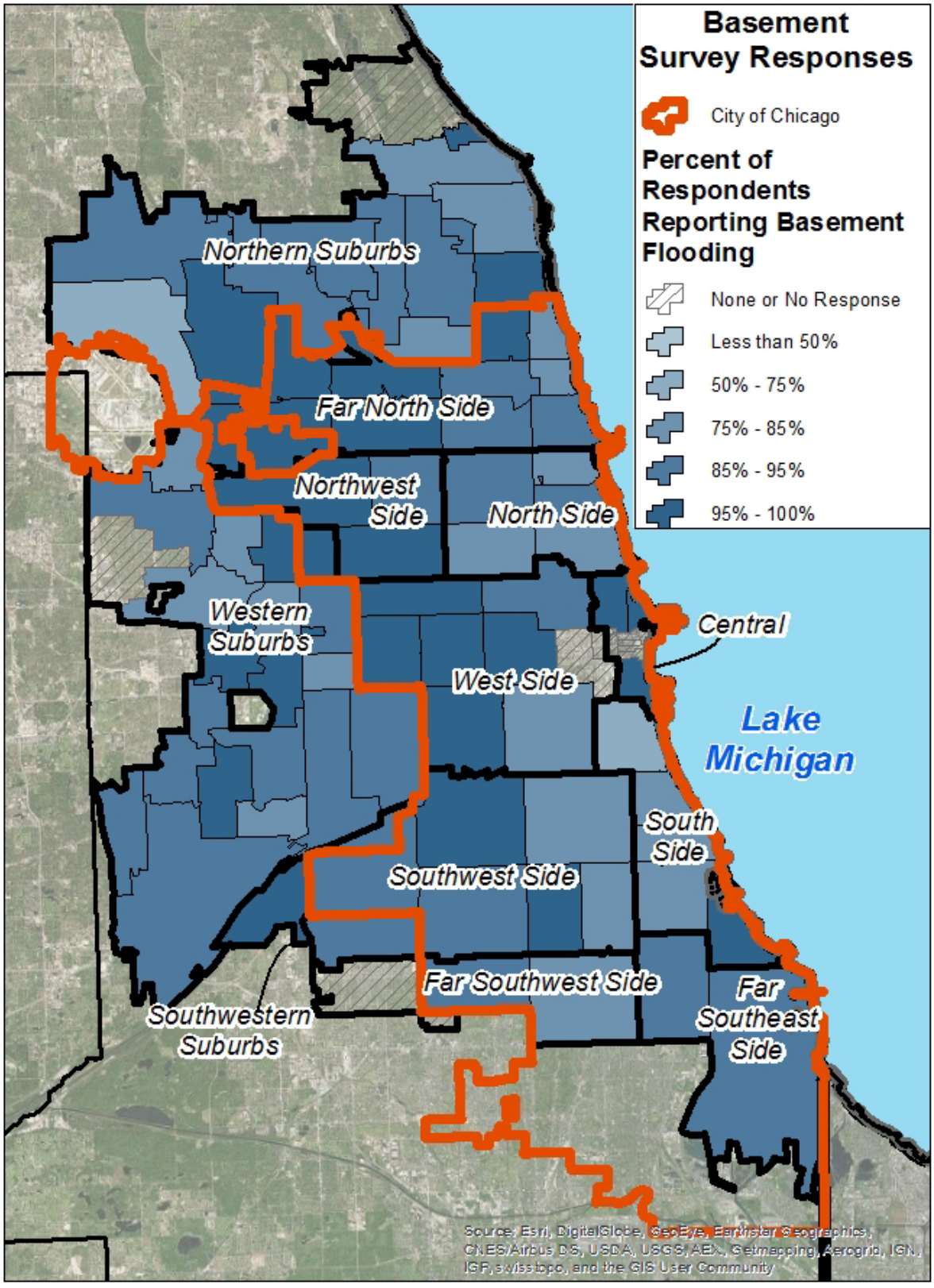

Figure 21 – Basement Survey: Percent of Respondents Reporting Basement Flooding

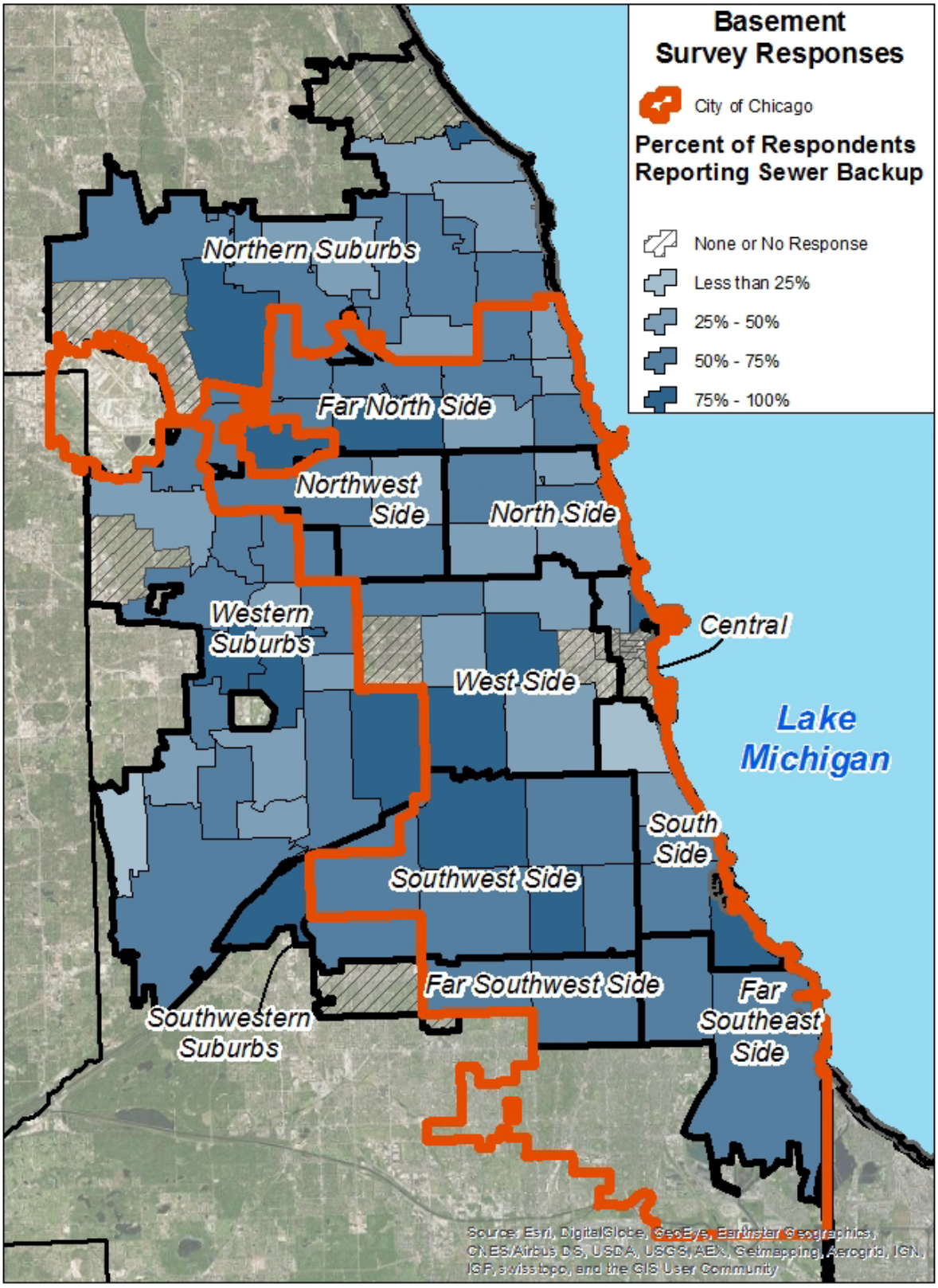

Figure 22 – Basement Survey: Percent of Respondents Reporting Sewer Backup

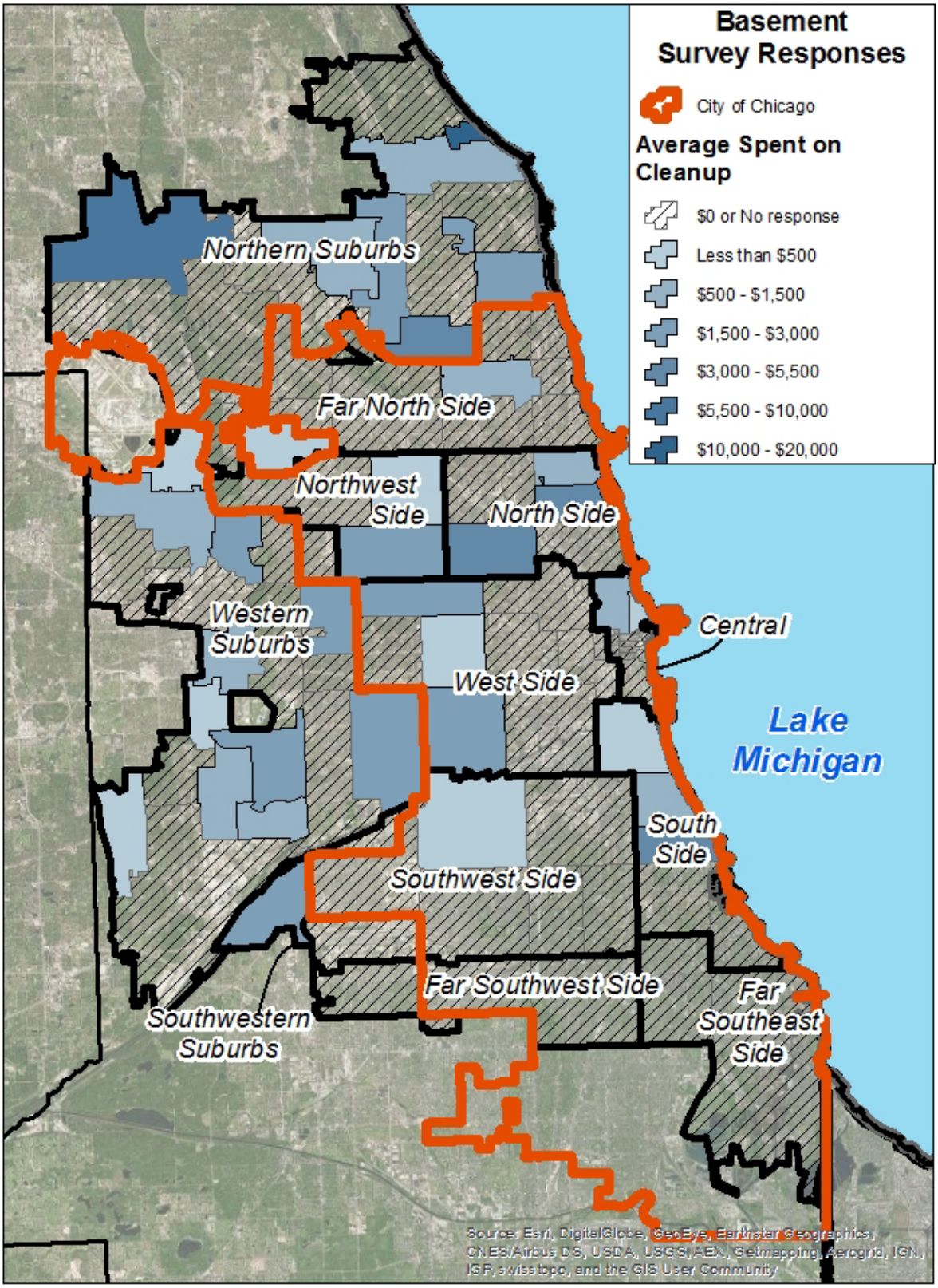

Figure 23 – Basement Survey: Average Spent on Cleanup

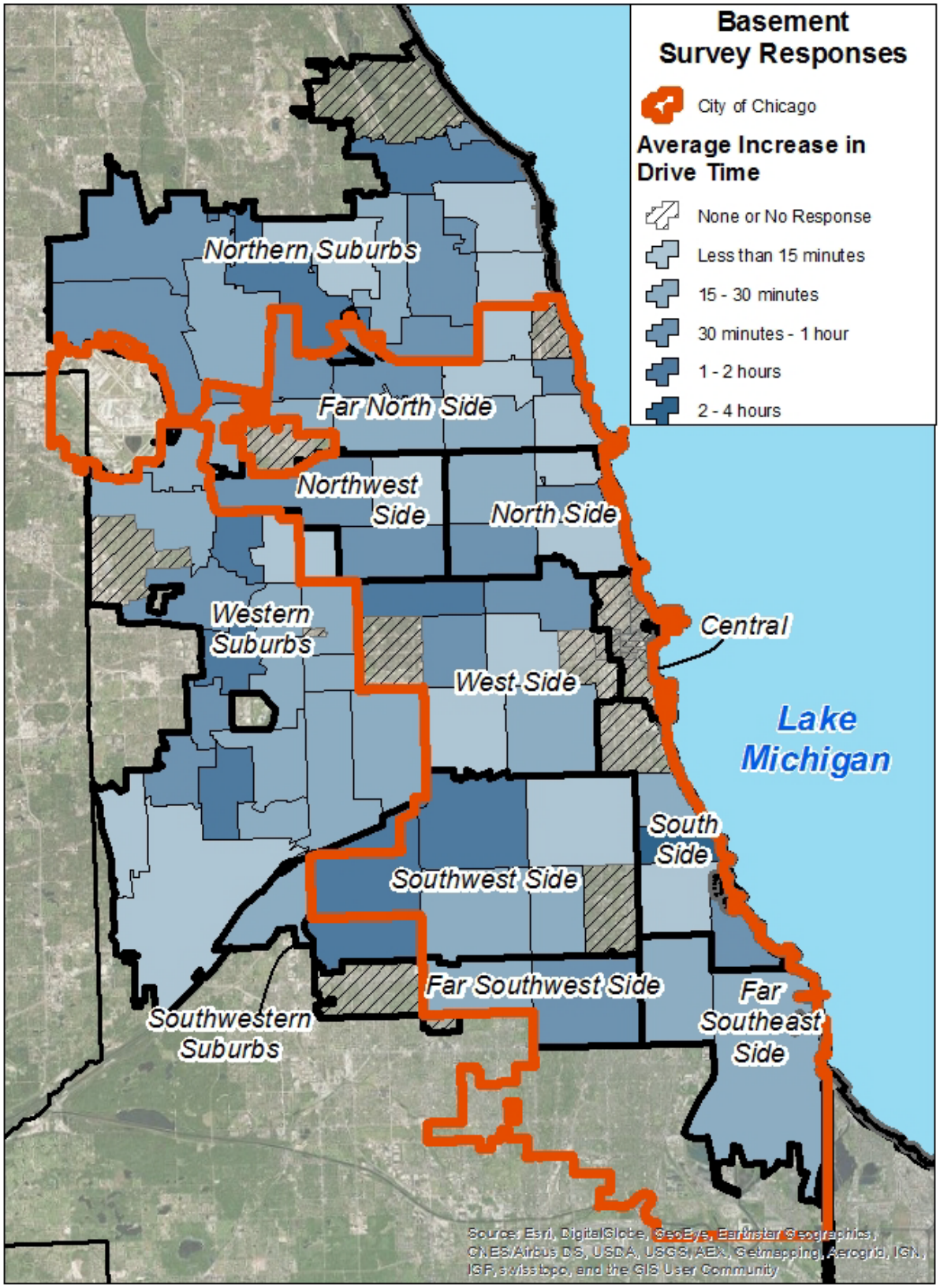

Figure 24 – Basement Survey: Average Increase in Drive Time

6 Recommendations

Of particular note is that while nearly all survey respondents reported receiving some type of warning prior to the flood event (95%), nearly 40% reported that the warning was only in the form of physically observing water levels rising. This type of warning allows only for reactive precautions rather than allowing for proactive response from property owners. It is noted that respondents may have perceived the option of "observing the river water levels" on the survey to include seeking information from sources such as NWS or USGS as many respondents are accustomed to monitoring riparian water levels due to the proximity of their home, however this is not considered to be the majority of respondents reporting receiving warning only by observing water levels.

Additionally, only about 6% of respondents reported receiving that warning or notification from a public or emergency official or public alert system. This is in contrast to the nearly 40% who received notification from television or other news media. While notification from news media can effectively reach significant portions of a community and is certainly an important form of communicating risk, more targeted notifications to specific at-risk locations may be more effective in informing residents and business owners of their specific risk. More targeted notifications from public officials can also provide an opportunity to advise citizens of appropriate actions to take to address those specific risks at a community or neighborhood specific scale. Emergency notification systems utilizing reverse 911 communication systems or implementation of emergency telephone notification networks through voluntary registration of community members have proven to be effective means of outreaching to residents in emergency situations such as flooding events.

As was noted in Table 14 of Section 4.2, the survey highlighted several communities which successfully reached out to and contacted residents directly to warn them of potential flooding. Expanding similar notification and warning plans into other at-risk communities can improve property-owner response and evacuation activities.

Additionally, the basement flooding survey revealed that the majority of respondents had experienced basement flooding at some time while they resided at their current residence. While the worst flooding experience was not likely to have occurred during the April 2013 flood event, the survey results indicate that basement flooding is widespread and universal in the Chicago Area. Municipalities should consider increased education to homeowners about the risks associated with basement sewer backups and about measures that property owners can take to lower their risk to such flooding. Various communities in the Chicago area have or have had cost-share programs to incentivize homeowners to reduce their risk to basement backup flooding. The Village of Schaumburg and The City of Calumet City have such programs, which can be replicated by other municipalities.

Finally, the questions and specific language of the various surveys completed limited the ability to draw strong conclusions related to the extent and impact of the 2013 flood event. The

survey used was selected from available questionnaires previously approved U.S. Office of Management and Budget (OMB). Public surveys employed by any Federal Agency, such as the Corps of Engineers, must first receive final approval from OMB. It is recommended that a more concise and targeted survey be prepared by USACE in collaboration with regional partners based on the lessons learned from the analysis of these surveys and that OMB approval for that survey be pursued. Having a prepared and approved surveys available for quick use following a future flood event will improve quality of analysis and the strength of the results and conclusions drawn from the survey efforts.

7 Conclusions

The April 2013 storm resulted in record flooding for many waterways in Northeastern Illinois. Rain gages recorded as much as much as 6.84 inches of precipitation in a 24-hour period. Twenty one (21) mainstream gages recorded peak stages as a response to this event. Ten (10) gages were estimated to have exceeded the 1% annual chance flood stage and of those, four (4) were estimated to have surpassed the 0.2% annual chance flood stage. Gages on each of the major waterways studied exceeded "Major Flood Stage", as defined by the NWS, with the Fox River exceeding this stage for over 9 days in at least one location.

The storm resulted in widespread significant economic damages across the region. In response to the event, FEMA expended over $150 million in Individual Assistance and over $5 million in Public Assistance within the study area. Additionally, US Department of Housing and Urban Development (HUD) awarded nearly $119 million of disaster recovery funding through their Community Development Block Grant (CDBG) program.

During the course of analyzing the survey responses, some trends were identified. The survey results help to better understand the nature of flooding, how and if warnings are being disseminated, and the actions respondents took in response potential flooding.

The survey confirmed the occurrence of widespread flooding. While some areas observed more flooding than others, or more survey respondents in general, the data and supporting figures demonstrate that flooding occurred across the area as indicated in both the basement and riparian surveys. Riparian flooding in the four watersheds has been known to occur in the past, however while basement backup has often been discussed, the survey confirmed the widespread nature of this as well.

Of the 1,829 respondents, 895 reported flooding in April 2013 and 311 of those indicated that this was the first occurrence in which their property flooded. For most respondents who flooded, the inundation occurred quickly and lasted for more than a day. This disrupted businesses, required significant time and money to be spent on clean-up, and forced respondents to seek out temporary housing. Flood warning time was longer in the larger

watersheds of the Des Plaines and Fox Rivers, but the duration of flooding was also longer in these areas.

While rainfall during this event was significant and fell over a short duration, many respondents were aware of potential flooding and took action to reduce their risk. There is an opportunity to improve existing warning systems, as the majority of respondents stated they received their warning through observing the water or through the general news media. However, with six hours or less of warning for most respondents, the rapid arrival of this event could account for the lack of official warning provided to affected residents.

Many respondents, either in response to a warning or in response to water entering their structure, tried to reduce their flood risk or potential damages. The vast majority of respondents opted to move or elevate their contents and attempted to construct some type of temporary barrier to prevent their structure from flooding. Flooding occurred despite many of these efforts, but educating people on what actions to take and how to prioritize their responses can go a long way in improving life-safety and reducing potential flood damage.

Evaluating existing warning systems, identifying where new warning systems should be put in place, and educating the community on how to prepare and respond to flooding can improve life-safety and reduce flood damages within northeastern Illinois.

8 Acknowledgements

The U.S. Army Corps of Engineers would like to acknowledge the FEMA Region V for sharing Individual Assistance and Public Assistance Data. The City of Chicago provided tabulated rain gage data for the period of analysis. Additionally, FEMA, United States Geological Survey – Illinois Water Science Center (USGS-IWSC), Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR), MWRDG, DuPage County, and Will County provided review assistance and comments for this report. USACE would also like to thank the survey respondents for their time and efforts completing the survey; without their valuable responses, this effort would not have been possible.

Appendix A – Residential Survey

US ARMY
CORPS OF ENGINEERS

CHICAGO REGION RESIDENTIAL FLOOD DAMAGE SURVEY

Project Description and Privacy Act Statement

The U.S. Army Corps of Engineers is conducting a flood damage survey in response to floods that occurred in your area in April 2013. This survey will help us to describe and quantify the types of flood damage that occurred due to this flood event. The results of this survey will also help us better plan for and respond to future flood events, as well evaluate the benefits of potential Corps projects in your area.

Individual responses will be collected and tabulated by type of response, but information specific to an individual residence will remain confidential. Individual responses will be retained in our files as backup data and retired to the Record Center after 10 years. Only the tabulated totals of the type of responses will be published in a project report, which will be circulated to the public.

Your participation in this survey is voluntary. There will be no consequences for declining to respond. However, your response is important and will provide us with information about flooding in your area.
Thank you for your time.

Public Report Burden

The public report burden for this information collection is estimated to average 10-15 minutes per response. Send comments regarding this burden estimate or any other aspect of this data collection, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, Virginia 22202-4302, and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503, Attn.: Desk Officer for U.S. Army Corps of Engineers. Respondents should be aware that notwithstanding any other provision of law, an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Please DO NOT RETURN your completed form to either of these addresses.

If you have questions, please contact Carol Tobler at Survey Center: (312) 321-8130.

Background Information

House Address: _____

Town: _____

Surveyor: _____ Photo File Number: _____

Coordinates: X _____ Y _____

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CHICAGO REGION RESIDENTIAL FLOOD DAMAGE SURVEY

1. How many years have you lived at this address? _____ years

2a. Did your home experience flooding during the April 2013 flood event in the Chicago Metropolitan area?

( ) No ( ) Yes

2b. Before the flooding of April 2013, had your home ever been flooded?

( ) No…**SKIP TO Q4.** ( ) Yes

3. Approximately how many times, including the April 2013 flood, has your home been flooded since you have lived here?

_____time

4. Do you own or rent your home?

( ) Own (or have mortgage) ( ) Rent

( ) Other…**Please specify:**_____

5. How old is your home? _____ years old

6. Prior to this last flood how many years ago had you completed any of the following renovations?

Renovation	**# of Years Ago**
New roof	_____
New heating or air condition system	_____
New floors or floor coverings	_____
Kitchen remodeling	_____
New siding	_____
New room(s)	_____
Other:_____	_____

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7. Not counting your basement, attic, or garage, how many square feet of living area are in your home?

_____ square feet

8. Please indicate the total basement area, in square feet, and the amount or proportion that is finished and unfinished?

	Square Feet
Total basement area	_____
Finished basement area	_____
Unfinished basement area	_____

9. Do you have a garage on this property?

( ) No…**SKIP TO Q10.** ( ) Yes

9a. Is the garage attached to the structure?

( ) No ( ) Yes

9b. How large is the garage in square feet? (If respondent is unsure, ask for the dimensions and calculate.)

_____ square feet

10. Do you have a carport?

( ) No…**SKIP TO Q11.** ( ) Yes

10a. How large is the carport in square feet? (If respondent is unsure, ask for the dimensions and calculate.)

_____ square feet

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PART II – FLOOD EMERGENCY RESPONSE

The next group of questions is to determine how you learned about the approaching flood and how you responded at the time.

11. Just before the April 2013 flood, how did you first become aware that flooding might reach your home?

( ) TV ( ) Radio ( ) Telephone by a public or emergency worker ( ) Telephone by other

( ) Face to face by public or emergency worker ( ) Face to face by other

( ) Loudspeaker ( ) Siren ( ) C.B., ham radio or police scanner ( ) Newspaper

( ) Observing the river water levels ( ) Other…**Please specify:**_____

11a. How many hours were there between the time you became aware that flooding might reach your home until the water actually reached your property?

_____ hours

12. What actions, if any, did you take to safeguard your property immediately prior to flooding and what were the damages prevented by each action?

Damage Preventive Action	**Dollar Damage Prevented**
( ) Moved contents to higher ground	$_____
( ) Elevated contents to a higher spot in the building	$_____
( ) Shut off electrical equipment	$_____
( ) Sandbagged the outside of the building	$_____
( ) Used another type of temporary barrier	$_____
( ) Other action _____	$_____
( ) None	

PART III - COSTS AND DAMAGES

The next group of questions is to determine flood damages to different types of property from the April 2013 flood.

13. Please indicate how high in feet and inches that the water was in your home.

_____feet; _____inches (basement or first floor)

14. How long did the water remain in this building?

_____days; _____hours

15. Did the flooding make it necessary for you or other members of your household to stay in temporary residence due to evacuation or while your home was being repaired?

( ) No…**SKIP TO Q16.** ( ) Yes

15a. How many days did you spend in temporary residence due to the evacuation or while flood damage to your home was being repaired?

_____ days

15b. How much money did your household spend on travel, beyond your normal travel expense, and lodging (including trailer rental) due to your evacuation(s) for the April 2013 flood?

_____ dollars

15c. Due to your evacuation, how much money did your household spend on food in excess of what you normally would have spent?

_____ dollars

16. For each motor vehicle, including cars, trucks, recreational vehicles, boats, and motorcycles, located at this residence during the flood, please indicate the dollar value, whether or not it was moved, the amount of damage to the vehicle, if any, and the level, in feet and inches, that the flood water reached above the bottom of the vehicle's wheels.

Vehicle Category and Year (Categories include: sedan, van, sports utility, sports cars, pickup trucks, and motorcycles)	**Dollar Value**	**Was it Moved?** (Circle Y or N)	**Dollar Damage**	**Water Depth Above Ground At Vehicle**
Vehicle 1:_____	$_____	Y N	$_____	_____
Vehicle 2:_____	$_____	Y N	$_____	_____
Vehicle 3:_____	$_____	Y N	$_____	_____
Vehicle 4:_____	$_____	Y N	$_____	_____
Vehicle 5:_____	$_____	Y N	$_____	_____
Vehicle 6:_____	$_____	Y N	$_____	_____

The following questions are to determine the dollar cost and unpaid hours for repair and cleanup of your home, and repair, replacement, and cleanup to the contents of your home that resulted from the April 2013 flood.

17. What was the cost of the structural damage to your home? (Structural damage is defined as damage to any building components, including foundation, walls, floors, windows, roof, electrical systems, heating and cooling systems, plumbing, attached carpeting, attached shelves and cabinets, and built-in equipment and appliances.)

$_____

17a. Which of the following is the primary source of your structure damage value?

( ) Contractor estimate (before repairs) ( ) Contractor invoice (after repairs)

( ) Your own assessment ( ) Other: _____

17b. What was the direct dollar cost to you for labor and supplies to clean up your **home** (structure) after the flood?

$_____

17c. What was the total number of unpaid hours that you and others spent on repair and cleanup to your home?

_____ hours

18. Please list your total real estate damages into the following categories.
Please also itemize any additional time that was spent on repairs other than paid labor hours.

	Value of Damages		
Area of Damage	**In % of total Or in dollars**		**Unpaid Hours to repair or install, in addition to $ spent**
Built-in shelves and appliances	_____%	$_____	_____
Electrical	_____%	$_____	_____
Plumbing	_____%	$_____	_____
Exterior walls, windows, doors (painting included), and roofing	_____%	$_____	_____
Footings and foundation	_____%	$_____	_____
Interior doors and walls (painting included)	_____%	$_____	_____
Interior floors, carpet and ceilings	_____%	$_____	_____
Mechanical systems – heat, A/C, sump pump, built-in vacuum	_____%	$_____	_____
Outbuildings, decks, fireplaces and garages	_____%	$_____	_____
Outside property and landscaping	_____%	$_____	_____
Septic, sewer, and water systems	_____%	$_____	_____
TOTAL	**100 %**	$_____	_____

19. What was the dollar cost of flood damage to the contents of your home, garage, and shed, excluding motor vehicles? (Only include content replacement and repairs, do not include repairs to the structure of the house. *Content damage refers to damage to personal property kept inside the home or the garage that is not permanently affixed to the home.*)

$_____

20. What were the total number of unpaid hours that you and others spent on repair of appliances, furniture, and other **contents** of your home?

_____ hours

21. How much, if anything, did each of the following cost you in actual dollar expenditures as a result of the April 2013 flood?

Costs for moving furniture and other belongings $_____

Costs for storing furniture and other belongings $_____

Vandalism, looting, or theft costs $_____

Costs from flooding-related medical problems $_____

Any other costs due to the _____ flood. $_____

Describe: _____

_____

Thank you so much for your help!

Please mail your completed survey to:

SURVEY CENTER
153 W. Ohio St., Suite 400
Chicago, IL 60654
Attn: Carol Tobler

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Appendix B – Non-Residential Survey

US ARMY
CORPS OF ENGINEERS

CHICAGO REGION NON-RESIDENTIAL FLOOD DAMAGE SURVEY

Project Description and Privacy Act Statement

The U.S. Army Corps of Engineers is conducting a flood damage survey in response to floods that occurred in your area in April 2013. This survey will help us to describe and quantify the types of flood damage that occurred due to this flood event. The results of this survey will also help us better plan for and respond to future flood events, as well evaluate the benefits of potential Corps projects in your area.

Individual responses will be collected and tabulated by type of response, but information specific to an individual residence will remain confidential. Individual responses will be retained in our files as backup data and retired to the Record Center after 10 years. Only the tabulated totals of the type of responses will be published in a project report, which will be circulated to the public.

Your participation in this survey is voluntary. There will be no consequences for declining to respond. However, your response is important and will provide us with information about flooding in your area.
Thank you for your time

Public Report Burden

The public report burden for this information collection is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this data collection, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503, Attn.: Desk Officer for U.S. Army Corps of Engineers. Respondents should be aware that notwithstanding any other provision of law, an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Please DO NOT RETURN your completed form to either of these offices.

If you have questions, please contact Carol Tobler at Survey Center: (312) 321-8130.

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CHICAGO REGION NON-RESIDENTIAL FLOOD DAMAGE SURVEY

PART ONE: BUSINESS DATA

1. What year was your business established at this location? _____

2. Briefly describe the major purpose of this business facility? _____

   _____

3. Please indicate which best describes your business facility's location:

   ( ) This business is the sole building occupant

   ( ) This business occupies multiple buildings in this location

   ( ) This business shares a building with (____) # of other businesses

4. Please indicate the number of full time, part time, and total employees.

   _____ _____ _____
   Full Time Part Time Total Employees

5. How many shifts are there in your daily operation? _____ shifts per day

6a. Did your business experience flooding during the April 2013 flood event in the Chicago Metropolitan area?

   ( ) No ( ) Yes

6b. While at this location, approximately how many times has this facility experienced flood damage, including the flooding from the April 2013 flood?

   _____ times

   If one or more times, skip to Q7.

6c. If this facility did <u>not</u> experience flooding, was this attributed to any flood prevention measures?

   ( ) No ( ) Yes…**Please identify:**_____

   Since your facility did not experience flooding, we can now end this survey. Thank you for your participation in this flood damage survey. Please skip to the last page for the return mailing address.

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7. How many days, if any, was this business closed due to the April 2013 flood? _____ days

   a. Did your business set up temporary quarters at another location because of the April 2013 floods? ( ) No ( ) Yes

   b. How much additional money did the flood cost your business in increased operational expenses, such as temporary quarters, additional transportation, communications, or storage expenses? $_____

8a. Just before April 2013 floods, how did you first become aware that flooding might reach your business?

( ) TV ( ) Radio ( ) Telephone by a public or emergency worker ( ) Telephone by other

( ) Face to face by public or emergency worker ( ) Face to face by other

( ) Loudspeaker ( ) Siren ( ) C.B., ham radio or police scanner ( ) Newspaper

( ) Observing the creek or river water levels ( ) Other…**Please specify:**_____

b. How many hours were there between the time you became aware that flooding might reach your business until the water actually reached your property? _____ hours

9. What actions, if any, did you take to safeguard your business property immediately prior to flooding and what were the dollar damages prevented by each action?

Damage Preventive Action	**Dollar Damage Prevented**
( ) Moved contents to higher ground	$_____
( ) Elevated contents to a higher spot in the building	$_____
( ) Shut off electrical equipment	$_____
( ) Sandbagged the outside of the building	$_____
( ) Used another type of temporary barrier	$_____
( ) Other action _____	$_____
( ) None	

10. What is the four-digit North American Standard Industrial Classification Number for this business?_____

11. What is the Marshall-Swift Occupancy Code for this business? _____

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PART TWO: INDIVIDUAL BUILDING DATA

(Include PART TWO questions for each building)

12. Building Number _____

13. Prior to the April 2013 floods, what was the value of all equipment physically attached or anchored to this building, not including the building itself? $_____

14. Prior to the April 2013 floods, what was the value of all other equipment, furniture, supplies, raw materials, and inventory generally stored in this building? $_____

15. Prior to the April 2013 floods, what was the value of all vehicles generally stored at this building? $_____

16. Prior to the April 2013 flooding, what was the value of all other equipment, supplies, and inventory stored outside of, but in the immediate vicinity of this building? $_____

17. Please indicate how high in feet and inches that the water got on the inside of the building relative to the first floor of the building?

_____ feet; _____ inches (above, below) first floor level
[CIRCLE]

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18. Please indicate the approximate dollar value of damage from the April 2013 floods to the following categories:

Structure Damage = Damage to any building components, including foundation, walls, floors, doors, windows, roof, electrical system, heating and cooling systems, plumbing, attached carpeting, attached shelves and cabinets, and built-in equipment and appliances.

Content Damage = Damage to unattached equipment, supplies, raw materials, and inventory.

Vehicles and Outside Property Damage = Damage to vehicles parked on premises; damage to inventory, materials, and equipment kept outside; and damage to signs, landscaping, and parking areas.

Preventive Costs = Costs of moving contents prior to and after flooding to avoid damage, costs of flood fighting.

Clean Up Costs = Costs of labor and materials to clean up interior and outside of building.

Business Record Replacement Costs = The financial costs and unpaid hours for reconstructing business records that where damaged by the flood.

Lost Revenues = Revenues lost due to business closure during or after the flood.

Type of Damage	**Amount of Cost or Damage**
Structure damage	$_____
Content damage	$_____
Vehicle damage	$_____
Preventive costs	$_____
Cleanup cost	$_____
Landscaping and outside property	$_____
Unpaid hours of time for clean and repair	#_____ unpaid hours
Business record replacement costs	$_____
	#_____ unpaid hours
Lost revenues	$_____

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19. How long did the water remain in this building? _____ days _____ hours

20. Excluding any basement or attic how many stories does this building have? _____ stories

21. What is the average story height in this building? _____ feet

22. What year was this building constructed? _____

23. What is the size of your building in square feet? _____ square feet

24. Does this building have a basement? ( )No…**SKIP TO Q25.** ( ) Yes

    a. If yes, please indicate the total basement area, and the area in square feet or dimensions of the area that is finished and unfinished?

    Total Area: _____ square feet

    Finished Area: _____ square feet

    Unfinished Area: _____ square feet

25. What is the 5-digit zip code of this business? _____

26. Indicate the class of this building:

    ( ) Fireproof Structural Steel Frame ( ) Reinforced Concrete Frame ( ) Masonry Bearing Walls

    ( ) Wood or Steel Stud Framed Exterior Walls ( ) Metal Frame Walls ( ) Mill Type Construction

    ( ) Pole Frame Construction

27. What is the effective age of this building? _____ years

28a. How many passenger elevators are in this building? _____ passenger elevators

b. How many freight elevators are in this building? _____ freight elevators

29. What is the rank (quality) of this building?

( ) Low ( ) Average ( ) Above average or good ( ) High cost or excellent

Thank you so much for your help!

Please mail your completed survey to:

SURVEY CENTER
153 W. Ohio St., Suite 400
Chicago, IL 60654
Attn: Carol Tobler

SURVEY CENTER, LLC, 153 W. Ohio St., Suite 400 Chicago IL | 312.321.8111 | lis@lis.com OMB Control Number: 0710-0001

Appendix C – Basement Survey

POST-FLOOD BASEMENT SURVEY FOR METRO CHICAGO

OMB Control Number: 0710-0001

The public report burden for this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this data collection, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503, Attn.: Desk Officer for U.S. Army Corps of Engineers. Respondents should be aware that notwithstanding any other provision of law, an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Please DO NOT RETURN your completed form to either of these offices.

We are conducting a brief survey on behalf of the U. S. Army Corps of Engineers to find out about flooding in your area. This information is being collected for internal purposes only and will not be publicly released in a format that where individual respondents can be identified. Participation is strictly voluntary. The interview will take no longer than 10 minutes. Are you willing to participate?

IF NO, THANK RESPONDENT AND TERMINATE.

SCREENING QUESTIONS:

1. a. What is your home address? _____

   ...SKIP TO 1B IF RESPONDENT PREFERS NOT PROVIDE HOME ADDRESS.

   b. What is your zip code?

( )	60016	( )	60018	( )	60043	( )	60053	( )	60068	( )	60076
( )	60077	( )	60091	( )	60093	( )	60130	( )	60131	( )	60153
( )	60155	( )	60160	( )	60164	( )	60171	( )	60176	( )	60201
( )	60202	( )	60203	( )	60301	( )	60302	( )	60304	( )	60305
( )	60402	( )	60456	( )	60459	( )	60501	( )	60513	( )	60525
( )	60526	( )	60534	( )	60546	( )	60558	( )	60605	( )	60606
( )	60607	( )	60608	( )	60609	( )	60610	( )	60611	( )	60612
( )	60613	( )	60614	( )	60615	( )	60616	( )	60617	( )	60618
( )	60619	( )	60620	( )	60621	( )	60622	( )	60623	( )	60624
( )	60625	( )	60626	( )	60629	( )	60630	( )	60631	( )	60632
( )	60634	( )	60636	( )	60637	( )	60638	( )	60639	( )	60640
( )	60641	( )	60642	( )	60644	( )	60645	( )	60646	( )	60647
( )	60649	( )	60651	( )	60652	( )	60653	( )	60654	( )	60656
( )	60657	( )	60659	( )	60660	( )	60661	( )	60706	( )	60707
( )	60712	( )	60714	( )	60804						

( ) OTHER (SPECIFY): _____ ...**IF OTHER TERMINATE**

2. Do you live a single-family home? ( ) YES ( ) NO... **IF NO, TERMINATE.**

OWN/RENT STATUS:

3. a. Do you own or rent your current residence? ( ) OWN ( ) RENT

   b. How long have you lived at this address?

   ____ ( ) MONTHS ____ ( ) YEARS

   c. Do you have a basement? ( ) YES ( ) NO... **If NO SKIP to Q. 11.**

DETERMINE SOURCE OF FLOODING:

I would like to find out more about any flooding you may have experienced. The next few questions will help determine if you experienced flooding.

4. a. Since you have moved into this residence, have you had any of the following problems in your basement?

   b. FOR EACH "YES," ASK: When was the last time you experienced…?

	(a) Any Problems?	(b) Last Time?
A sewer backup?	N Y…	____AGO
Water seepage through the walls or floors?	N Y…	____AGO
Entry of ponded waters, that is, water that has collected around your home?	N Y…	____AGO
Water damage through windows or doors, from streets, river, creek, or stream overflow?	N Y…	____AGO

IF NO TO ALL IN Q. 4 OR IF NONE IN "PAST THREE YEARS," SKIP TO Q. 11.

FLOOD EXPERIENCE: MOST SEVERE FLOOD EVENT:

5. For the most a severe flooding experience in the past three years in this residence, when did it occur?

   MONTH _____ …**IF DOESN'T RECALL MONTH, ASK SEASONS:** Summer, Fall, Winter, or Spring.

   YEAR: _____

6. And for the most severe flooding experience in this residence, was your basement flooded?

   ( ) NO… **IF NO, SKIP TO Q. 8a.**

   ( ) YES…**CONTINUE WITH Q.7.**

   ( ) DON'T KNOW…**GO TO Q.8a.**

7. a. **IF YES:** Where did the water come from? Did it come from…(ASK FOR EACH)?

	Yes	No
Sewer backup?		
Seepage through the walls or floors?		
Entry of ponded waters, that is, water that has collected around your home?		
Water damage through windows or doors, from streets, river, creek, or stream overflow?		

   b. What was the approximate water depth in basement?
   _____( ) FEET _____( ) INCHES **IF SPONTANEOUS:** ( ) DON'T KNOW

c. In terms of materials used such as cleaning supplies, plastic sheeting, pumps, vacuums and other materials, about how much did your household spend due to the flooding, not including the cost of repair damage to the structure of your house or its contents? $ _____ DOLLARS

d. Was there any structural damage to your home or any of the contents in your home?

( ) NO... **SKIP TO Q. 7e.**

( ) YES... What was the total dollar value of the damage to the structure and contents of your home, not including the cost of supplies or cleaning materials you purchased due to the flooding? $ _____

e. Thinking about the time spent trying to minimize the damages, such as time spent moving household items or furnishings, diverting the flow of water into your home, or removing water from your home, how many hours, in total, did your household spend before, during, and after the flood event trying to minimize damages like these? _____ HOURS

ROADS:

8. a. Did your daily driving time increase as a result of flooded roads?

( ) NO... **IF NO, SKIP TO Q.11.** ( ) YES

b. By about how long did your daily driving time increase? ____ ( ) MINUTES _____( ) HOURS

9. a. Were any roads made impossible to travel through due to flooding?

( ) NO... **IF NO, SKIP TO Q.11.** ( ) YES ( ) DON'T KNOW

b. What are the names of three most important roads which were impassible at any time?

1) _____ 2) _____ 3) _____

INTERVIEWER, AT THE END OF Q. 9b. , CONFIRM THE SPELLING OF ROADS BY "SPELLING BACK" ROAD NAMES TO THE RESPONDENT BY SAYING THE FOLLOWING:

"Could I please take a moment to confirm the spelling of those roads? Road 1was... (NAME OF ROAD), Road 2 was... (NAME OF ROAD), and Road 3 was ... (NAME OF ROAD).

10. a. Thinking about the road that was closed for the longest period of time, about how many days or hours was that road closed?

_____ ( ) DAYS _____ ( ) HOURS **IF SPONTANEOUS:** ( ) DON'T KNOW

b. Which road was closed for the longest period of time? _____

11. What is your best guess of the current market value of your residence, including the lot?
READ ALTERNATIVES:

( ) UNDER $50,000 ( ) $151,000 TO $200,000

( ) $51,000 TO $100,000 ( ) OVER $200,000

( ) $101,000 TO $151,000

RECORD GENDER FROM OBSERVATION: ( ) MALE ( ) FEMALE

Thank you for cooperating with this survey and for aiding the U. S. Army Corps of Engineers in collecting data about flooding in your area. Have a nice day/evening! In closing, my name is _____. If you would like to contact the U. S. Army Corps of Engineers, you can call Dena Abou at (312) 846-5584, between the hours of 8:00 a.m. to 4:30 p.m., Monday through Friday. This questionnaire has been approved for use by the Office of Management and Budget, a federal agency, with a reference number of 0710-0001.

Your name, address, and phone number are being requested for response verification purposes only and will be kept confidential.

NAME: _____ PHONE: _____

ADDRESS: _____ CITY/STATE: _____

ZIP CODE: _____ INTERVIEWER: _____ DATE: _____