



ILLINOIS

Illinois State Water Survey

PRAIRIE RESEARCH INSTITUTE

Estimating the Return on Investment of Buyouts: A Loss Avoidance Case Study for the City of Ottawa, Illinois

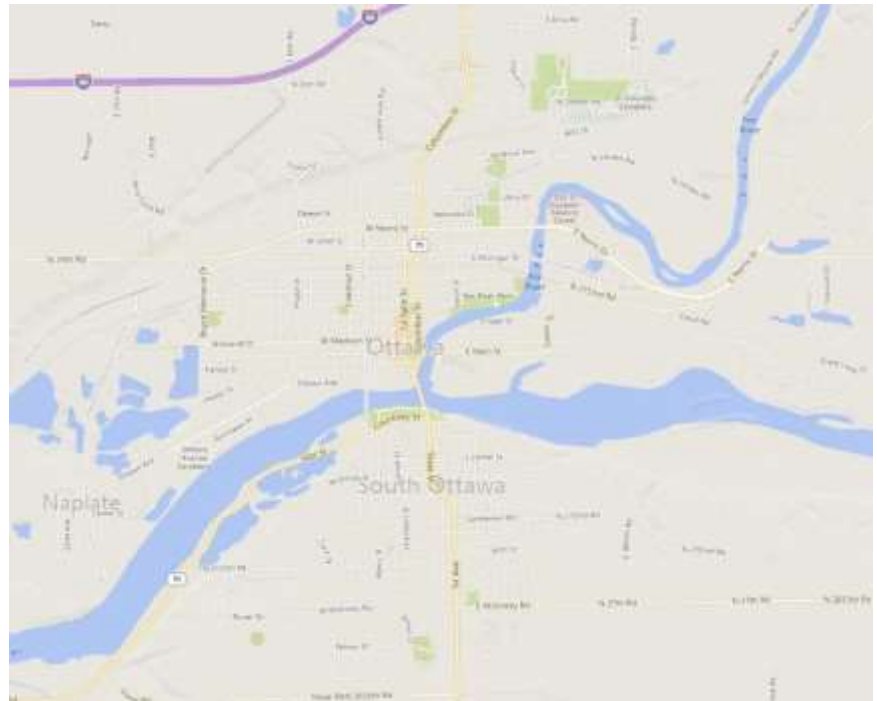
Brad McVay, GISP, CFM

Chris Hanstad, P.E., CFM

Sally McConkey, P.E., CFM, D. WRE.

Overview

- City of Ottawa, IL
 - Population: 18,768 (2016 Estimate. U.S. Census)
 - Confluence of Illinois River and Fox River
- Major Flood in 1996
- Over the past 20 years Ottawa has been working to remove at-risk structures from the floodplain
- Case study
 - Estimate the Return on Investment (ROI) for these buyouts
 - State of Illinois Hazard Mitigation Plan



BCA versus Loss Avoidance

- Benefit-Cost Analysis (BCA) vs. Loss Avoidance
 - BCA
 - Estimate of future benefits of a mitigation project
 - Benefit Cost Ratio (BCR)
 - Total Benefits / Total Cost
 - Loss Avoidance Analysis
 - Estimate of the return on investment from real flood events that have occurred in the past
 - Return on Investment
 - Losses Avoided / Project Investment * 100
- Looking at what could happen vs. what has happened

Project Partners

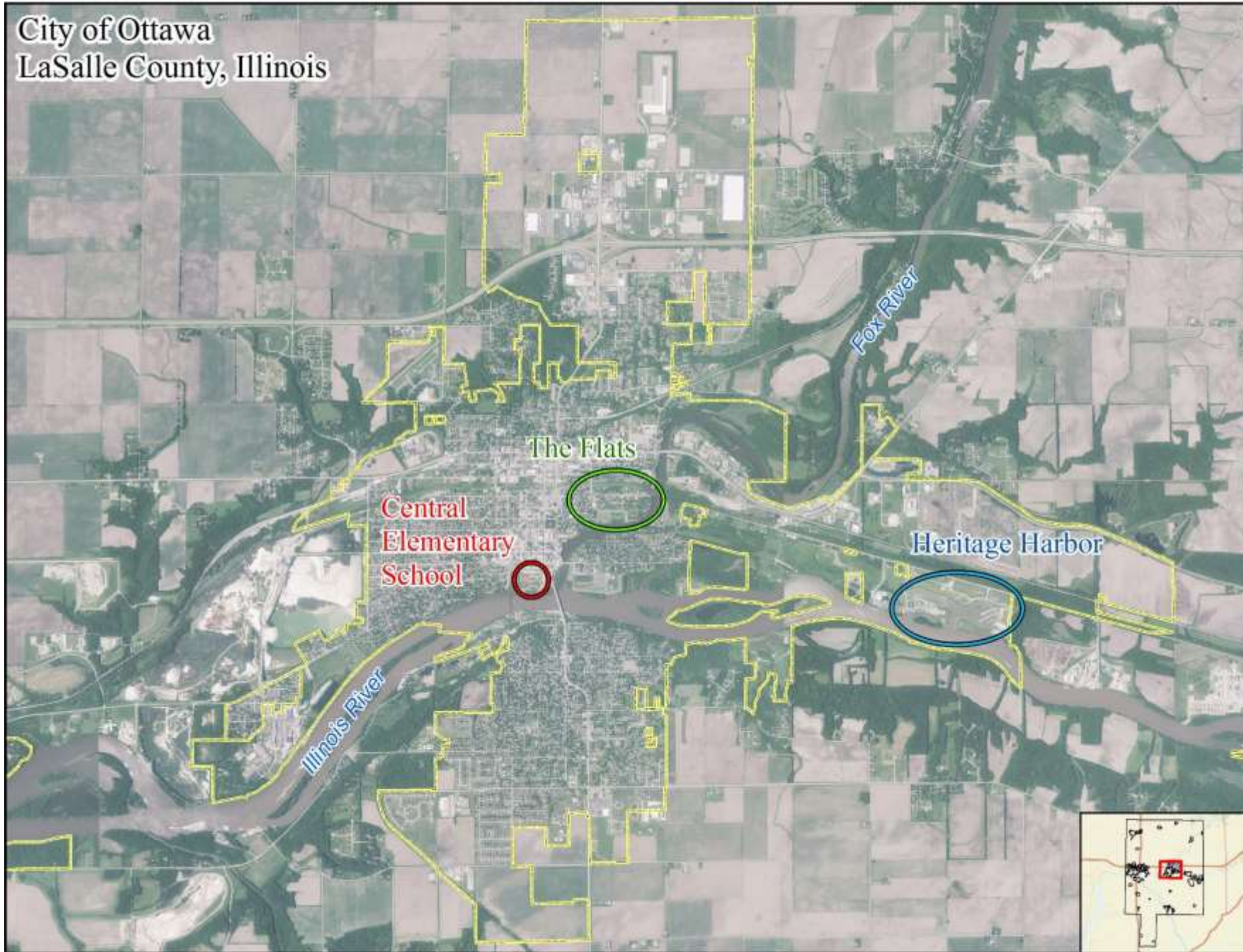
- Illinois State Water Survey (ISWS)
- Critical Infrastructure Resilience Institute (CIRI)
- Illinois Department of Natural Resources, Office of Water Resources (IDNR/OWR)
- Illinois Emergency Management Agency (IEMA)
- City of Ottawa
- LaSalle County

Summary

- **Description of Project Area (City of Ottawa)**
- **History**
 - Flooding
 - Funding
- Gathering and Developing Data for Analysis
- Hazus Analysis
- Timeline of Buyouts and Results
- Central Elementary School and Heritage Harbor
- Obstacles
- Drone Flight



City of Ottawa
LaSalle County, Illinois



Recent History of Flooding

- Fox River at Dayton

- Flood Stage: 12'
- Moderate: 14'
- Major: 24'

- Peaks

- Peak of Record: 24.63' (Oct. 1954)
- 7/19/1996: 24.47'
- 2/22/1997: 21.46'
- 1/17/2005: 17.53'
- 8/24/2007: 16.86'
- 9/14/2008: 21.48'
- 4/19/2013: 20.74'
- 2/21/2018: 15.94'

Source: LaSalle Co. FIS, NWS Advanced Hydrologic Prediction Service

- Illinois River at Ottawa

- Flood Stage: 463'
- Moderate: 466'
- Major: 469'

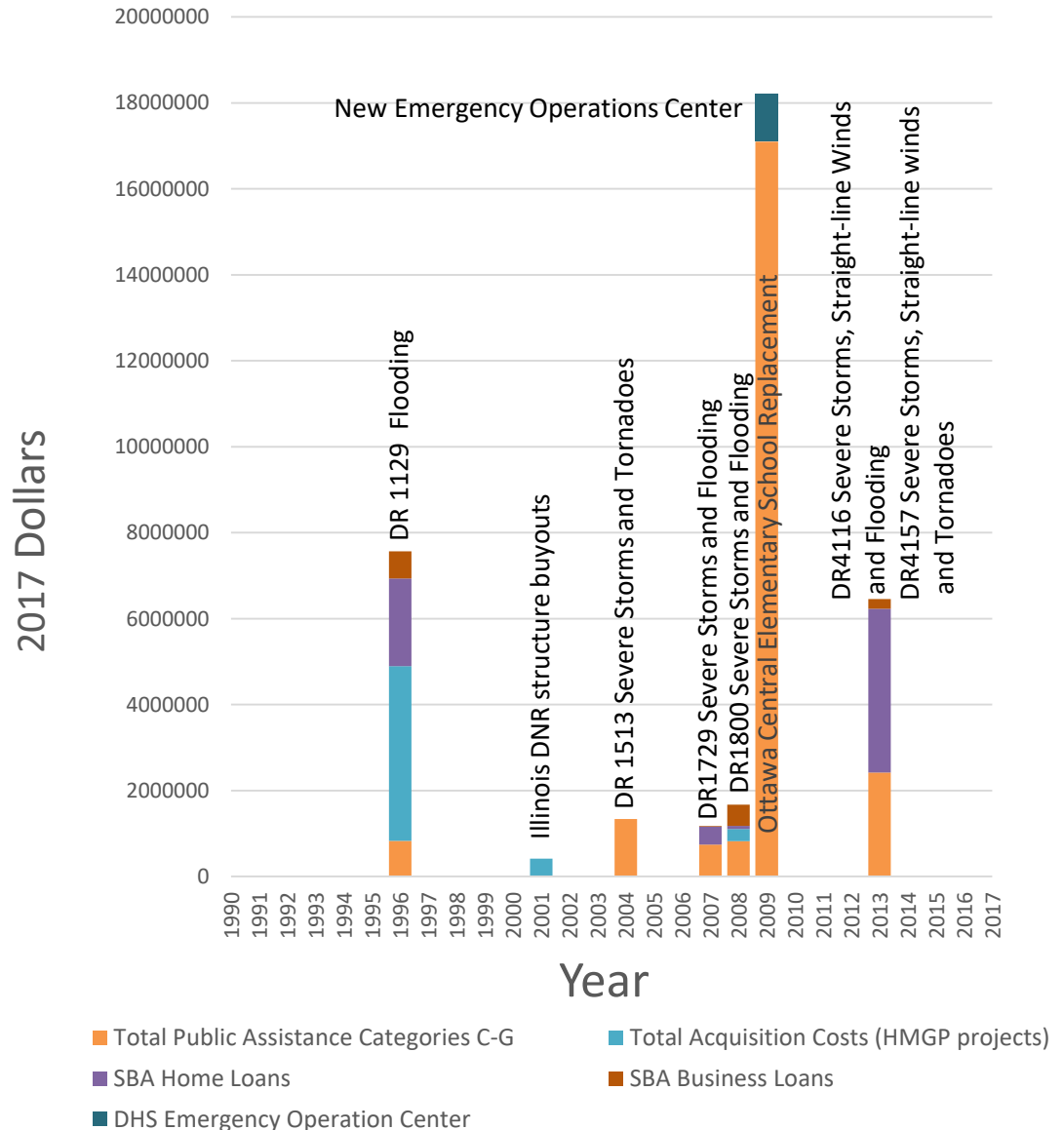
- Peaks

- Started Recording 2008
- 9/16/2008: 472.21'
- 3/11/2009: 470.23'
- 4/19/2013: 473.72'
- 2/22/2018: 471.49'

Source: NWS Advanced Hydrologic Prediction Service

Buyout Funding

- Buyout Funding
 - FEMA – Mitigation Programs & Public Assistance
 - IDNR
 - Provided funds for 5 structures in 2001
 - Department of Commerce and Economic Opportunity (DCEO)
 - City of Ottawa



Summary

- Description of City of Ottawa
- History
 - Flooding
 - Buyouts
- **Gathering and Developing Data for Analysis**
- Hazus Analysis
- Timeline of Buyouts and Results
- Central Elementary School and Heritage Harbor
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Data for Analysis

- Building Inventory
 - Points representing each buyout structure used in analysis
- Flood Depth Grids
 - Generated from 16 modeled historical flood events between 1996 and 2018
 - Includes the February 2018 flood event

Data Sources

- Parcel GIS Shapefile
 - Provided by LaSalle County
- Multiple spreadsheets of buyouts provided by Ron Davis (SHMO)
 - Addresses and valuation data
- Buyout files from IDNR/OWR
- City of Ottawa
 - Mike Sutfin
 - Nancy Stisser

Building Inventory

- Converted parcel polygons into points
- Used historical orthophotos to place points where structures used to exist
- Worked with the City of Ottawa to confirm information about the structures
 - Appraisals for each structure
 - Characteristics
- Year of buyouts
 - Spreadsheets/Files
 - Assessor's Website
 - Match Last Sale Price to Acquisition Cost

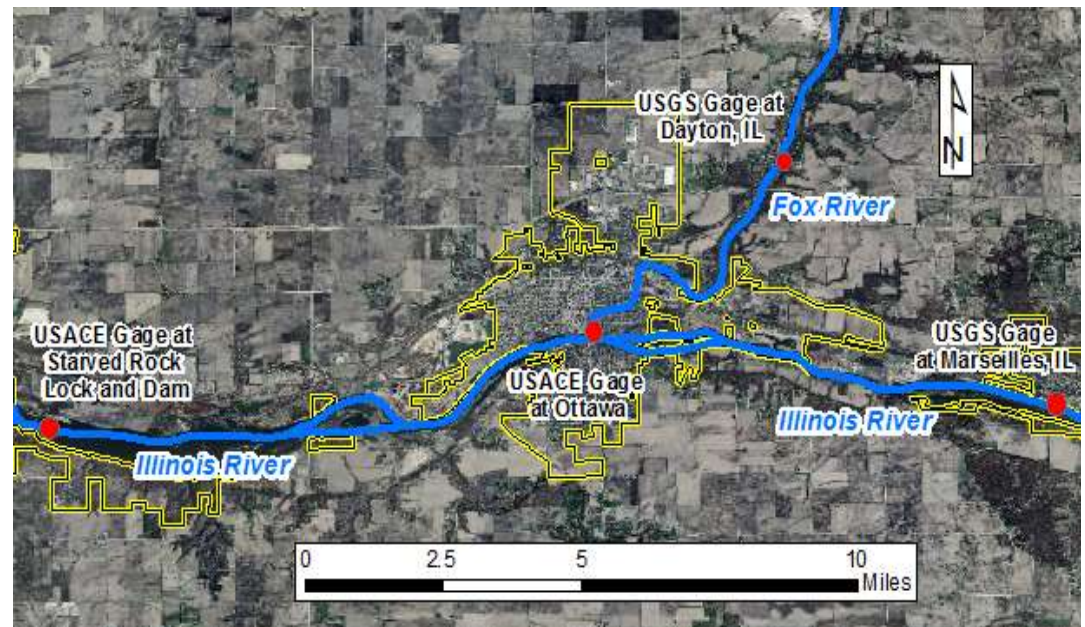
Building Inventory

- 64 structures identified in this analysis
 - Some are multiple structures on same parcel
- Occupancy
 - 57 Residential
 - 43 Single Family Dwelling
 - 7 Duplexes
 - 1 6-Unit Apartment Building
 - 5 Commercial
 - 1 Industrial
 - Central Elementary School



Ottawa Depth Grids


- Depth grids were created for annual maximum flood events using HEC-RAS models for the Illinois River and Fox River
- USGS gages at Dayton and Marseilles provided peak flows
- USACE gages at Starved Rock Lock and Dam and Ottawa provided stage



Ottawa Depth Grids

- The Illinois River HEC-RAS model used the combined flows from the Dayton gage and Marseilles gage along with the Starved Rock stage as a starting elevation.
- The Fox River HEC-RAS model used the Dayton gage flows along with the Ottawa stage as a starting elevation
- The USACE Ottawa gage has only been recording stage since 2008
- For flood events prior to 2008 the Illinois River HEC-RAS model served as an estimate of the Fox River starting elevation at Ottawa.

Summary

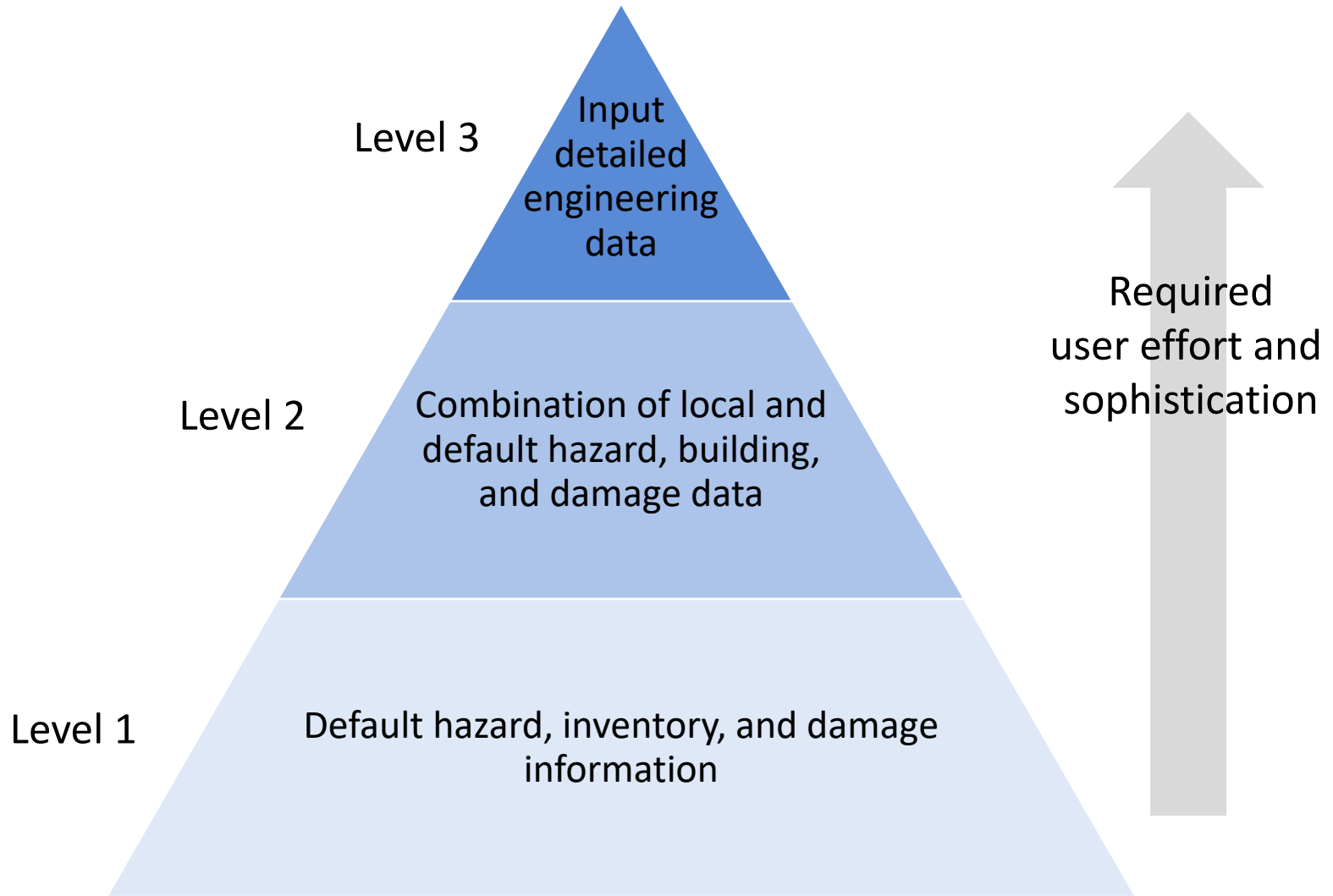
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- **Hazus Analysis** 
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Hazus Loss Estimation Tool

- Loss estimation software designed by FEMA
- Works with ESRI's ArcGIS software
- Purpose is to provide the means to identify and reduce risk from natural hazards
- Four Models:
 - Flood
 - Earthquake
 - Hurricane
 - Tsunami
- Hazus 4.0

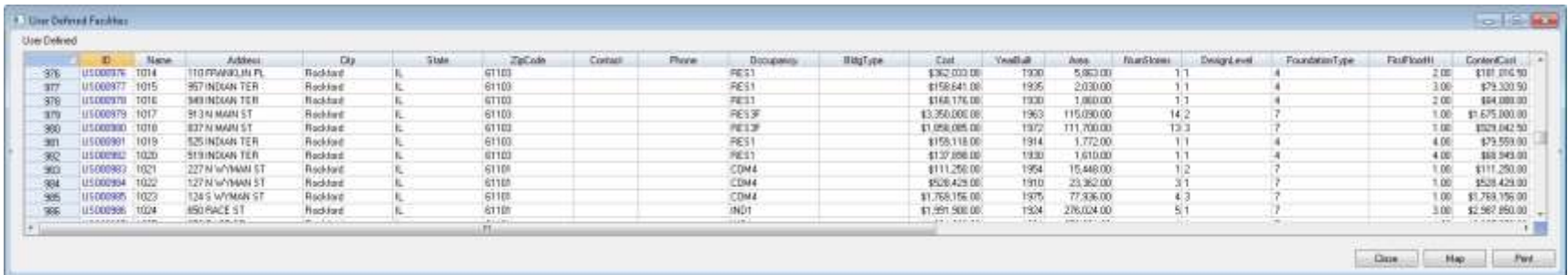


Levels of analysis



Input for Level 2 Analysis

- Building Inventory
 - Point feature class in a personal gdb
 - Contains the attributes for each buyout structure
 - Lat Long values to represent location
- Flood Depth Grids
 - ESRI Grid format



ID	Name	Address	City	State	ZipCode	Contact	Phone	Occupancy	BldgType	Cost	YearBuilt	Area	NumStories	DesignLevel	FoundationType	FirstFloorHt	ContentCost
376	U5000976	1014	110 FRANKLIN PL	Rockford	IL	61103		RES1		\$362,000.00	1900	5,853.00	1.1	4		2.00	\$181,875.90
377	U5000977	1015	957 INDIAN TER	Rockford	IL	61103		RES1		\$159,641.00	1935	2,030.00	1.1	4		3.00	\$79,320.50
378	U5000978	1016	349 INDIAN TER	Rockford	IL	61103		RES1		\$168,176.00	1930	1,860.00	1.1	4		2.00	\$84,088.00
379	U5000979	1017	813 N MAIN ST	Rockford	IL	61103		RES3F		\$3,350,000.00	1963	115,090.00	14.2	7		1.00	\$1,675,000.00
380	U5000980	1018	827 N MAIN ST	Rockford	IL	61103		RES3F		\$1,658,085.00	1972	111,700.00	13.3	7		1.00	\$829,042.50
381	U5000981	1019	525 INDIAN TER	Rockford	IL	61103		RES1		\$159,118.00	1914	1,772.00	1.1	4		4.00	\$79,559.00
382	U5000982	1020	815 INDIAN TER	Rockford	IL	61103		RES1		\$137,886.00	1930	1,610.00	1.1	4		4.00	\$68,943.00
383	U5000983	1021	227 N WYMAN ST	Rockford	IL	61103		COM4		\$111,266.00	1954	15,448.00	1.2	7		1.00	\$111,250.00
384	U5000984	1022	127 N WYMAN ST	Rockford	IL	61103		COM4		\$528,429.00	1910	23,362.00	3.1	7		1.00	\$528,429.00
385	U5000985	1023	134 S WYMAN ST	Rockford	IL	61103		COM4		\$1,768,156.00	1975	77,936.00	4.3	7		1.00	\$1,768,156.00
386	U5000986	1024	450 RACE ST	Rockford	IL	61103		IND1		\$1,991,500.00	1924	276,024.00	5.1	7		3.00	\$2,582,850.00

Attributes for Hazus

- Occupancy Class

Residential
Commercial
Industrial
Agricultural
Government
Religious



Hazus Label	Occupancy Class	
Residential		
RES1	Single Family Dwelling	
RES2	Mobile Home	
RES3A	Multi Family Dwelling - Duplex	
RES3B	Multi Family Dwelling - 3-4 Units	
RES3C	Multi Family Dwelling - 5-9 Units	
RES3D	Multi Family Dwelling - 10-19 Units	
RES3E	Multi Family Dwelling - 20-49 Units	
RES3F	Multi Family Dwelling - 50+ Units	
RES4	Temporary Lodging	70
RES5	Institutional Dormitory	
RES6	Nursing Home	8051, 80
Commercial		
COM1	Retail Trade	52, 53, 5
COM2	Wholesale Trade	42, 50, 5
COM3	Personal and Repair Services	72, 75, 7
COM4	Business/Professional/Technical Services	40, 41, 4 78 (excep)
COM5	Depository Institutions	60
COM6	Hospital	8062, 80
COM7	Medical Office/Clinic	80 (excep)
COM8	Entertainment & Recreation	48, 58, 7
COM9	Theaters	7832, 79
COM10	Parking	
Industrial		
IND1	Heavy	22, 24, 2
IND2	Light	23, 25, 2 39
IND3	Food/Drugs/Chemicals	20, 21, 2
IND4	Metals/Minerals Processing	10, 12, 1
IND5	High Technology	3571, 35
IND6	Construction	15, 16, 1
Agriculture		
AGR1	Agriculture	101, 02, 0

Attributes for Hazus

- Building Cost
 - Appraised Value
- Content Cost
 - Contents of the Structure
 - Couch, Refrigerator, etc...
 - Multiplier based of Occupancy Class of the Structure
- Converted to 2017 U.S. Dollars
 - Bureau of Labor Statistics-Consumer Price Index

Attributes for Hazus

- Provided by City of Ottawa
 - Square Footage
 - Number of Stories
 - Year Built
 - Design Level
 - Based off of Year built
 - Foundation Type

Table 6.2 DesignLevel Field Description

YearBuilt	Design Level
Prior – 1950	1
1950 – 1970	2
Post 1970	3
0 (set to Null)	0

Table 6.3 FoundationType Field Description

Real Foundation Type	FoundationType	Basement
Pile	1	0
Pier	2	0
Solid Wall	3	0
Basement /Yard	4	1
Crawl Space	5	0
Fill	6	0
Slab on Grade	7	0

Attributes for Hazus

- First Floor Height
 - The height of the first floor, in feet, above ground elevation.

Ganiero Appraisal Service
SUBJECT PHOTO ADDENDUM

File No. 801ESUPERIORST
Case No.

Property Address 801 E. Superior St. - ROGER
City Ottawa County LaSalle State IL Zip Code 61350-2435
Lender/Client City of Ottawa Address 301 W. Madison St., Ottawa IL, 61350



FRONT OF
SUBJECT PROPERTY
801 E. Superior St.
Ottawa, IL 61350-2435

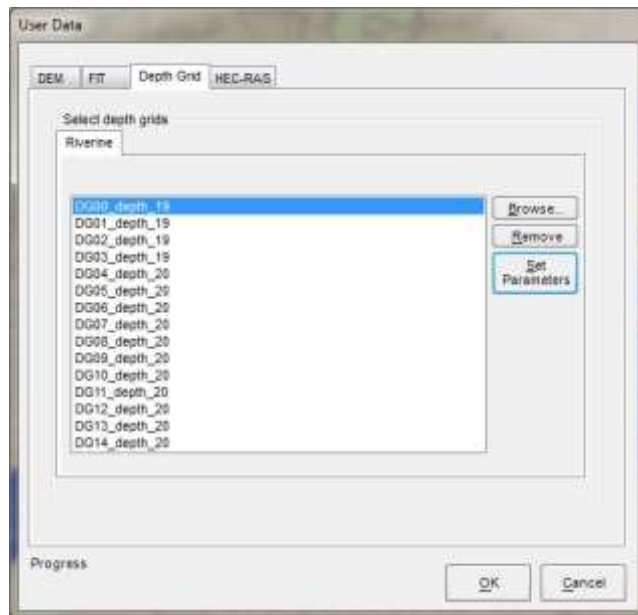


REAR OF
SUBJECT PROPERTY

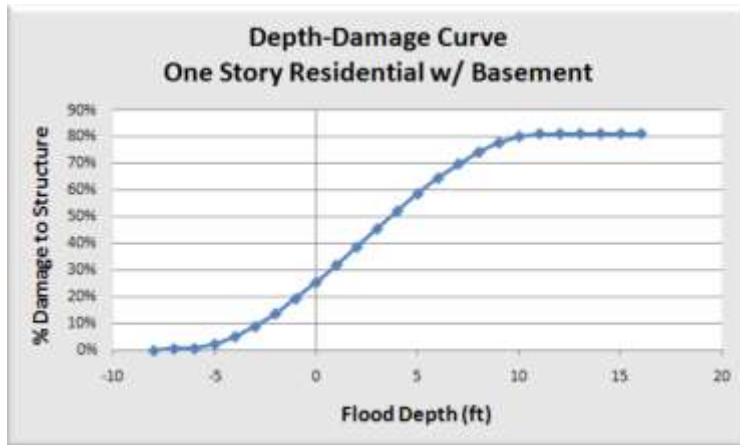
ID	Foundation Type	Pre-FIRM	Post-FIRM
1	Pile	7 ft	8 ft
2	Pier (or post and beam)	5 ft	6 ft
3	Solid Wall	7 ft	8 ft
4	Basement (or Garden Level)	4ft	4 ft ¹
5	Crawlspace	3 ft	4 ft
6	Fill	2 ft	2 ft
7	Slab	1 ft	1 ft ¹

Hazus Analysis

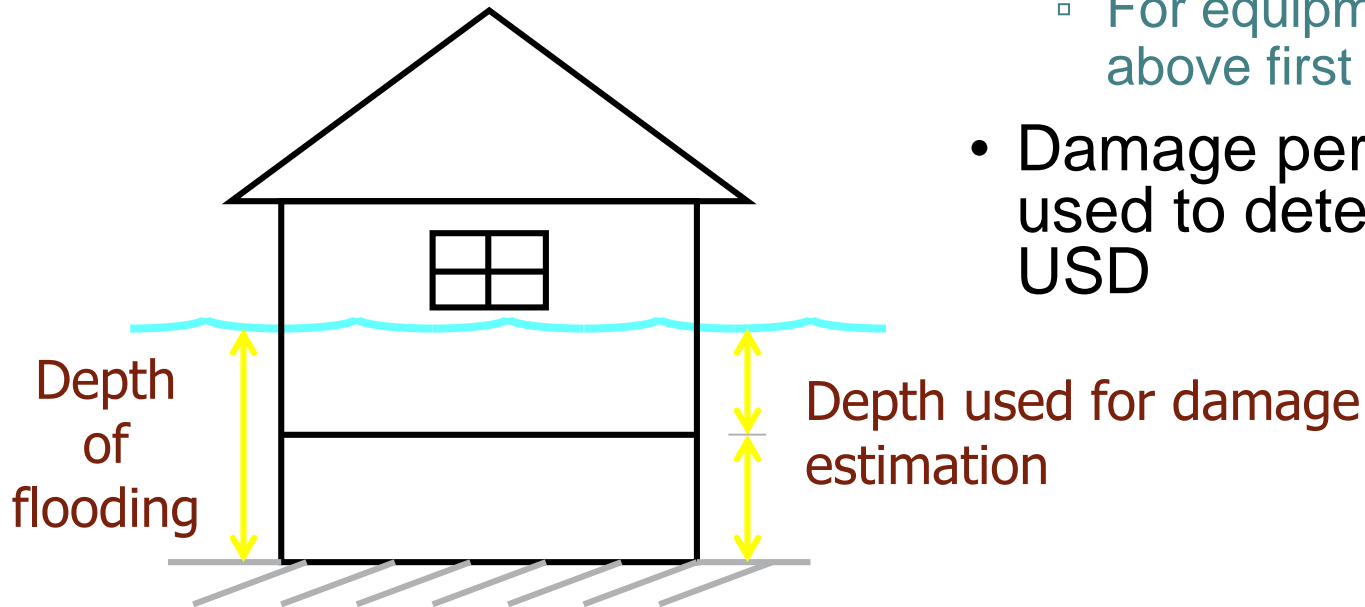
- Import user data into Hazus
 - Building Inventory
 - Import into CDMS
 - Depth Grids



Depth-Damage Curves



- Percentage of damage is calculated for each structure based on the depth of flooding.
 - Based on Attributes of the structures
 - For buildings, first floor height
 - For equipment, height above first floor
- Damage percentage is used to determine loss in USD



Analysis Output

- Building Loss
- Content Loss
- Business Inventory Loss
- Percent Damaged for Structures

Table


UOF_Results_100yr

FacilityName *	UserDefinedPtyId	ControllingHazard	OccupancyClass	BldgCost	BldgDmgPct	BldgLossUSD	ContentCost	ContDmgPct	ContentLossUSD	InventoryLossUSD	NumStories	RETURN_PER	FoundationType	Bl
1238	US000638	R	RES1	88556	33.357424	29540.000397	44278	37.357424	16541.120199	0	1	01pct	7	<Nu
689	US000651	R	RES1	115868	7.923766	9119.303814	57544	5.015844	3231.581271	0	1	01pct	4	<Nu
728	US000690	R	RES3A	179030	4.379396	7840.432859	89515	7.094848	6350.954062	0	1	01pct	4	<Nu
773	US000735	R	RES3F	899940	0	0	429970	0	0	0	2	01pct	7	<Nu
785	US000747	R	RES3B	258589	0	0	129294.5	0	0	0	1	01pct	4	<Nu
815	US000777	R	COM1	320276	3.252928	10418.347881	326276	8.758784	28052.283044	37163.648424	1	01pct	7	<Nu
821	US000783	R	RES1	212262	7	14858.34	106131	0	0	0	1	01pct	4	<Nu
869	US000831	R	RES1	124047	18.365224	22788.164715	62023.5	16.69403	10354.221697	0	1	01pct	4	<Nu
870	US000832	R	RES1	313649	15.709472	49272.801833	156824.5	11.988768	18801.325472	0	1	01pct	4	<Nu
912	US000874	R	RES3D	2810570	0	0	1305285	0	0	0	4	01pct	7	<Nu
915	US000877	R	ND1	2020957	0	0	383085.5	0	0	0	1	01pct	7	<Nu
923	US000885	R	RES1	86529	7	6057.03	43284.5	0	0	0	1	01pct	4	<Nu
927	US000886	R	RES1	43835	45.04098	19743.50305	24030	45.04098	10755.566407	0	1	01pct	7	<Nu

10 out of 838 Selected

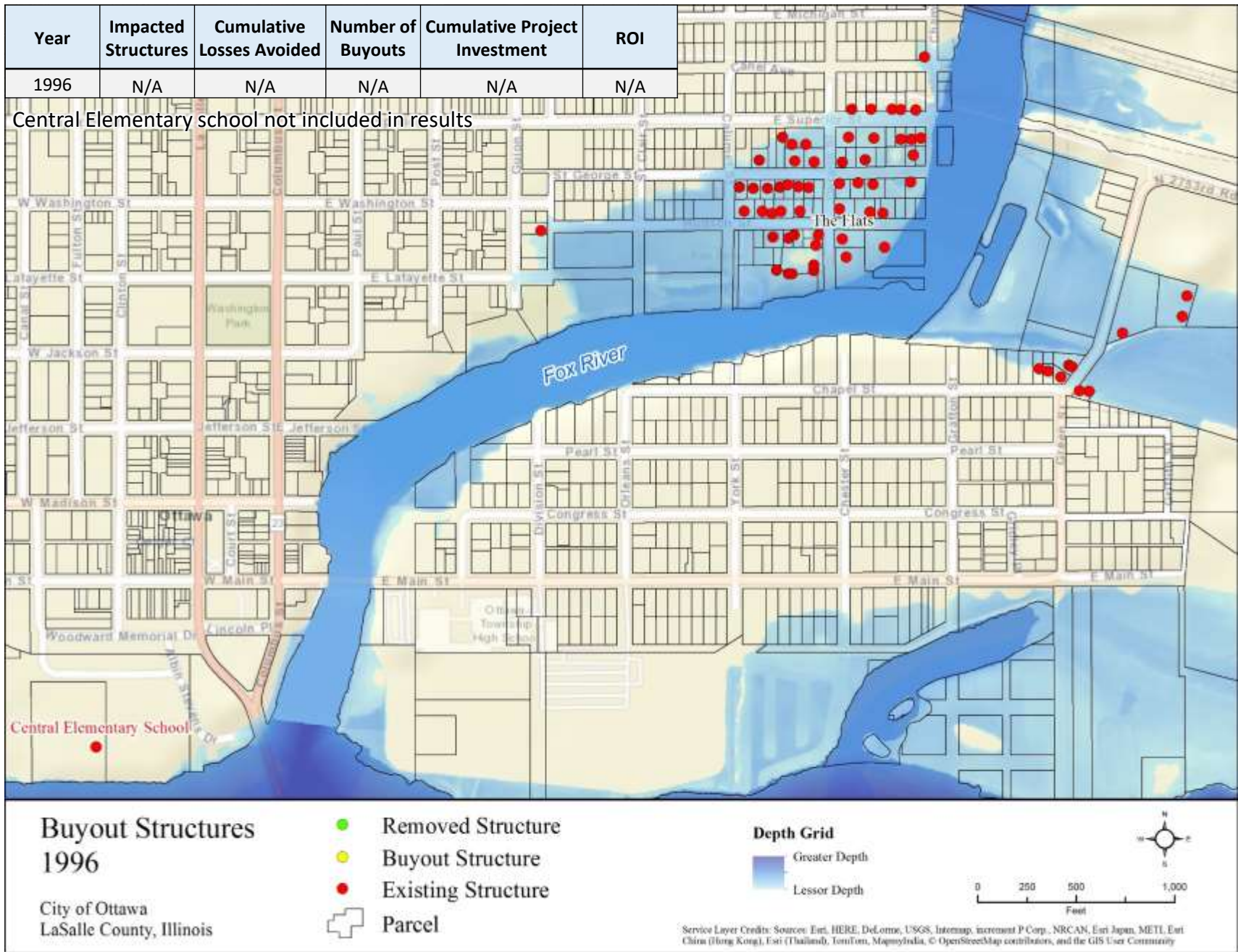
UOF_Results_100yr

Summary

- Description of City of Ottawa
- History
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- **Timeline of Buyouts and Results** 
- Central Elementary School and Heritage Harbor
- Obstacles
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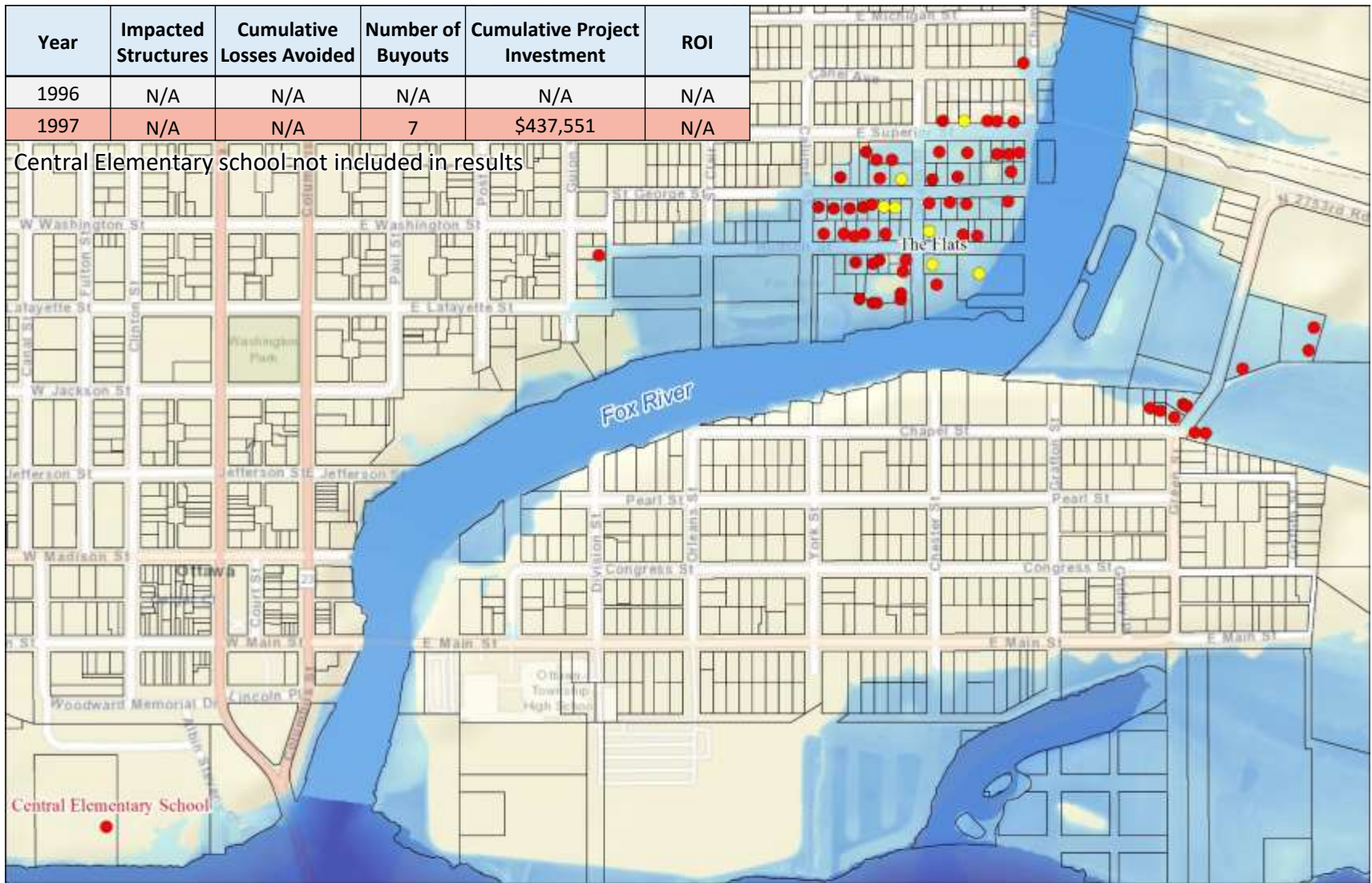
Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
1996	N/A	N/A	N/A	N/A	N/A

Central Elementary school not included in results



Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
1996	N/A	N/A	N/A	N/A	N/A
1997	N/A	N/A	7	\$437,551	N/A

Central Elementary school-not included in results



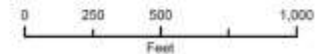
Buyout Structures 1997

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
- Lesser Depth



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Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
1996	N/A	N/A	N/A	N/A	N/A
1997	N/A	N/A	7	\$437,551	N/A
1998	6	\$174,029	19	\$1,915,702	9%

Central Elementary school not included in results



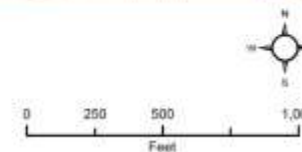
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1998	6	\$174,029	19	\$1,915,702	9%
1999	1	\$177,005	12	\$2,911,012	6%

Central Elementary school not included in results



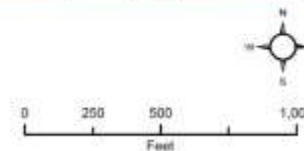
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Depth Grid

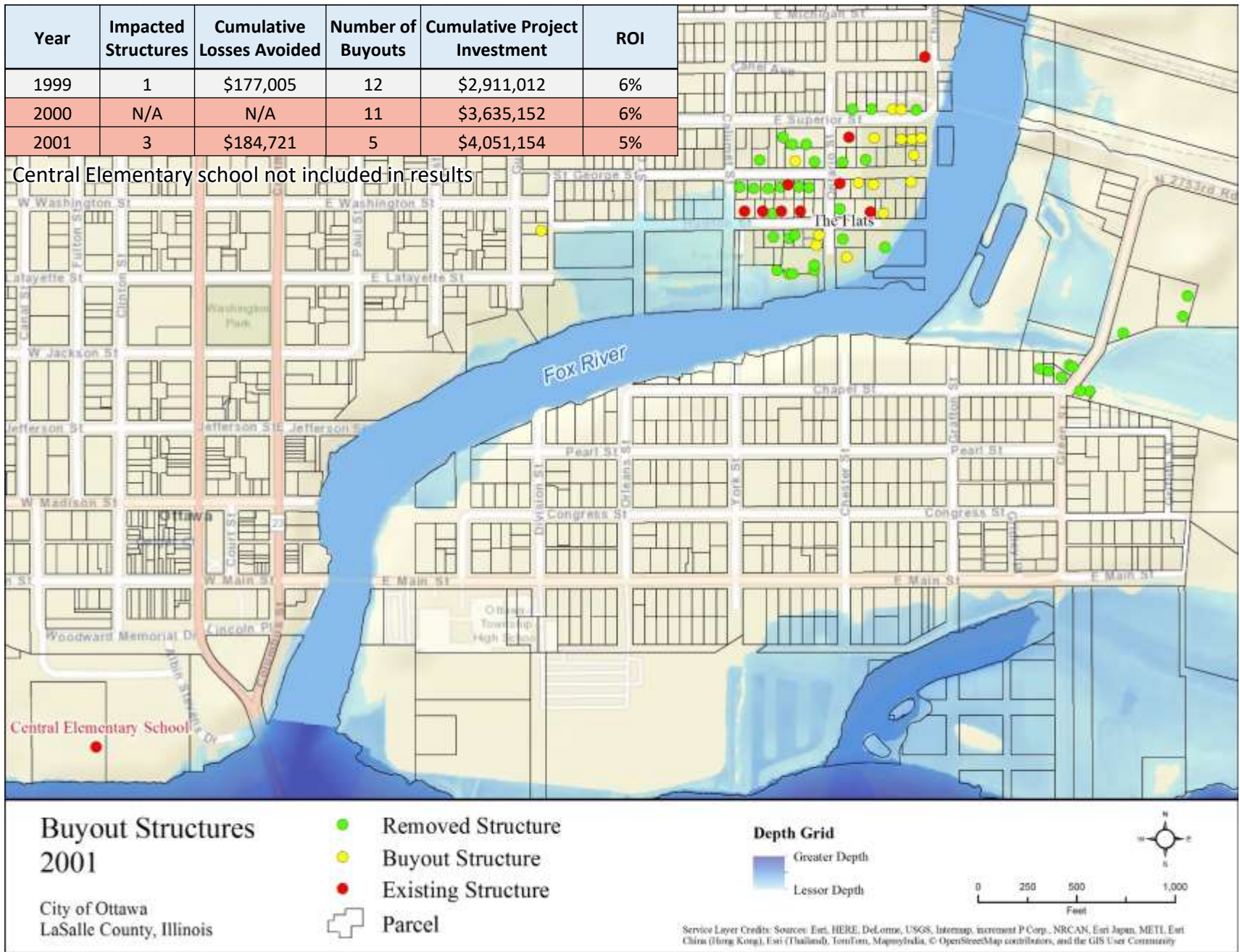
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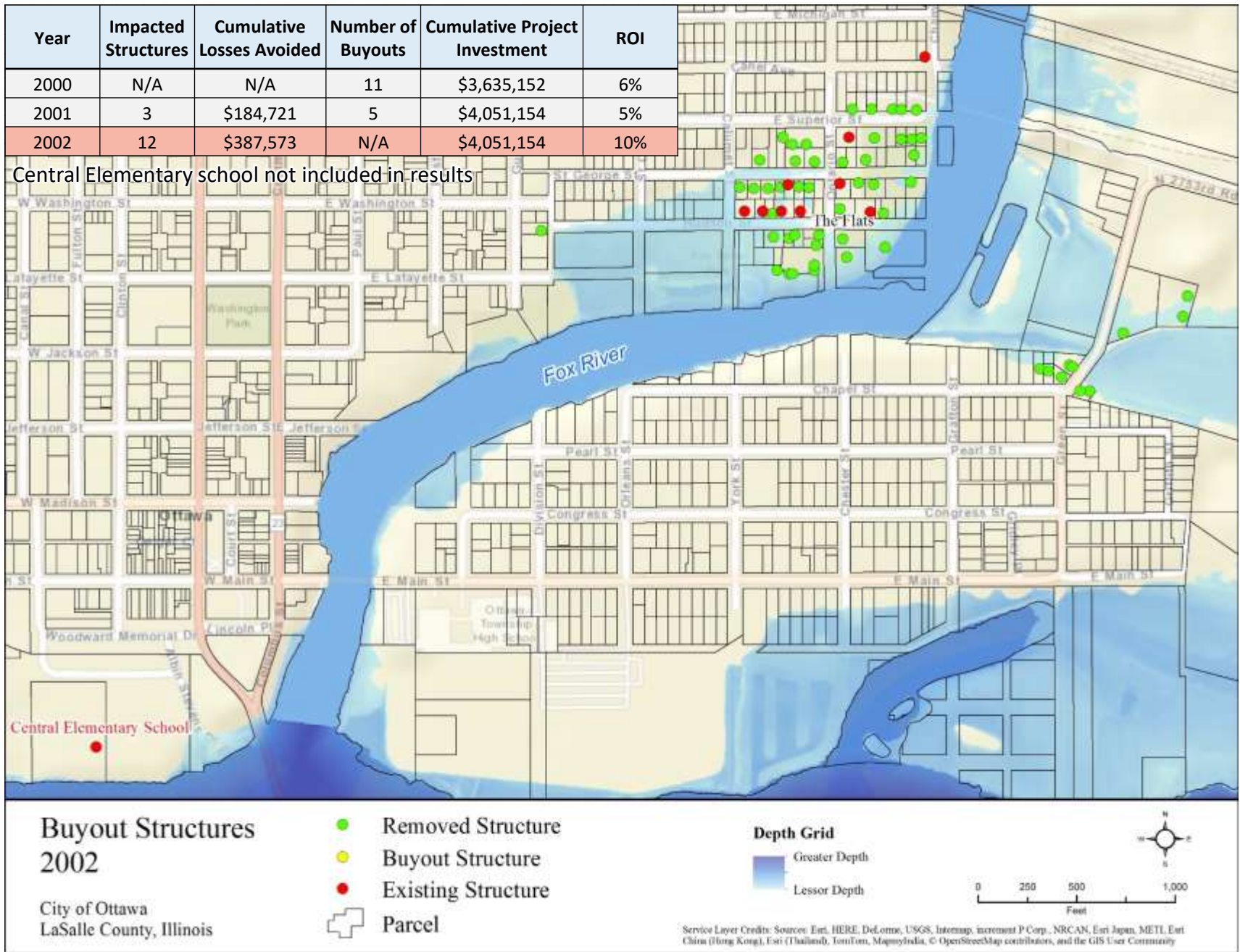
Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
1999	1	\$177,005	12	\$2,911,012	6%
2000	N/A	N/A	11	\$3,635,152	6%
2001	3	\$184,721	5	\$4,051,154	5%

Central Elementary school not included in results



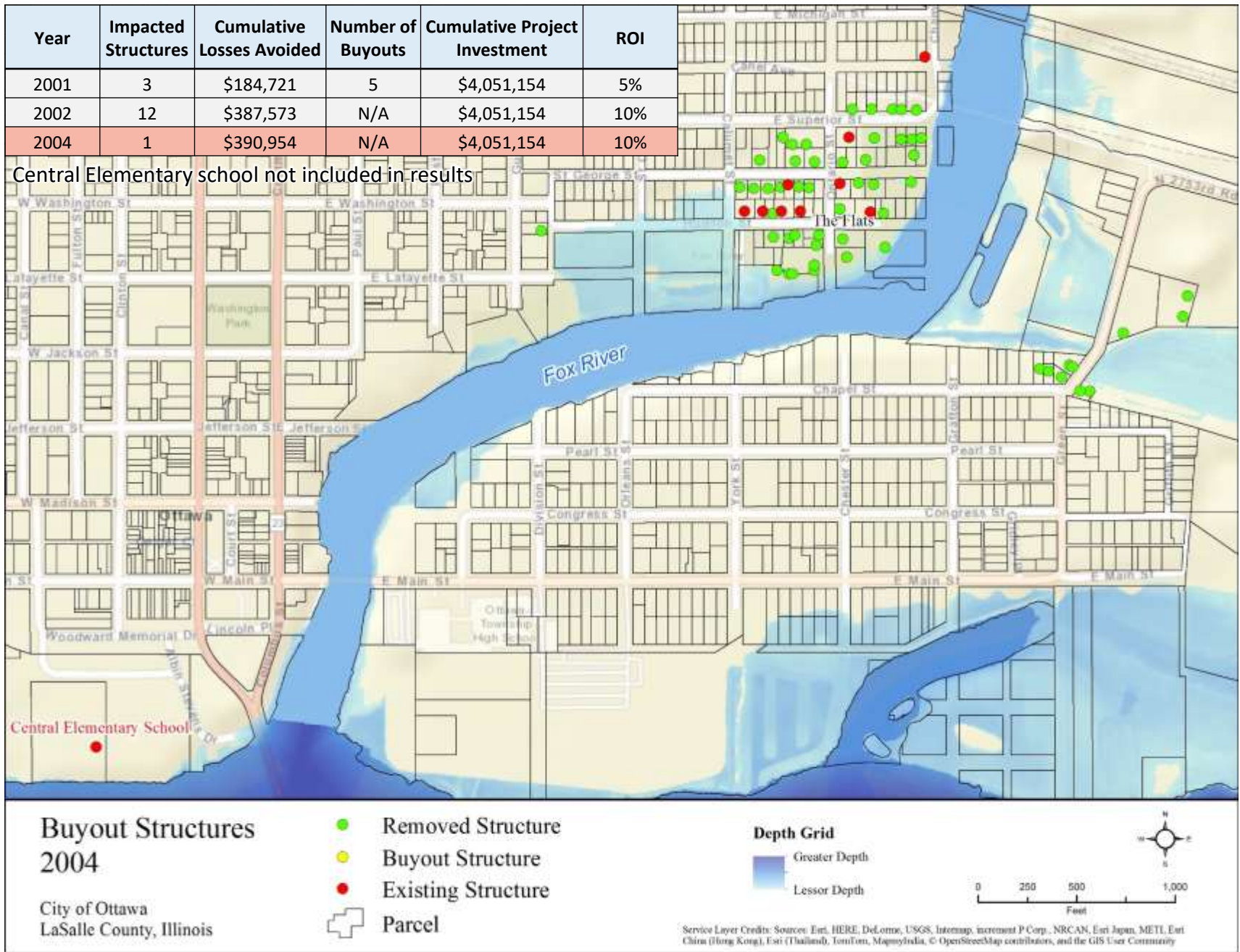
Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2000	N/A	N/A	11	\$3,635,152	6%
2001	3	\$184,721	5	\$4,051,154	5%
2002	12	\$387,573	N/A	\$4,051,154	10%

Central Elementary school not included in results



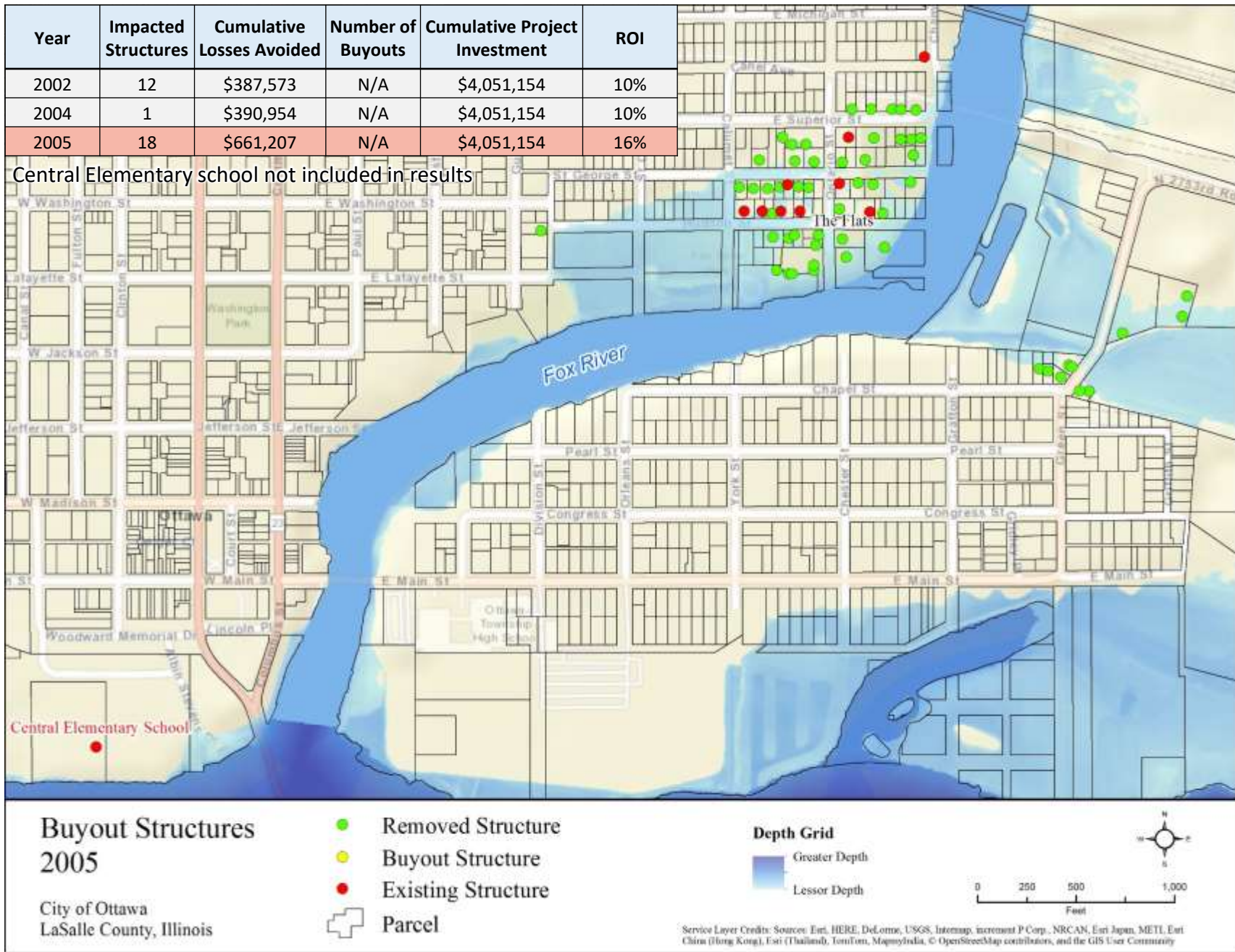
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2001	3	\$184,721	5	\$4,051,154	5%
2002	12	\$387,573	N/A	\$4,051,154	10%
2004	1	\$390,954	N/A	\$4,051,154	10%

Central Elementary school not included in results



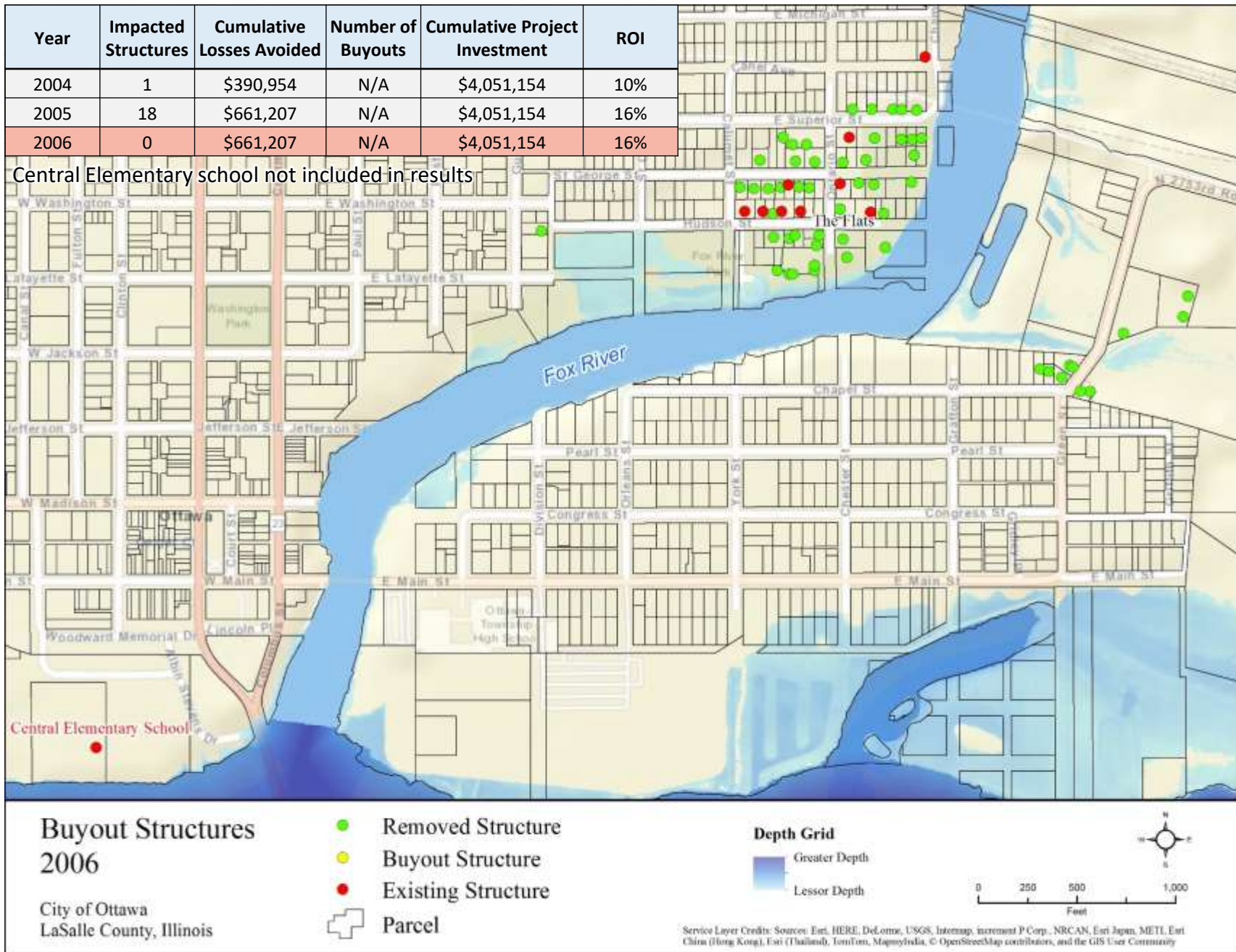
Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2002	12	\$387,573	N/A	\$4,051,154	10%
2004	1	\$390,954	N/A	\$4,051,154	10%
2005	18	\$661,207	N/A	\$4,051,154	16%

Central Elementary school not included in results



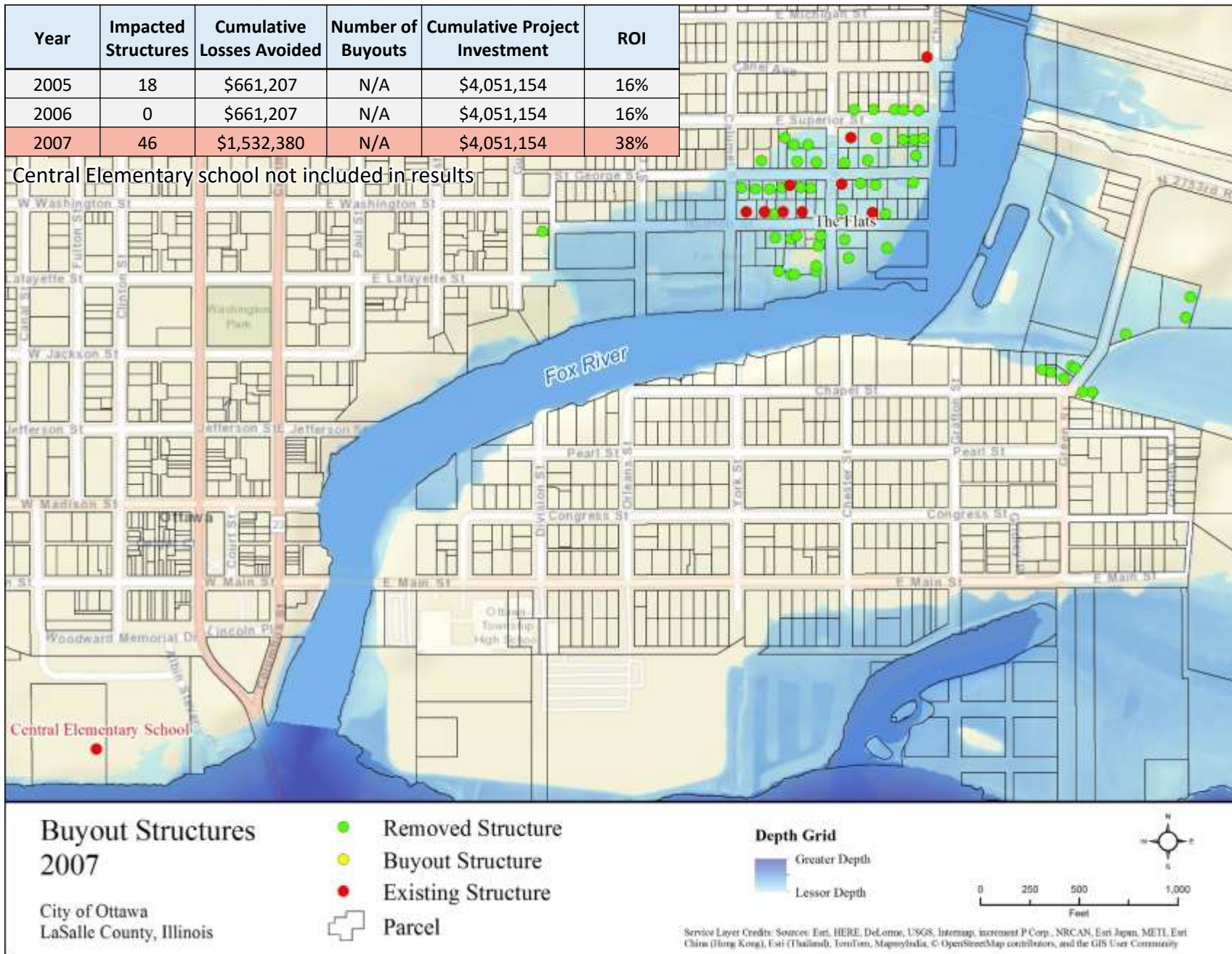
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2004	1	\$390,954	N/A	\$4,051,154	10%
2005	18	\$661,207	N/A	\$4,051,154	16%
2006	0	\$661,207	N/A	\$4,051,154	16%

Central Elementary school not included in results



Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2005	18	\$661,207	N/A	\$4,051,154	16%
2006	0	\$661,207	N/A	\$4,051,154	16%
2007	46	\$1,532,380	N/A	\$4,051,154	38%

Central Elementary school not included in results



Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2006	0	\$661,207	N/A	\$4,051,154	16%
2007	46	\$1,532,380	N/A	\$4,051,154	38%
2008	54	\$3,807,223	N/A	\$4,051,154	94%

Central Elementary school not included in results



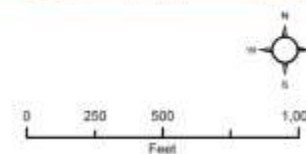
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Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2007	46	\$1,532,380	N/A	\$4,051,154	38%
2008	54	\$3,807,223	N/A	\$4,051,154	94%
2009	47	\$4,881,644	N/A	\$4,051,154	121%

Central Elementary school not included in results



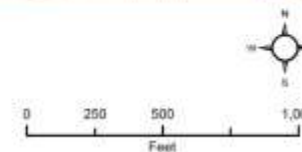
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Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2009	47	\$4,881,644	N/A	\$4,051,154	121%
2012	N/A	\$4,881,644	4	\$4,428,997	110%
2013	58	\$7,464,363	5	\$4,879,545	153%

Central Elementary school not included in results



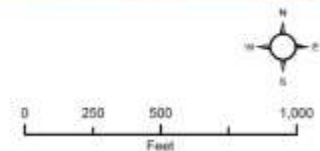
Buyout Structures 2013

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
- Lesser Depth



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapboxIndia, © OpenStreetMap contributors, and the GIS User Community

Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2012	N/A	\$4,881,644	4	\$4,428,997	110%
2013	58	\$7,464,363	5	\$4,879,545	153%
2015	20	\$7,746,883	N/A	\$4,879,545	159%

Central Elementary school not included in results



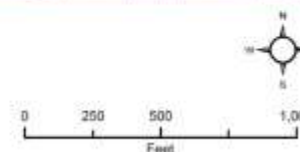
Buyout Structures 2015

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
- Lesser Depth



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapboxIndia, © OpenStreetMap contributors, and the GIS User Community

Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2013	58	\$7,464,363	5	\$4,879,545	153%
2015	20	\$7,746,883	N/A	\$4,879,545	159%
2017	4	\$7,807,273	N/A	\$4,879,545	160%

Central Elementary school not included in results



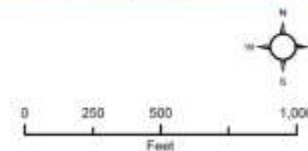
Buyout Structures 2017

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
- Lessor Depth



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapboxIndia, © OpenStreetMap contributors, and the GIS User Community

Year	Impacted Structures	Cumulative Losses Avoided	Number of Buyouts	Cumulative Project Investment	ROI
2015	20	\$7,746,883	N/A	\$4,879,545	159%
2017	4	\$7,807,273	N/A	\$4,879,545	160%
2018	61	\$9,565,303	N/A	\$4,879,545	196%

Central Elementary school not included in results



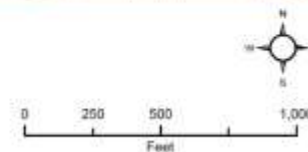
Buyout Structures 2018

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
- Lesser Depth

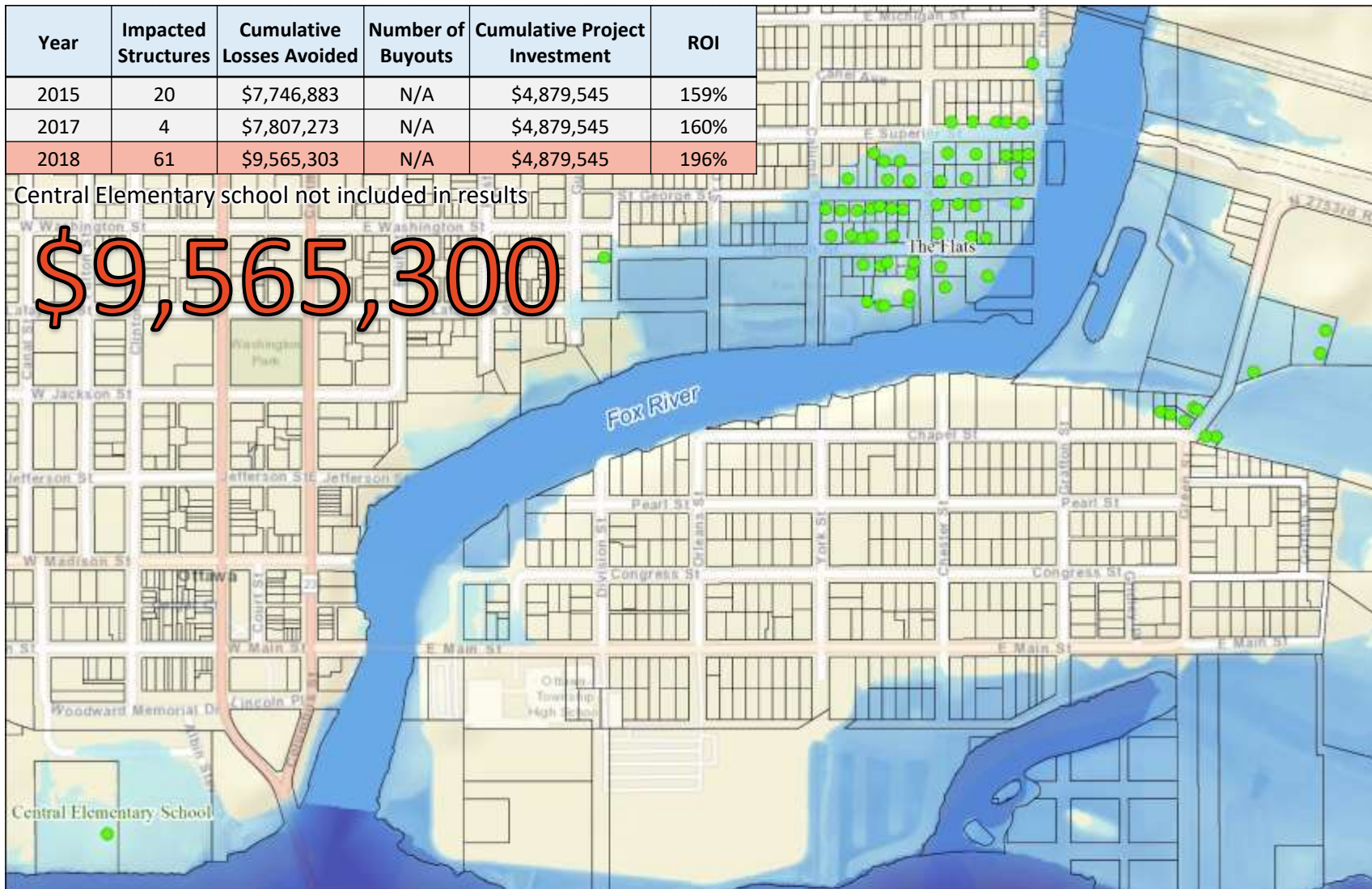


Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapboxIndia, © OpenStreetMap contributors, and the GIS User Community

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Central Elementary school not included in results

\$9,565,300



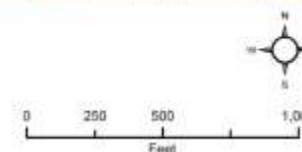
Buyout Structures 2018

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
- Lesser Depth



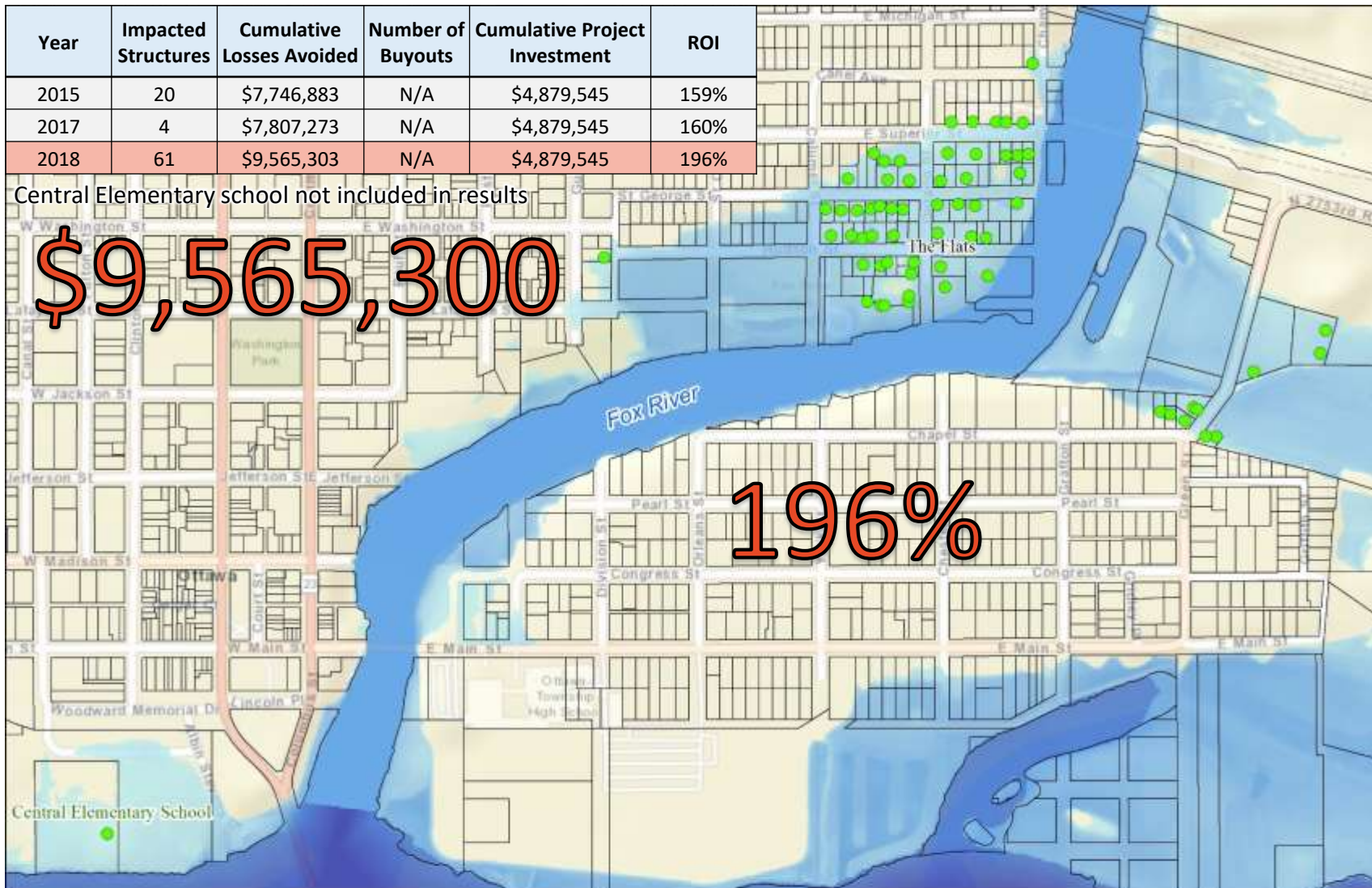
Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapboxIndia, © OpenStreetMap contributors, and the GIS User Community

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Central Elementary school not included in results

\$9,565,300

196%



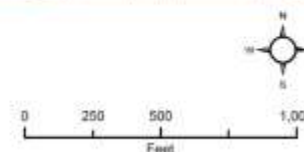
Buyout Structures 2018

City of Ottawa
LaSalle County, Illinois

- Removed Structure
- Buyout Structure
- Existing Structure
- Parcel

Depth Grid

- Greater Depth
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Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapboxIndia, © OpenStreetMap contributors, and the GIS User Community

Current Conditions

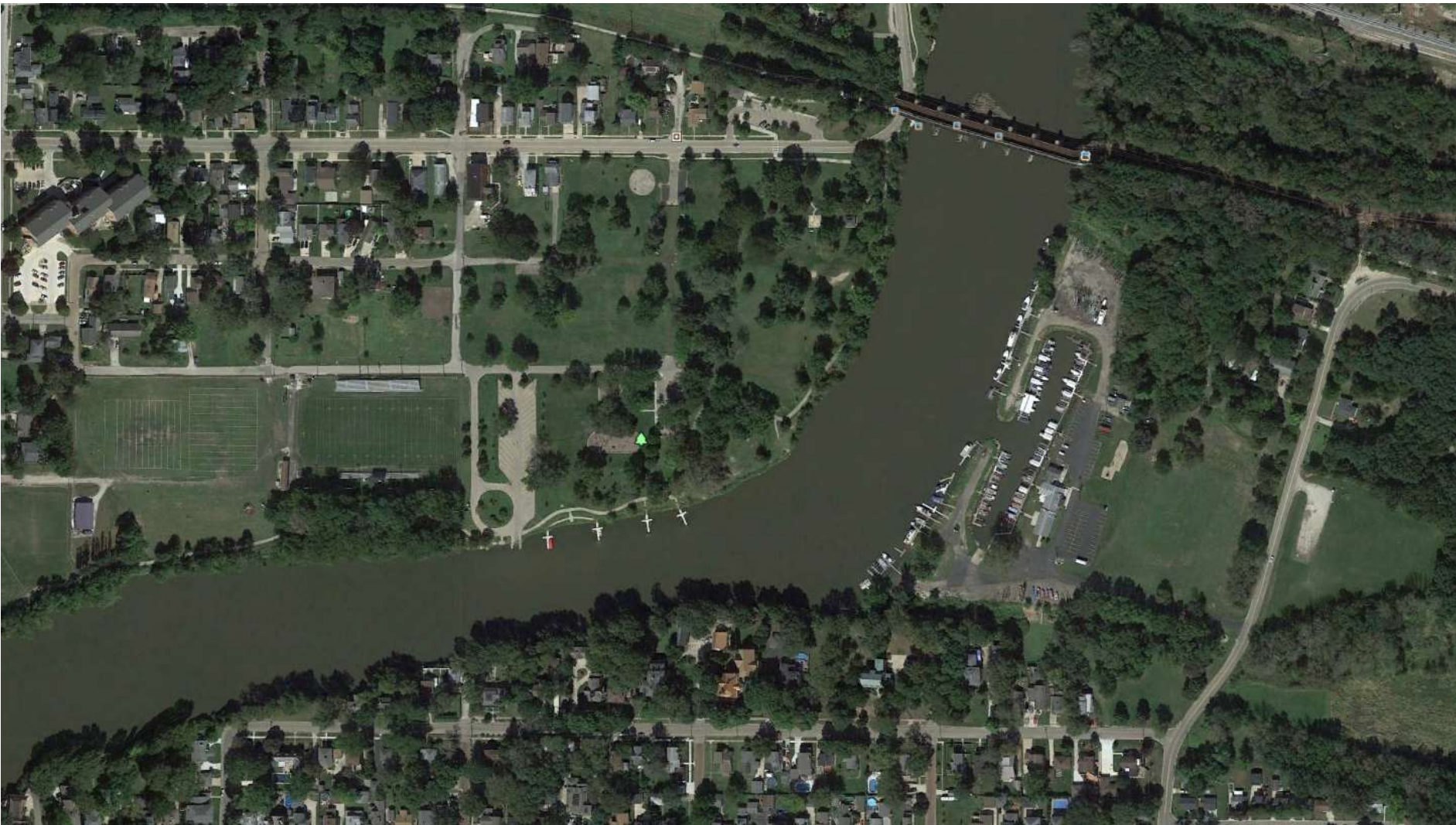
- Fox River Park
- Playground
- Green Space



March 25th, 1998



September 20th, 2015

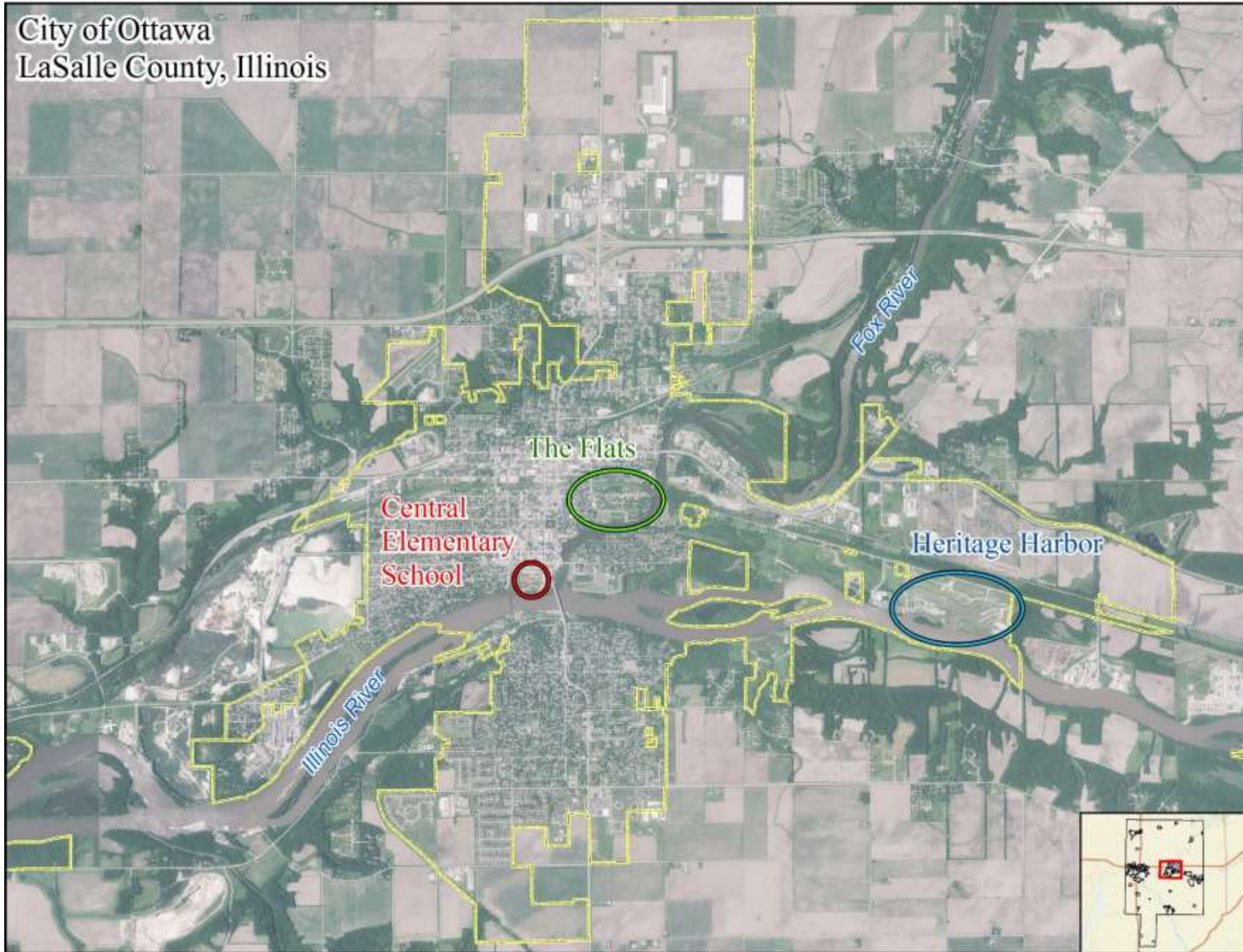


Summary

- Description of City of Ottawa
- History
 - Flooding
 - Funding
- Gathering and Developing Data for Analysis
- Hazus Analysis
- Timeline of Buyouts and Results
- **Central Elementary School and Heritage Harbor**
- Obstacles
- Drone Flight



City of Ottawa
LaSalle County, Illinois



Central Elementary School

- Flooded Sept. 2008
- Demolished in August, 2013
- New School Built
- Project Investment of \$22 million
 - Adjusted to 2017 dollars
- Funds awarded
 - FEMA \$12 million
 - Illinois \$10 million
- Two scenarios:
 - Original School Building
 - New School Building
- Modeled flood event is April, 2013



Scenario	Structure	Building Replacement Cost	Square Footage	Total Losses Avoided to Date (Estimated) ¹	Project Investment ¹	Projected ROI
1	Original Building	\$13,760,184	70,000	\$4,591,382	\$23,132,010	20%
2	New Construction Building	\$23,132,010	103,000	\$10,822,964	\$23,132,010	47%

Heritage Harbor

- High value Condos
- New construction required to be 2 feet above the 1% annual chance base flood elevation.
- Building Value
 - Estimated Fair Market Value using 2017 assessor's data.
 - Assessed Building Value multiplied by 3



Heritage Harbor

- Hazus Analysis
 - Depth Grids
 - 1% Annual Chance Flood event
 - Ran analysis with two versions of each structure
 - With current elevation
 - With simulated elevation 2' below current conditions

Event Type	Projected Structures impacted without 2' Higher Elevation Requirement	Total Loss without 2' Higher Elevation Requirement	Total Loss with Current Construction	Total Losses Avoided
1% Annual Chance Flood (100 year)	33	\$2,368,060	\$0	\$2,368,060

Summary

- Description of City of Ottawa
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Obstacles and Limitations

- Structures no longer exist
- Combining data from a variety of different sources in one building inventory
- The USACE Ottawa gage has only been recording stage since 2008
- Representing structures as points instead of polygons
- Accounting for all of the associated costs
 - Buyouts
 - Intangible Costs
 - Flood Losses
 - Displaced population, loss of service, etc.
- Results are Estimates

Thanks!

Questions?

Brad McVay

bmcvay@Illinois.edu