VILLAGE OF WILMETTE
STORMWATER
ACTION PLAN

Municipal Services Committee Meeting

September 24, 2015
7:00 PM

Separate Storm Sewer Study

Purpose of tonight's meeting:

Studies by Christopher B. Burke Engineering Ltd. (CBBEL):

1. Refinement of alternatives developed in the original stormwater report to lower the 10-year hydraulic grade line to the back of sidewalk instead of below street level.

2. Above-ground stormwater storage at Community Playfield

3. Glenview stormwater connection for drainage improvements in the Lockerbie Lane and LeClaire Avenue area.

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Separate Storm Sewer Study

Summary of Progress

January, 2014	Village Board meeting	Christopher B. Burke Engineering Ltd (CBBEL) awarded contract
March, 2014	Open Houses	Resident input was gathered
August, 2014	MSC Meeting	Study update on progress
January, 2015	MSC Meeting	Presentation of results
March, 2015	MSC Meeting	Recommended supplemental studies
September, 2015	MSC Meeting	Presentation of results of the supplemental studies

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Separate Storm Sewer System

- West of Ridge Road
- 1930 to 1950 – Separate sewers constructed
- Pipe network conveys stormwater to the Pump Station on Lake Avenue
- Stormwater discharges to the North Branch of the Chicago River
- Study shows the conveyance (pipe) system is the “bottleneck”

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Village of Wilmette
Storms of record 1980-2013

Rank	Date	Location	Inches	Minutes	Hours	Inches/hour	Storm Freq, yrs
1	8/2/2001	WTP	4.11	80	1.33	3.08	100
2	7/12/1981	SWPS	3.60	120	2.00	1.80	100
3	8/7/1989	SWPS	4.20	150	2.50	1.68	100
4	8/13/1987	SWPS	9.80	1440	24.00	0.41	100
5	9/12/2008	SWPS	6.60	1200	20.00	0.33	70
6	9/12/2008	WTP	6.29	1200	20.00	0.31	70
7	8/22/2002	WTP	3.85	210	3.50	1.10	50
8	8/22/2002	SWPS	3.80	210	3.50	1.09	50
9	8/16/1995	WTP	2.71	90	1.50	1.81	25
10	**7/23/2011**	**SWPS**	**4.48**	**300**	**5.00**	**0.90**	**25**
11	6/24/1994	SWPS	4.10	600	10.00	0.41	25
12	**4/17/2013**	**WTP**	**5.56**	**1440**	**24.00**	**0.23**	**25**
13	**4/17/2013**	**SWPS**	**5.00**	**1440**	**24.00**	**0.21**	**17**
14	8/14/1981	SWPS	2.30	60	1.00	2.30	15
15	8/18/1990	SWPS	2.75	120	2.00	1.38	15
16	**7/23/2011**	**WTP**	**3.39**	**300**	**5.00**	**0.68**	**10**
17	7/24/2010	SWPS	4.20	810	13.50	0.31	10
18	7/24/2010	WTP	3.81	810	13.50	0.28	10
19	7/10/2004	SWPS	2.41	100	1.67	1.45	10
20	7/19/1993	WTP	2.80	160	2.67	1.05	10
21	8/19/1990	WTP	3.75	720	12.00	0.31	10
22	10/25/1991	WTP	2.25	105	1.75	1.29	8
23	5/9/1990	WTP	3.80	840	14.00	0.27	8
24	6/19/2009	SWPS	3.96	1440	24.00	0.17	7
25	6/19/2009	WTP	3.93	1440	24.00	0.16	7

Flood Survey results from April 18, 2013

15% response rate (1,597 residents)

Description	Separate Sewer Area (West of Ridge Road)
Number of responses	916
Sanitary Sewer Backup	396 (43%)
Street Flooding Entered Home	126 (14%)
Yard Flooding Entered Home	69 (8%)

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Sewer Infrastructure Improvements to Date

Total invested since 1990: $77 million

$24 million bond issue (2013-2015)

West Park Sanitary Storage Project	$18,397,000
Local Storage / Capacity Improvements	$ 3,285,000
Smoke Testing and I/I removal	$ 122,000
Manhole Rehabilitation	$ 1,574,000
Storm Sewer Study	$ 307,000
Total	**$23,685,000**

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What can homeowners do?

- Disconnect from storm sewer
- Less impervious area and less sod
- More rain gardens and bioswales
- Protect home with overhead sewer or flood control
- Check grading around foundation
- Install drain tile and sump pump

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Separate Storm Sewer Study Update

September 24, 2015

CBB

THE VILLAGE OF
Wilmette
EST. 1872

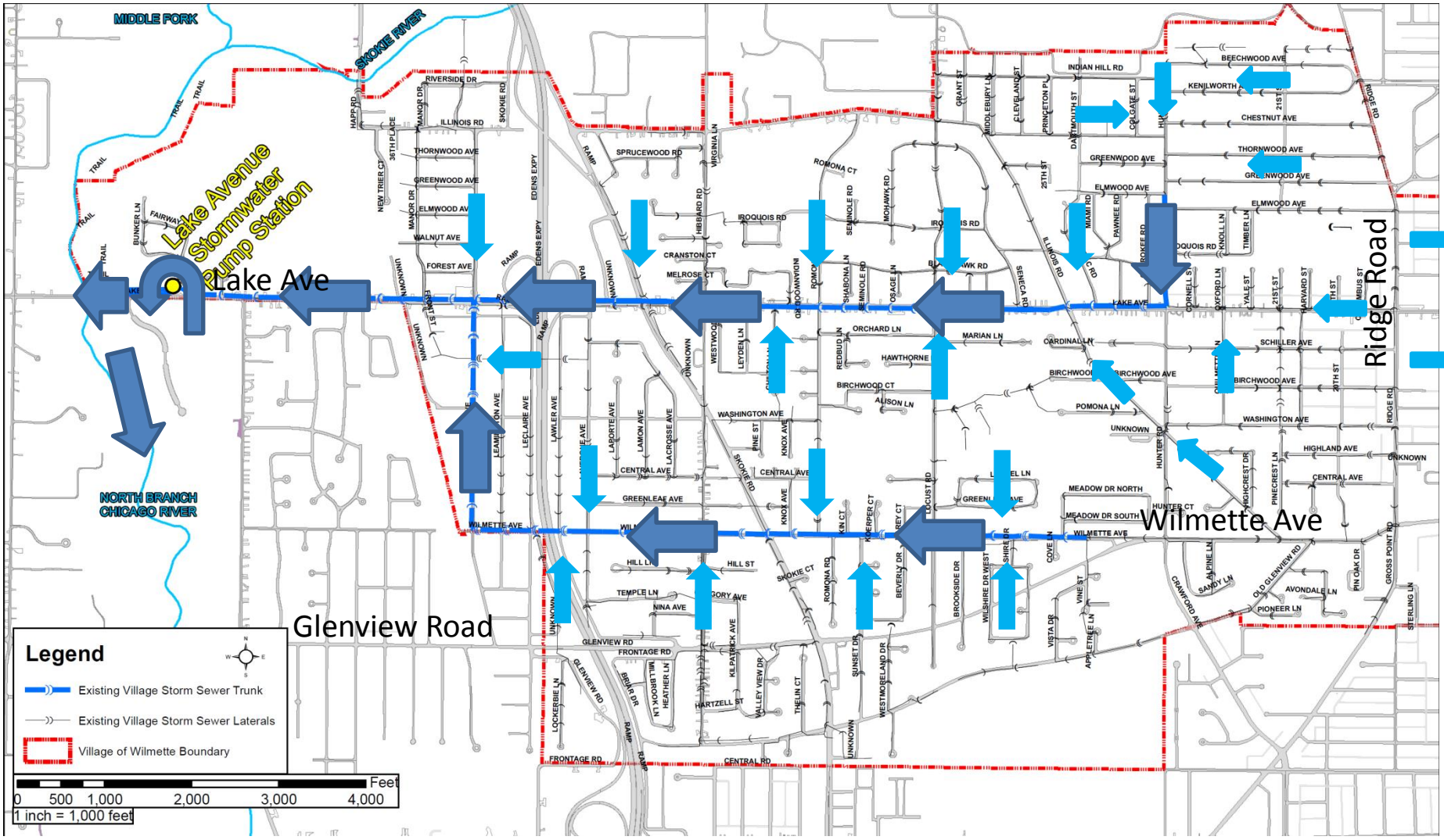
Outline of Presentation

- Summary of January 28th Presentation
- Presentation of Revised Alternatives
- Summary of Benefits and Costs
- Sample Phasing Plan
- Questions

Definitions

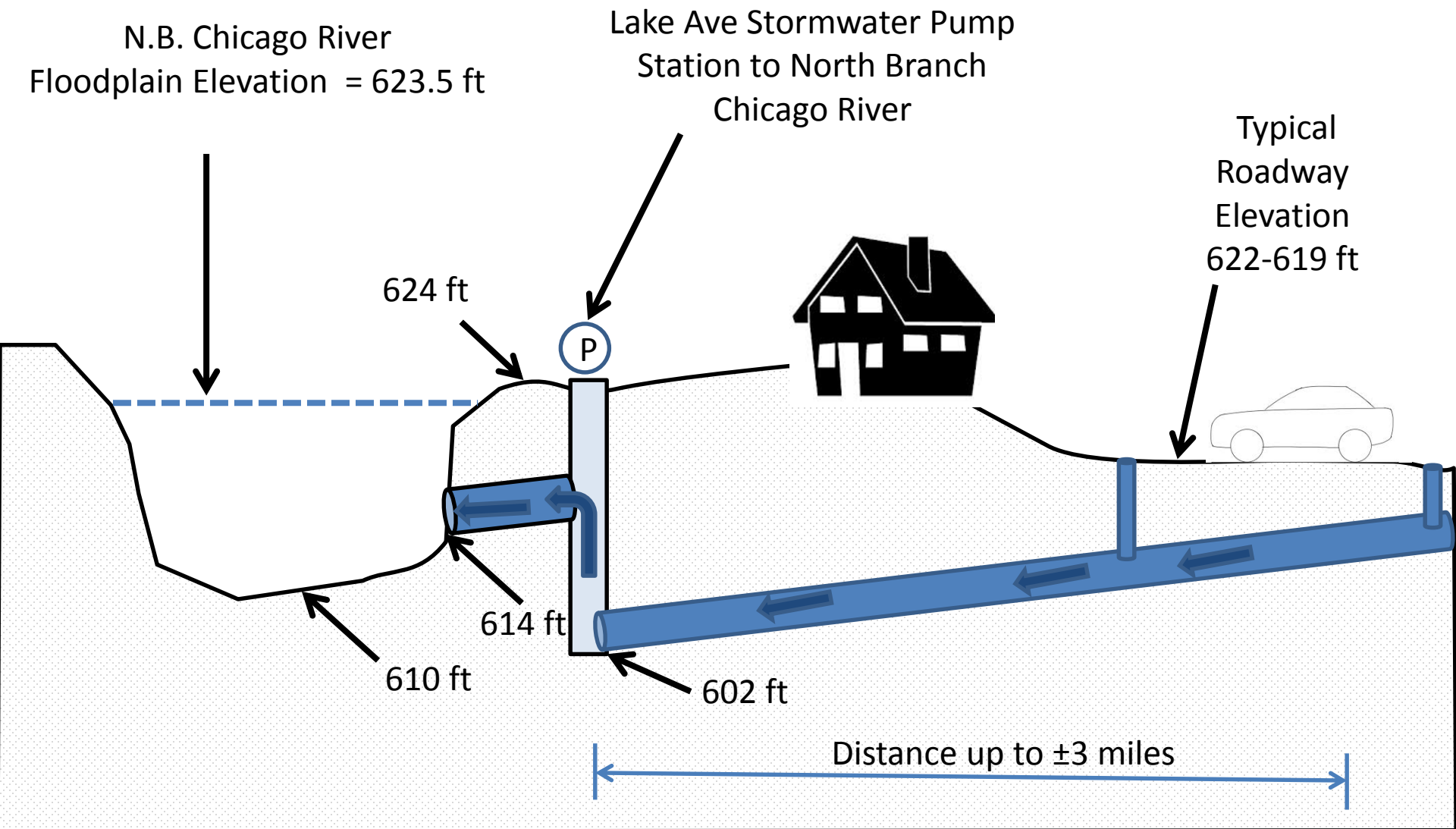
- 100-year storm event – Storm event with a 1% chance in occurring in any given year.
- 10-year storm event – Storm event with a 10% chance of occurring in any given year.
- 2-year storm event – Storm event with a 50% chance of occurring in any given year.
- Depth of flooding – Depth of standing water in the street.
- (cfs) cubic feet per second – flowrate measurement of water
- Acre-foot – Volume measurement for stormwater
    - 1 acre of land 1 foot deep
    - A flat football field with a depth of 1 foot
    - 616,715 2-liter bottles
    - 325,828 gallons

Existing Drainage System



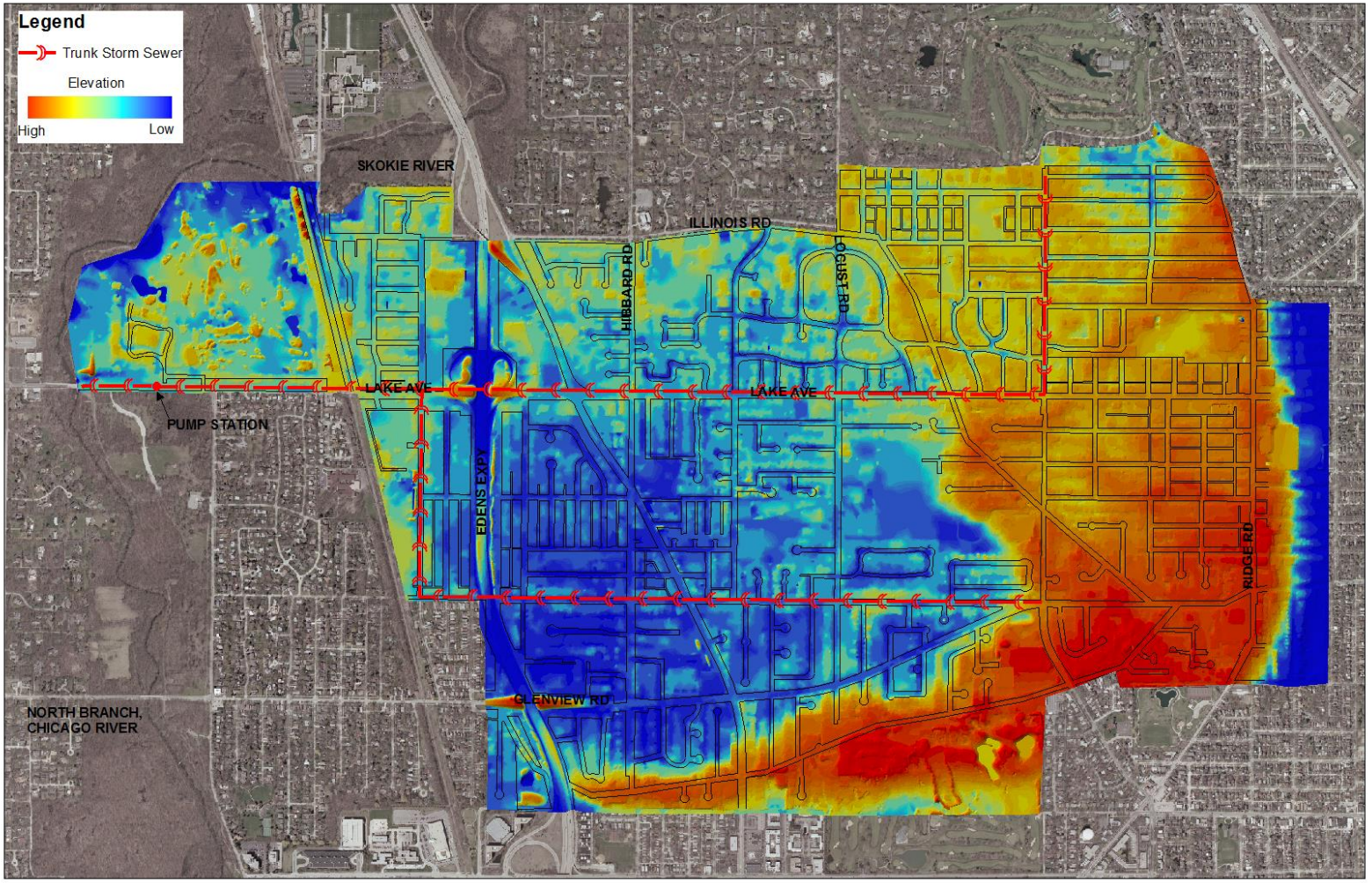
Limitations of Existing System

- Reliance on Storm Sewers and Pump Station



Limitations of Existing System

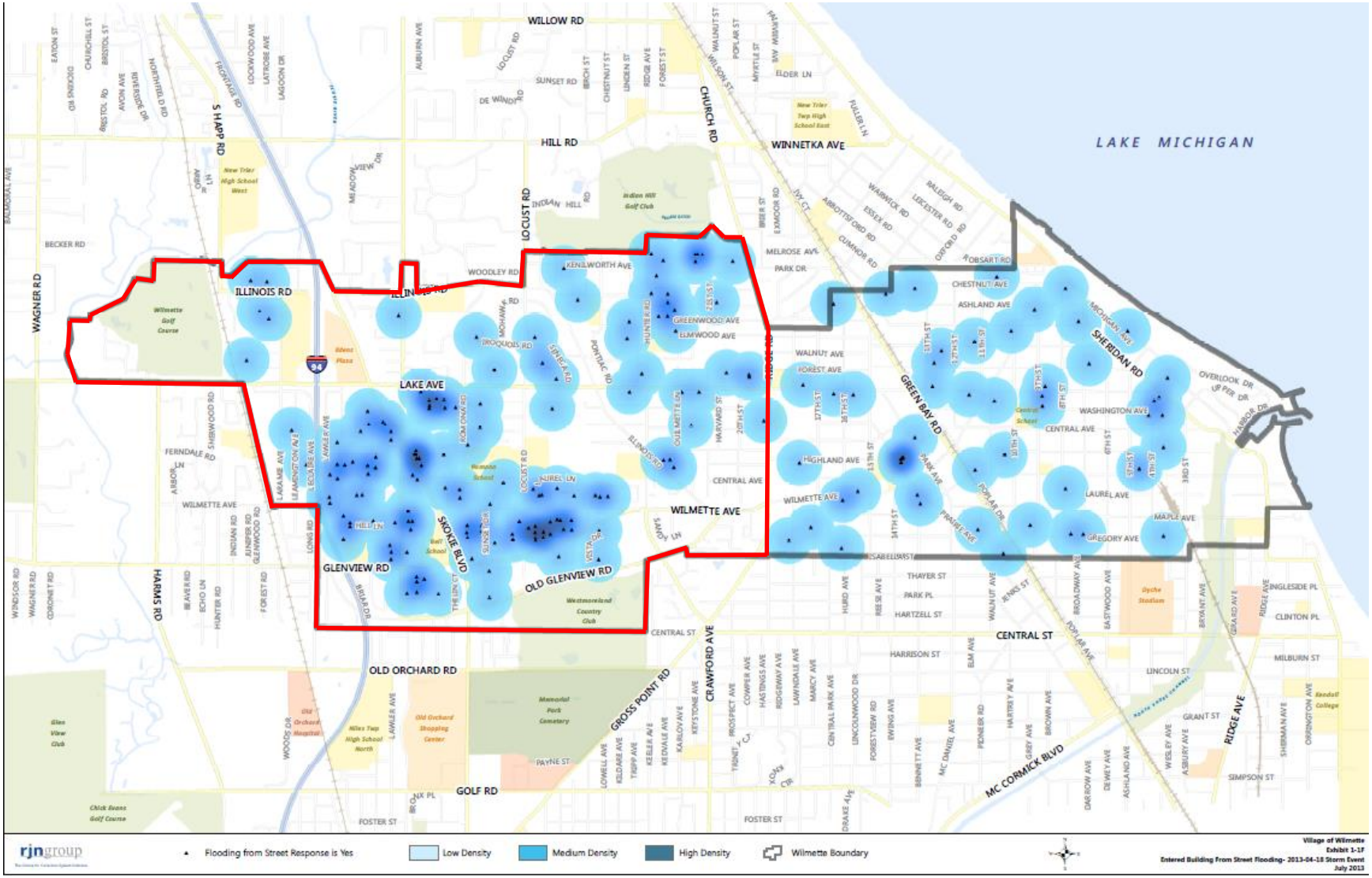
- Topographic Limitations



Limitations of Existing System

- Highly developed residential area
- Developed prior to modern stormwater management practices
  - Limited stormwater storage
  - Storm sewer undersized compared to modern design standards
  - No overland flow paths
- Limited open space
- No easy place to safely store or send runoff

Flood Heat Maps



April 2013 - Flooding from street response is “Yes”

Hydrologic and Hydraulic Modeling

- Stormwater model development
  - Incremental approach to develop a plan
  - Comprehensive analysis
  - Identify underutilized segments and/or restrictions
  - Identify potential improvements
- Calibration from monitoring & flood events
  - April 2013, May 2014 and June 2014

Existing Conditions Model Results

- Storm sewer system has 2-year capacity
- 10-Year storm event
  - Street flooding up to 2 feet in depth
- 100-year storm event
  - Street flooding up to 3 feet in depth
- April 2013 storm event
  - Equivalent to a 25-year storm event
  - Street flooding over 2.5 feet in depth
- June 2014 storm event
  - Equivalent to a 5-year storm event
  - Street flooding reported

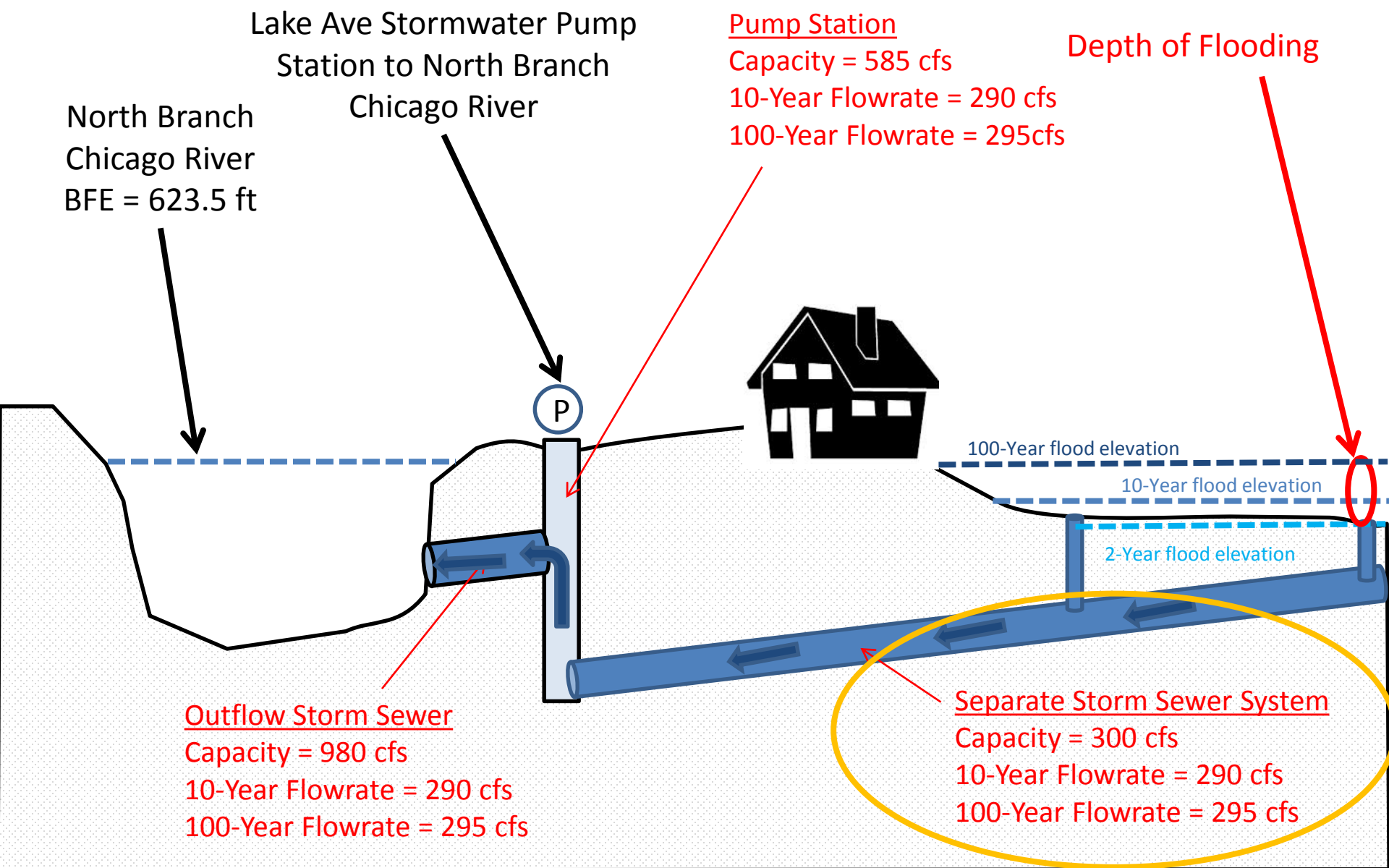
Existing Conditions Model Results

Estimated Number of *Structures* Impacted by Flooding

Return Interval Storm Event	Number of Structures*
10-year	120
25-year	280
50-year	480
100-year	700

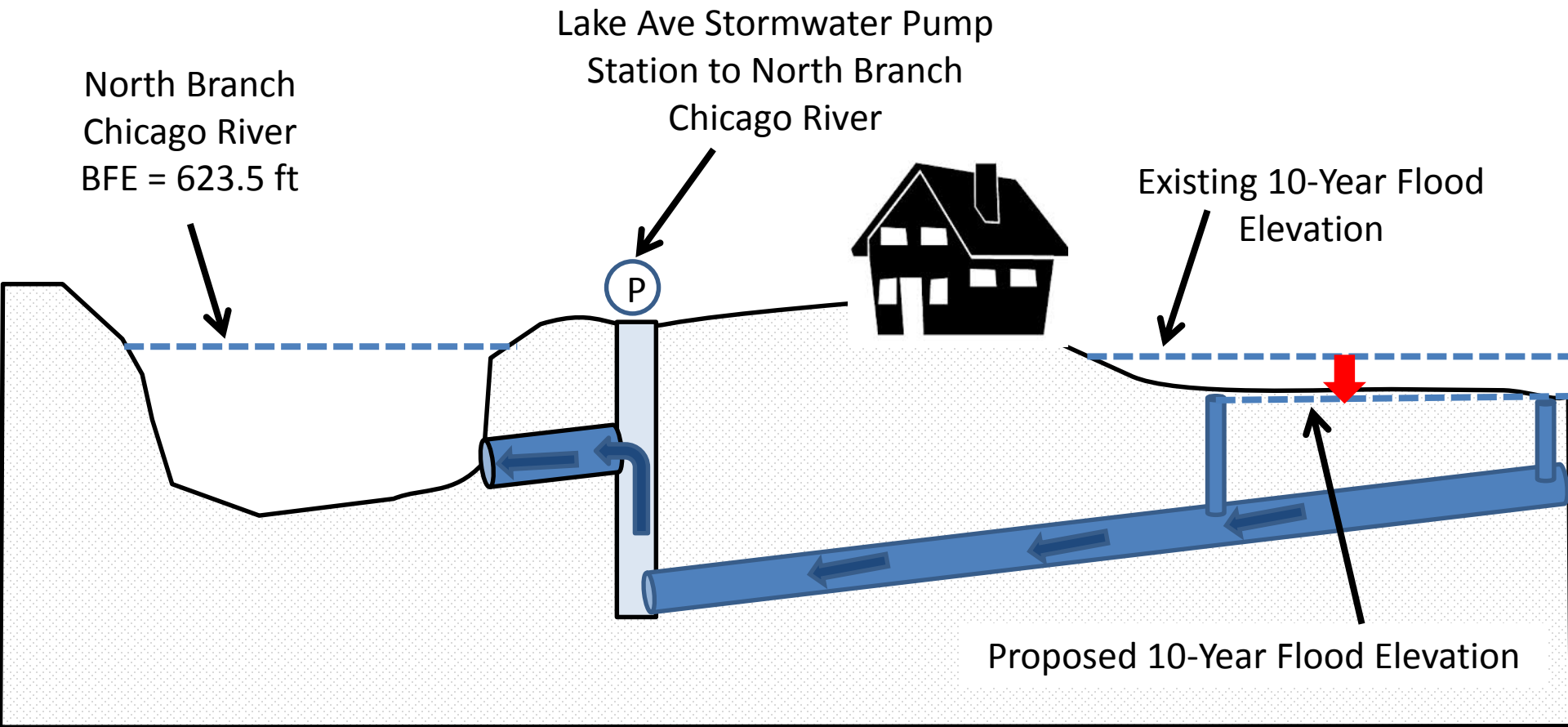
*Structure impacted when flood level is within 1 foot of highest lot elevation

Identification of System Bottlenecks



Proposed Drainage Improvements

- Goal: 10-Year System Capacity per August 2014 MSC meeting
  - Reduce 10-year flood elevation below pavement elevation
  - Similar to design standard for new construction



Summary of Projects

- Short Term Projects
  - Residential flood-proofing
  - High capacity inlets
  - Connection to Glenview system

- Green Infrastructure
  - Village owned property (roadside bioswales and islands)
  - Privately owned property (rain gardens and rain barrels)
  - Ordinance requirements, maintenance and limited flood reduction benefits

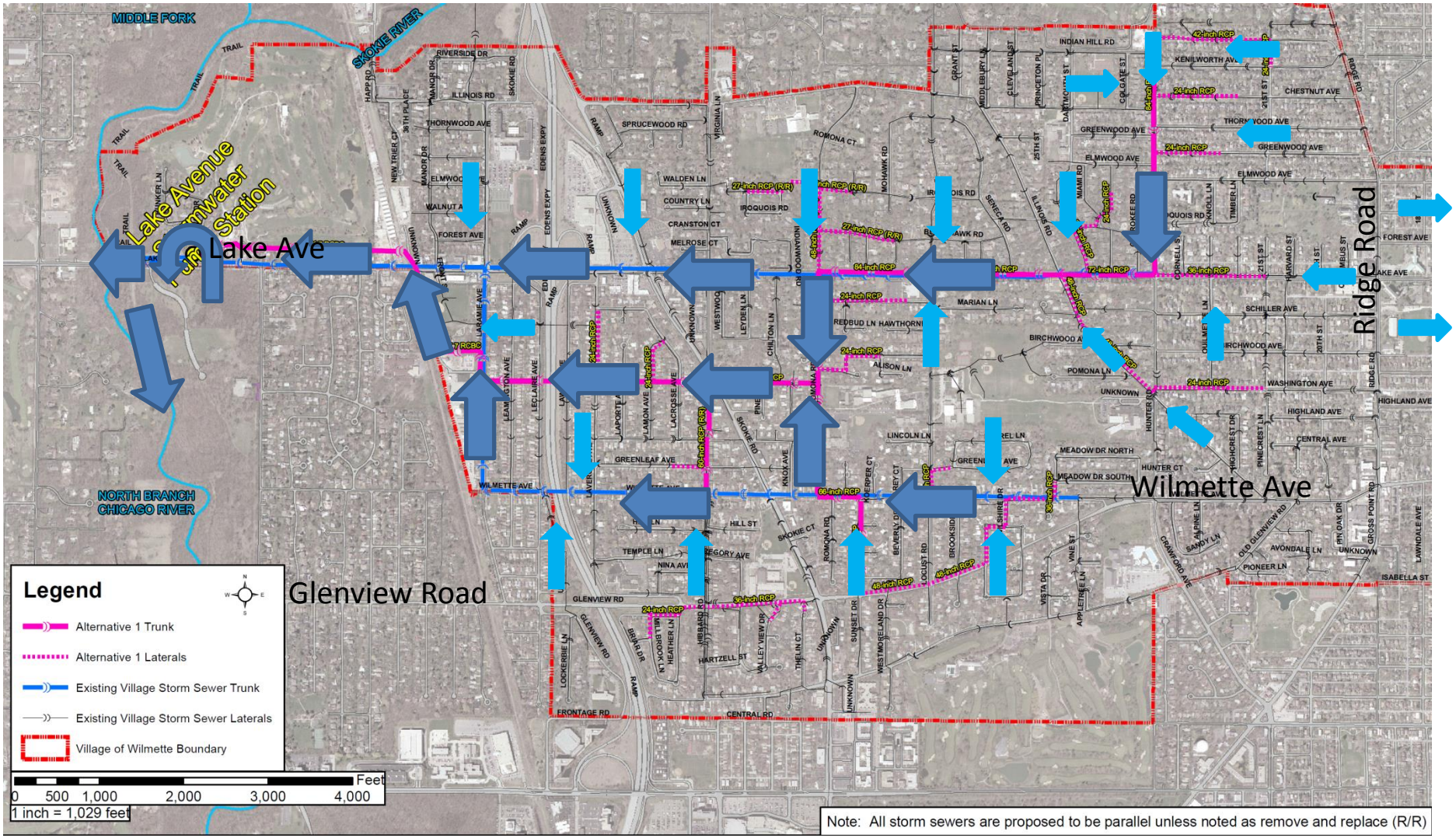
- Long Term Capital Projects
  - Alternative 1 – Relief Sewer System
  - Alternative 2 – Centralized Storage at Community Playfield
  - Alternative 3 – Neighborhood Stormwater Storage

Long Term Capital Projects

- Project Benefits
  - 10-year flood elevation at or below street level at all locations (except Alternative 3)
  - Reduction in street flooding depth and duration for all storm events
  - Reduction in structures impacted by flooding

Proposed Drainage Alternative 1

- Relief Storm Sewer System

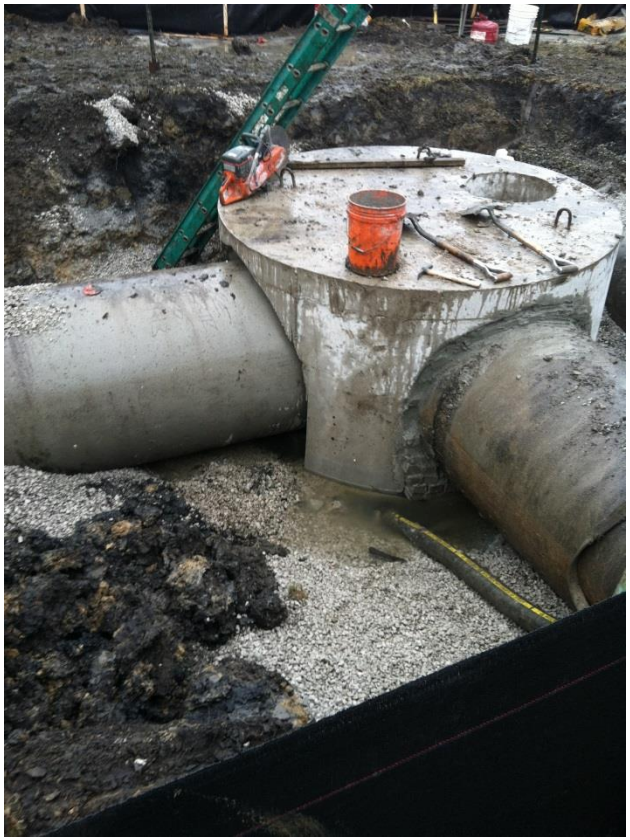


Proposed Drainage Alternative 1

- Add relief storm sewers to match pump station capacity
- Large diameter pipes & long distance
  - 21,000 linear feet of trunk storm sewer
  - 21,000 linear feet of lateral storm sewer
- Addition of 6th Variable Frequency Drive (VFD) pump (backup) at pump station
  - Redundancy and efficiency purposes only

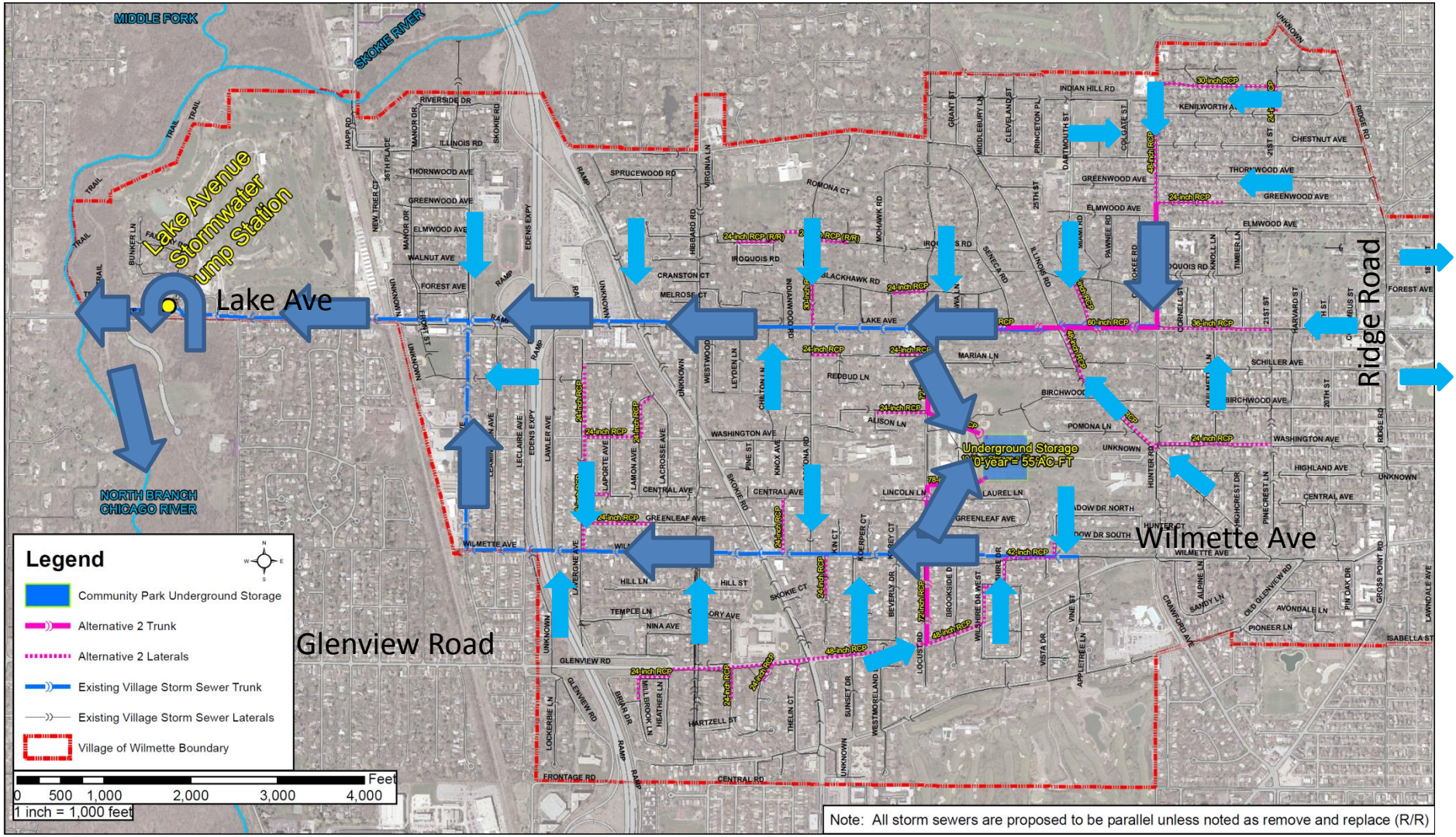
Proposed Drainage Alternative 1

- Project Costs
  - Engineer's Estimate = $75 Million
    - Contingency = 20%
    - Engineering costs included
    - 2014 Dollars
  - Other Costs
    - Long project duration
    - Significant traffic disruption
    - Utility conflicts
    - Golf course disruption



Proposed Drainage Alternative 2

- Centralized Storage at Community Playfield



Proposed Drainage Alternative 2

- Centralized Storage at Community Playfield
  - Storing water in system to reduce flowrates
  - 55 acre-ft (18 million gallons) of underground stormwater storage
  - Lift station required to dewater storage after storm
  - 6 acre footprint
  - 10,000 linear feet of trunk line upgrades
  - 25,000 linear feet of lateral sewer upgrades
  - Addition of 6th Variable Frequency Drive (VFD) pump (backup) at pump station
    - Redundancy and efficiency purposes only

Proposed Drainage Alternative 2

- Project Costs
  - Engineer's Estimate = $70 Million
    - 2014 dollars
    - Engineering costs included
    - 20% contingency
  - Other Costs
    - Long project duration
    - Significant park disruption
    - Roadway disruption
    - Utility conflicts

Photo of Underground Storage Installation in Northbrook, IL

Proposed Drainage Alternative 3

- Neighborhood Stormwater Storage

Proposed Drainage Alternative 3

- Smaller underground storage at 3 parks
- Total storage volume = 32 acre-ft
  - Thornwood Park: 10 acre-ft
  - Centennial Park: 12 acre-ft
  - Community Rec Center: 10 acre-ft
- 2,700 linear feet of trunk storm sewers
- 11,500 linear feet of lateral storm sewers
- Project can be more easily phased
- Does not provide 10-year level of protection to all residents
- Addition of 6th Variable Frequency Drive (VFD) pump (backup) at pump station
  - Redundancy and efficiency purposes only

Proposed Drainage Alternative 3

- Project Costs
  - Engineer's Estimate = $44 Million
    - Contingency = 20%
    - Engineering costs included
    - 2014 Dollars
  - Other Costs
    - Multiple & significant park disruption
    - Roadway disruption
    - Utility conflicts
    - Does not provide significant flood reduction to all locations

Capital Projects - Benefits and Costs

	Design Storm	Existing	Alternative 1	Alternative 2	Alternative 3
			Relief Storm Sewer System	Centralized Stormwater Storage at Community Playfield	Neighborhood Stormwater Storage
Benefits	Number of structures impacted by flooding (% reduction)				
	10-year	120	0 (100%)	0 (100%)	50 (58%)
	25-year	280	60 (79%)	90 (67%)	160 (43%)
	50-year	480	190 (60%)	240 (50%)	320 (33%)
	100-year	700	370 (47%)	490 (30%)	570 (19%)
	Street Flooding Depth in feet (Minimum - Maximum)				
	10-year	0.3 - 2.2	0.0	0.0	0.0 - 2.2
	25-year	0.5 - 2.7	0.0 - 1.7	0.1 - 1.8	0.3 - 2.6
	50-year	0.6 - 3.0	0.0 - 2.2	0.5 - 2.3	0.5 - 2.9
	100-year	0.6 - 3.3	0.0 - 2.6	0.6 - 2.7	0.6 - 3.2
Costs	Total Cost	--	$75 Million	$70 million	$44 million
	Cost per Structure Protected for 100-year event	--	$227,273	$333,333	338,462

Unquantified Benefits

- Reduction in:
  - Frequency and depth of flooding for *all* impacted structures
  - Infiltration into sanitary sewer system
  - Inflow into sanitary system
  - Basement seepage
  - Yard flooding
- Improved access during storm events
- Increased pump station flexibility
- Increased property values

End of Summary

The Following Slides Include the New Analysis

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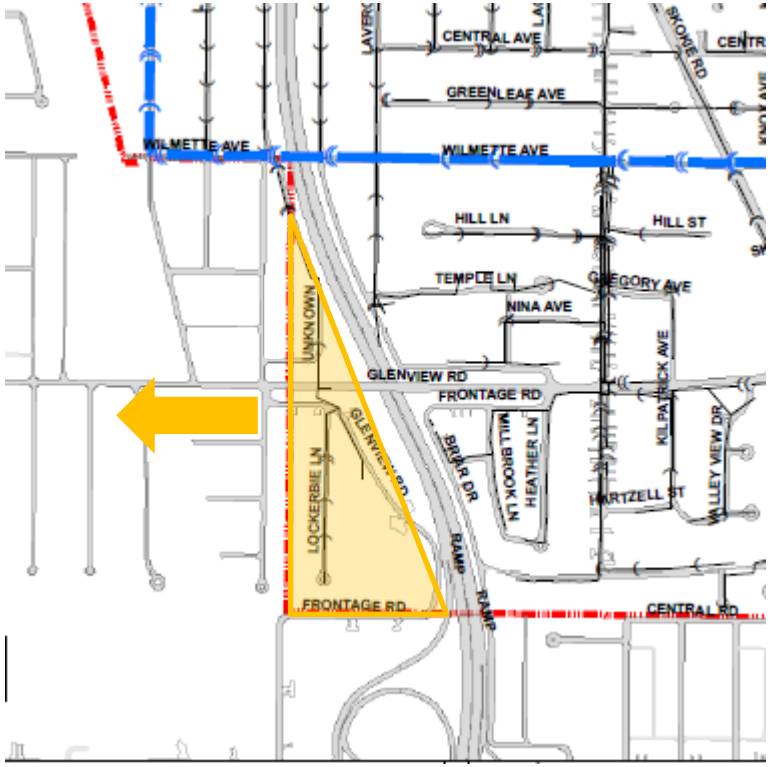
Summary of New Study

- Glenview Connection
  - Connection to Glenview storm sewer system
  - Reduce water flowing to Wilmette storm sewer system
  - Provide better drainage for 25 acres in SW corner of Village
  - Potential for “quick win”
- Revisions to Alternatives 1-3
  - New goal of minor ponding in Right of Way for 10-year event
  - Potential for cost savings as compared to original alternatives
  - Alternatives 1A, 2A, 3A
- Alternative 2 Revisions
  - Above ground storage in Community Park
  - Goal of no street flooding for the 10-year event
  - Potential for cost savings as compare to original Alternative 2
  - Alternatives 2.1 and 2.2

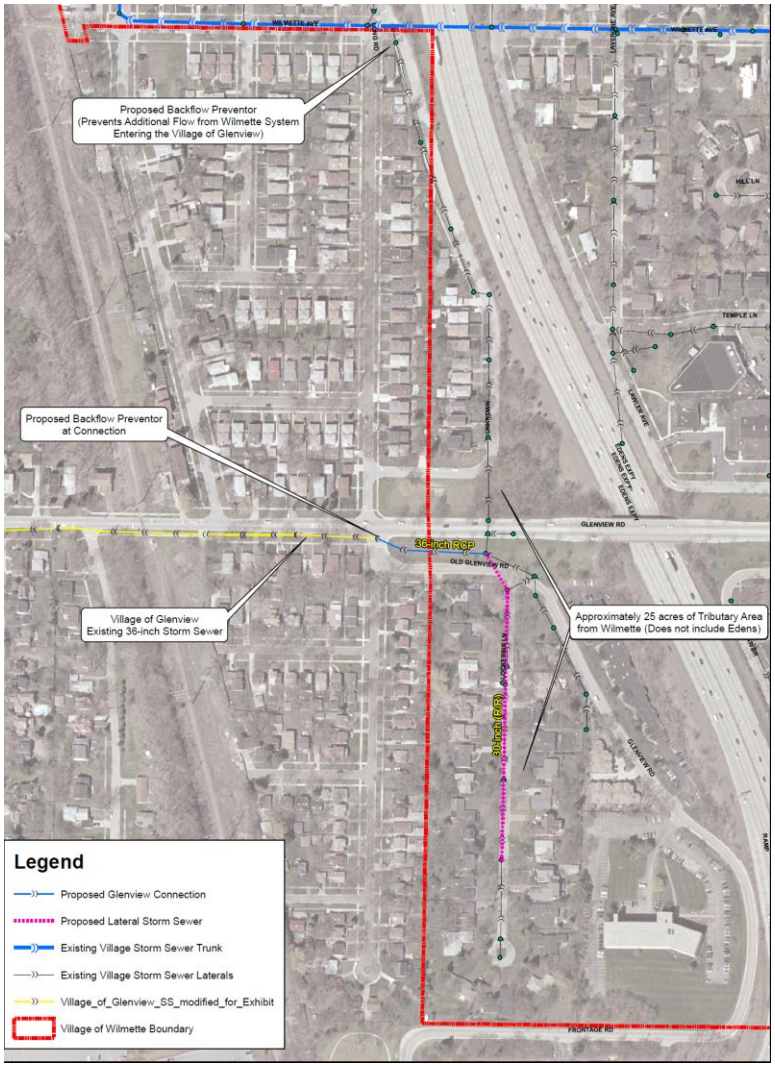
Glenview Connection

- Stand-alone short term project
- Inter-Jurisdictional coordination
- Glenview Drainage Projects
  - Phase 1 East of Harms
    - Pump Station
    - Backflow preventers
  - Phase 2 East of Harms
    - Storm sewer improvements
    - Designed for 10-year level of service
  - Designed to include 25 acres from Wilmette



Glenview Connection

- Proposed Wilmette Connection
  - Limited by existing and proposed Glenview system
    - Pump Station
    - Storm sewer system
    - 10-Year level of service
  - Existing Wilmette System
    - 2-Year level of service
  - Proposed Wilmette Improvements
    - New 30-inch storm sewer on Lockerbie Lane
    - New 36-inch storm sewer on Glenview Road
    - Backflow preventers

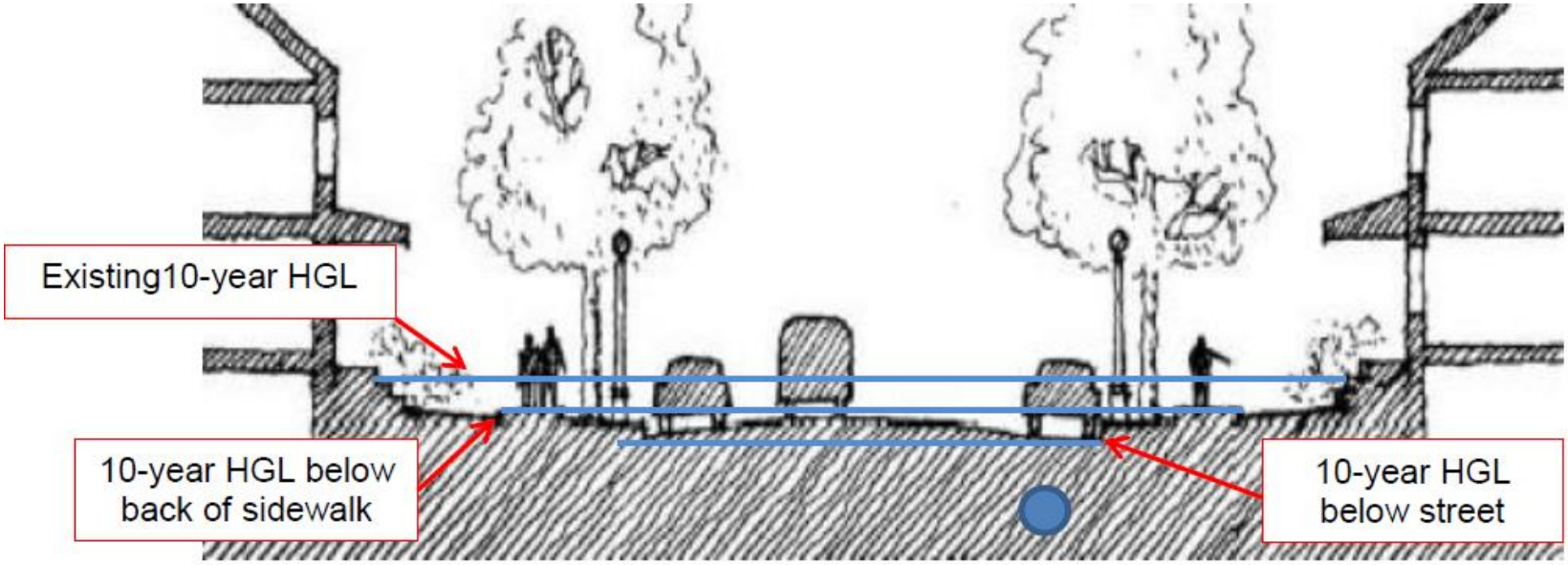


Glenview Connection

- Project Costs
  - Engineer's Estimate = $900,500
    - 2015 dollars
    - Engineering costs included
    - 20% contingency
  - Other Costs
    - Utility conflicts
- Project Benefits
  - 10-Year level of service for local drainage system
  - 5 structures with increased protection from 10-year to 50-year level of protection
  - Negligible benefit to remainder of separate storm sewer system

Alternatives 1A – 3A

- Revisions to Alternatives 1-3
  - New goal of minor ponding in Village Right of Way (ROW) for 10-year event to back of sidewalk or 6-8 inches in depth
  - Significant reduction in flood depths as compared to existing conditions



Alternatives 1A-3A

- Project Benefits
  - Reduce 10-year street flooding to back of sidewalk (approximately 6-8 inches) in all areas (except Alternative 3A)
  - Reduction in street flooding duration and depth
  - Reduction in structures impacted by flooding
- Unquantified Benefits
  - Reduction in:
    - Frequency and depth of flooding for *all* impacted structures
    - Infiltration into sanitary sewer system
    - Inflow into sanitary system
    - Basement seepage
    - Yard flooding
  - Improved access during storm events
  - Increased pump station flexibility
  - Increased property values

Alternative 1A

- Project Components and Cost
  - Relief storm sewer system
  - Similar layout as Alternative 1
  - Proposed storm sewer size decreased by approximately 6 inches in diameter
  - Cost reduced from $75M to $68M vs Alternative 1
  - Similar utility conflicts and traffic disruption

Alternative 1A

- Project Benefits
  - Number of structures impacted by flooding

Return Interval Storm Event	Number of Structures Impacted*			% Reduction	
	Existing Conditions	Alternative 1	Alternative 1A	Alt 1	Alt 1A
10-year	120	0	0	100	100
25-year	280	60	95	79	66
50-year	480	190	235	60	51
100-year	700	370	430	47	38

*Structure impacted when flood level is within 1 foot of highest lot elevation

Alternative 2A

- Project Components and Cost
  - Underground stormwater storage at Community Park
  - Similar layout as Alternative 2
  - Proposed storm sewer size decreased by approximately 6 inches in diameter
  - Underground storage decreased by 10% to 50 acre-ft
  - Cost reduced from $70M to $63M vs Alternative 2
  - Similar park disruptions as Alternative 2

Alternative 2A

- Project Benefits
  - Number of structures impacted by flooding

Return Interval Storm Event	Number of Structures Impacted*			% Reduction	
	Existing Conditions	Alternative 2	Alternative 2A	Alt 2	Alt 2A
10-year	120	0	0	100	100
25-year	280	90	115	67	60
50-year	480	240	290	50	40
100-year	700	490	540	30	23

*Structure impacted when flood level is within 1 foot of highest lot elevation

Alternative 3A

- Project Components and Cost
  - Similar layout as Alternative 3
  - Proposed storage at each park decreases by 10%
    - Thornwood Park = 8.2 acre-ft
    - Community Rec Center/Hibbard Park = 8.3 acre-ft
    - Centennial Park = 10.8 acre-ft
  - Proposed storm sewer size decreased by approximately 6 inches in diameter
  - Cost reduced from $44.0M to $39.1M vs Alternative 3

Alternative 3A

- Project Benefits
  - Number of structures impacted by flooding

Return Interval Storm Event	Number of Structures Impacted*			% Reduction	
	Existing Conditions	Alternative 3	Alternative 3A	Alt 3	Alt 3A
10-year	120	50	50	58	58
25-year	280	160	170	43	39
50-year	480	320	350	33	27
100-year	700	570	605	19	14

*Structure impacted when flood level is within 1 foot of highest lot elevation

Alternatives 2.1 and 2.2

- Revisions to Alternative 2
  - Goal of reducing 10-year flood elevation below street level
  - Use above ground storage in lieu of underground storage at Community Park to reduce costs

Underground Stormwater Storage

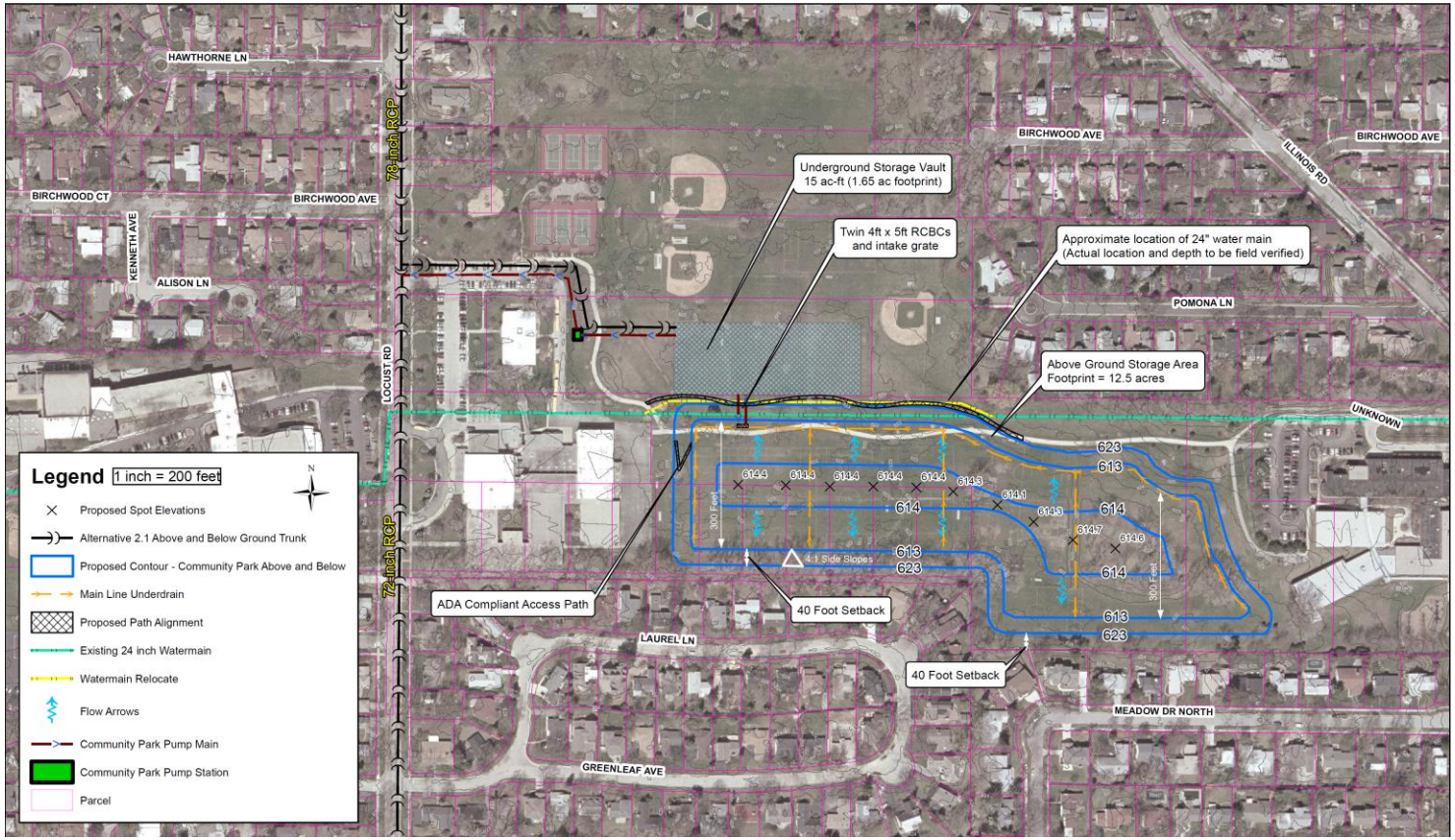
Above Ground Stormwater Storage

Alternatives 2.1 and 2.2

- Project Components
  - Sloped bottom with underdrains for enhanced drainage
  - Adequate bottom dimensions for existing soccer fields
  - Potential to add new park amenities
  - Designed to fill only when storm sewer systems near capacity
    - Water first enters at 6-month return interval storm event
    - 1.3 inches of rain over 3 hours
  - 40 foot setback along property lines for tree preservation
  - Alternative 2.1 will require pump station but smaller storm sewers under Locust Road
  - Will likely require relocation of existing 24-inch watermain and path within park

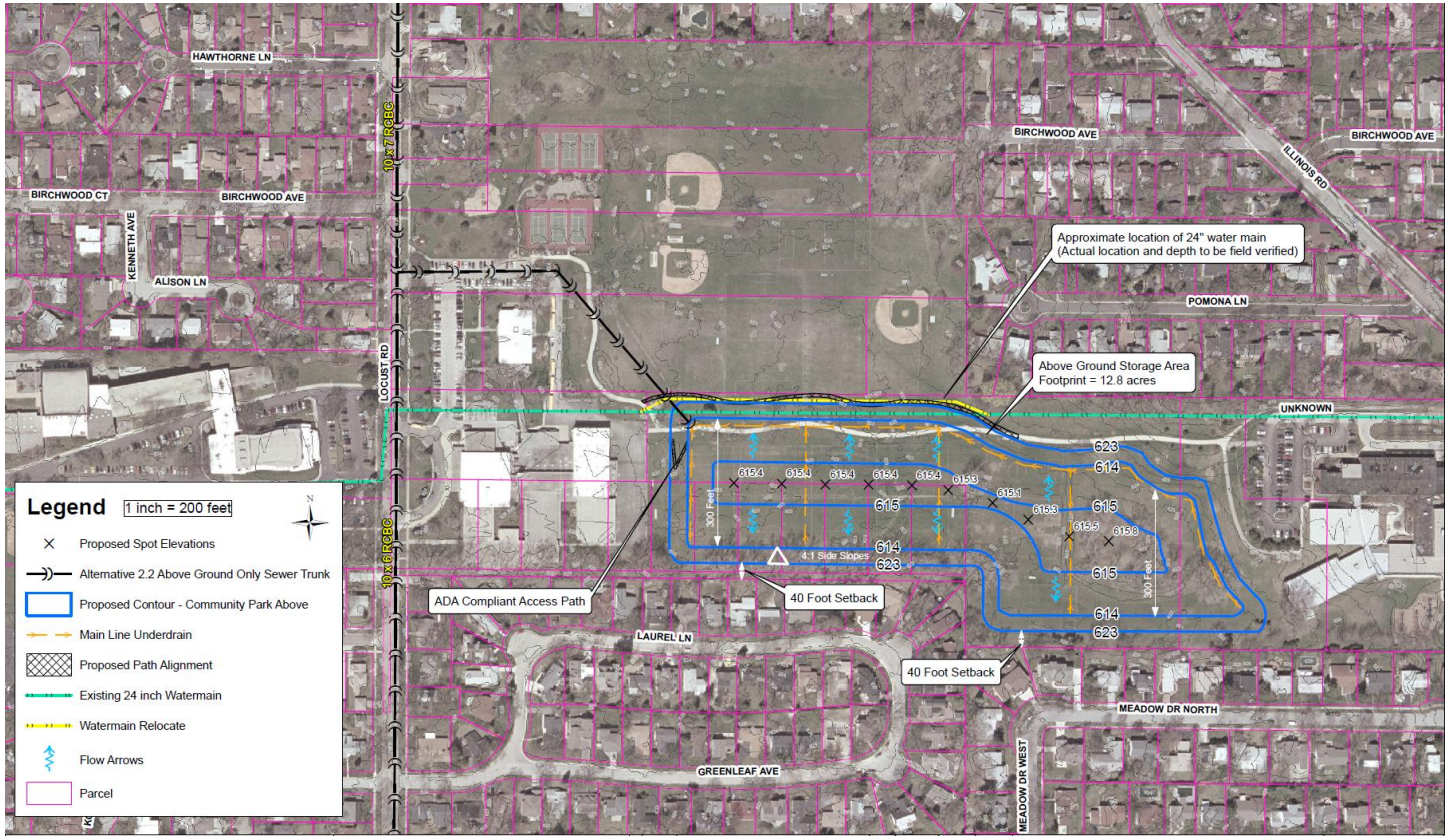
Alternative 2.1

- Primarily above ground storage with dry bottom for ballfields
- Total storage for 10-year event = 50 acre-ft at elevation 618 ft
- Depth from existing ground to bottom = 9-10 feet
- Storm sewer layout similar layout as Alternative 2



Alternative 2.2

- All above ground storage with dry bottom for ballfields
- Total storage for 10-year event = 50 acre-ft at elevation 619 ft
- Depth from existing ground to bottom = 8-9 feet
- Storm sewer layout similar layout as Alternative 2



Alternatives 2.1 and 2.2

- Project Benefits
  - 10-year flood elevation at or below street elevation at locations adjacent to storage
  - Increased pump station flexibility
  - 100-year storm event street flooding depth reductions:

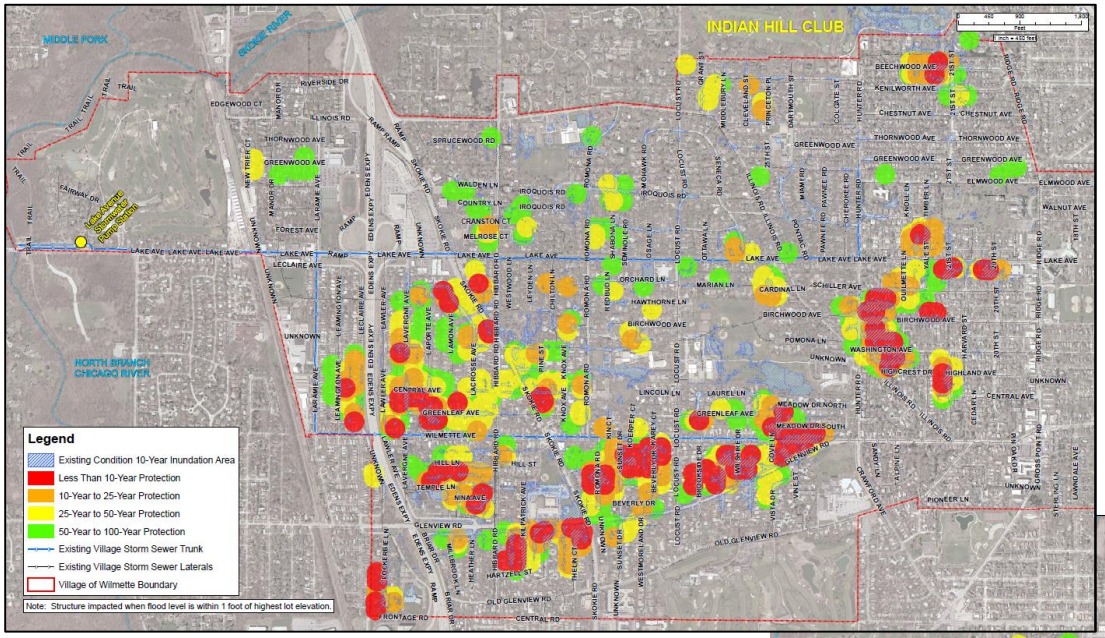
Location	Existing Flood Depth (ft)	Alternative 2 Proposed Flood Depth (ft)	Alternative 2.1 Proposed Flood Depth (ft)	Alternative 2.2 Proposed Flood Depth (ft)
Average All Study Areas	2.0	1.8	1.5	1.6
Valley View Lane	1.4	1.3	1.0	1.2
Beechwood Ave.	3.0	2.8	2.6	2.6
Wilshire Dr.	2.4	2.3	1.7	2.1

Alternatives 2.1 and 2.2

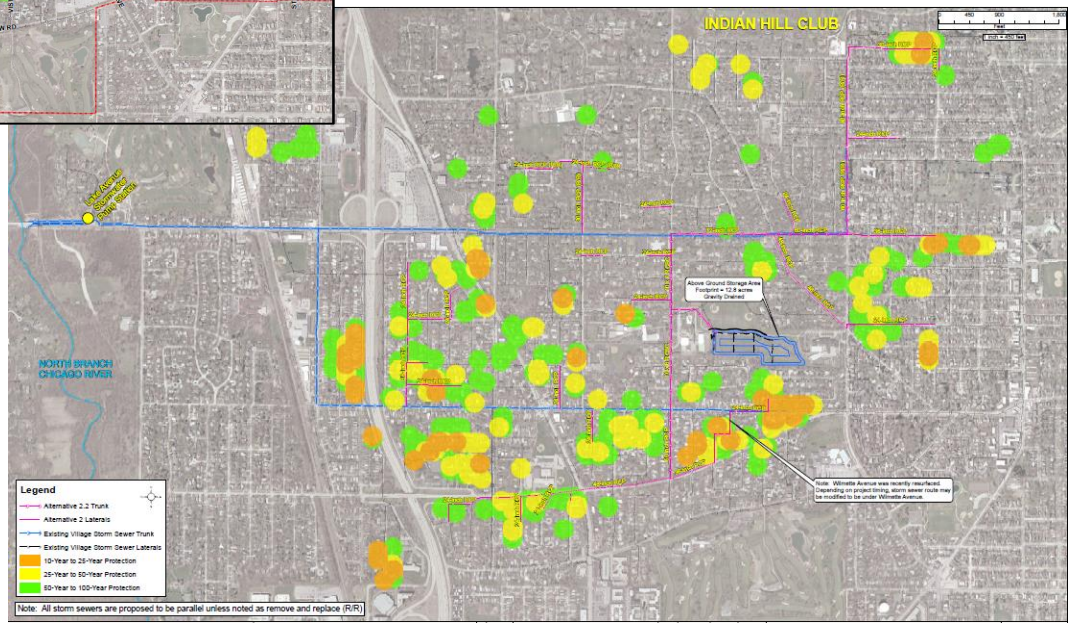
- Project Benefits
  - Reduction in duration of street flooding
  - Reduction in inflow/infiltration to sanitary system
  - Improved access during storm events
  - Reduction in structures impacted for 100-yr event:

Return Interval Storm Event	Number of Structures Impacted*				% Reduction		
	Existing Conditions	Alternative 2	Alternative 2.1	Alternative 2.2	Alt. 2	Alt 2.1	Alt 2.2
10-year	120	0	0	0	100	100	100
25-year	280	90	60	60	67	79	79
50-year	480	240	180	200	50	63	58
100-year	700	490	415	440	30	41	37

Alternative 2.2 – Flood Inundation



Existing Conditions– Residential Structures Impacted



Alternative 2.2 – Residential Structures Impacted

Alternatives 2.1 and 2.2

- Similar Projects

Pottawattomi Park – Tinley Park

Washington Park – Downers Grove

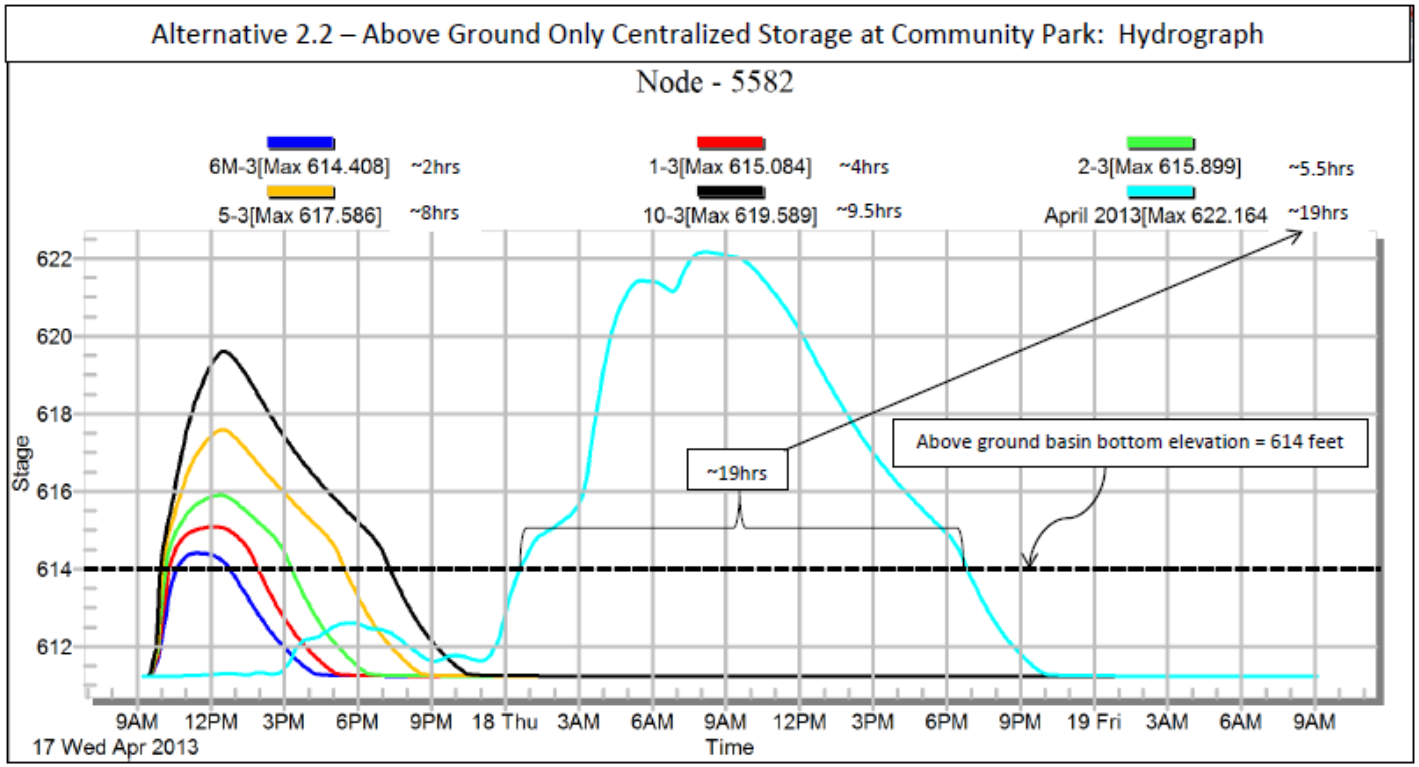
Parkside Park – Roselle

Alternative 2.2

- System Performance

Stage Hydrograph - Length of time stormwater is in the storage basin (hours).

Graph depicts the elevation of water (stage) on the y-axis versus time on the x-axis within the Commuminty Playfield Storage Basin.



Note 1: Above ground only storage alternative is gravity drained.

Note 2: 6M-3 refers to the 6-month, 3-hour (1.3 inches over 3 hours) design storm event, 1-3 refers to the 1-year, 3-hour design storm event, 2-3 refers to 2-year, 3-hour storm event, etc.

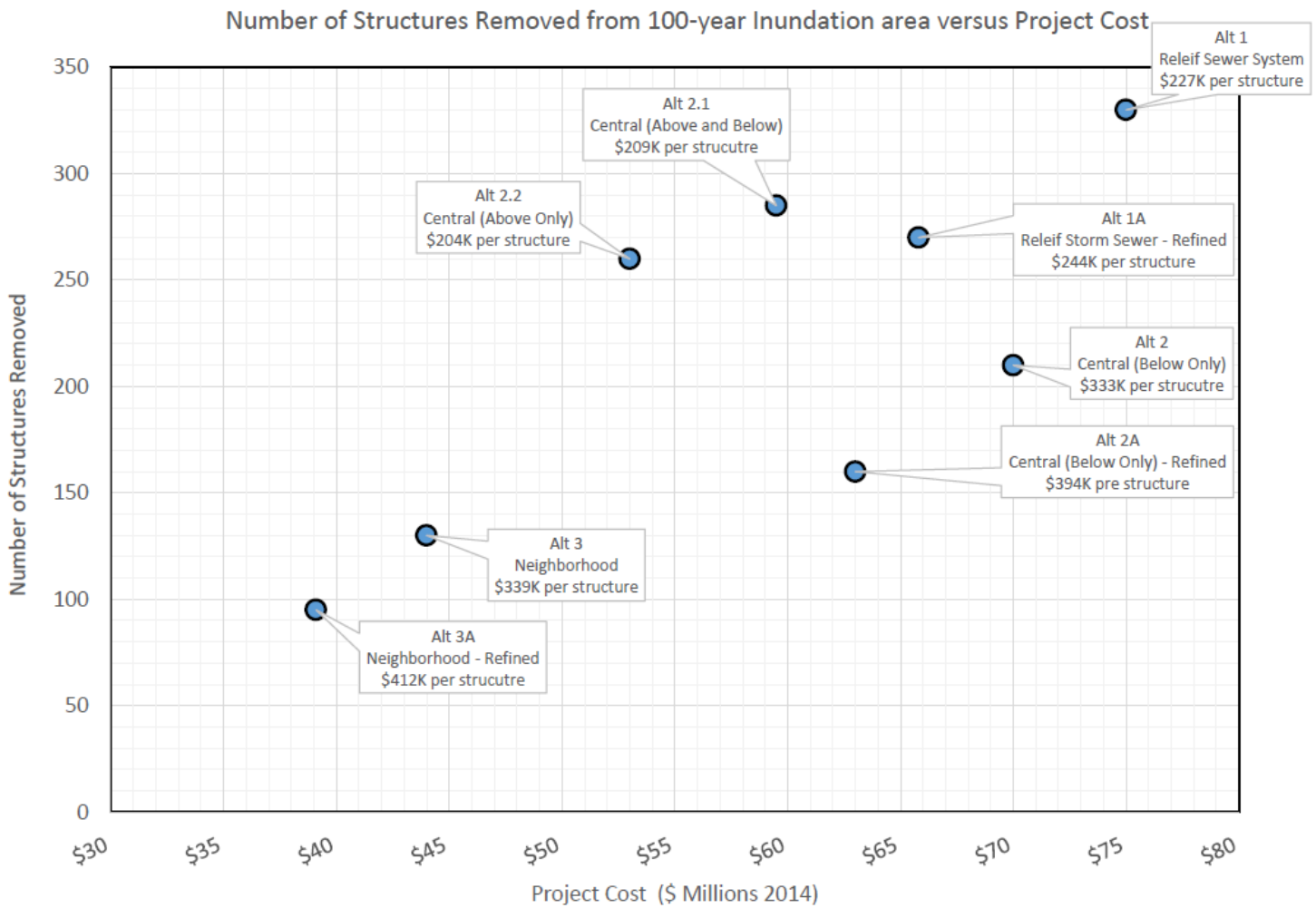
Alternatives 2.1 and 2.2

- Project Costs
  - Alternative 2.1
    - Cost reduced from $70M to $59.5M vs Alternative 2
  - Alternative 2.2
    - Cost reduced from $70M to $53.0M vs Alternative 2
  - Other Costs
    - Significant park disruption
    - Tree removal within footprint
    - Traffic disruption
    - Utility conflicts

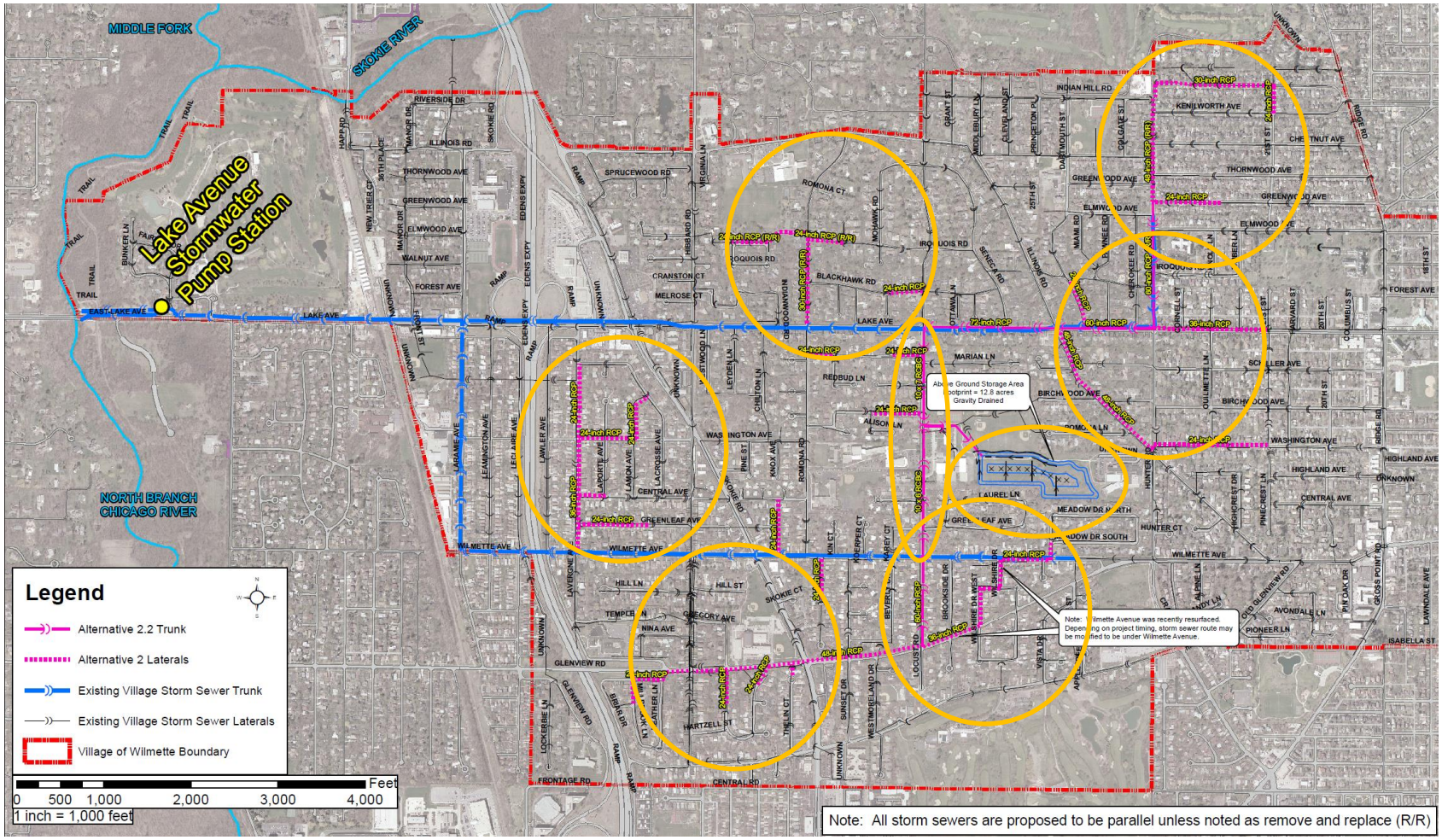
Capital Projects - Benefits and Costs

	Design Storm	Existing Conditions	Alternative 1	Alternative 1A	Alternative 2	Alternative 2A	Alternative 2.1	Alternative 2.2	Alternative 3	Alternative 3A
			Relief Storm Sewer System	Relief Storm Sewer System	Underground Stormwater Storage at Community Playfield	Underground Stormwater Storage at Community Playfield	Combination Stormwater Storage at Community Playfield	Above Ground Stormwater Storage at Community Playfield	Neighborhood Stormwater Storage	Neighborhood Stormwater Storage
Benefits	**Number of structures impacted by flooding (% reduction)**									
	10-year	120	0 (100%)	0 (100%)	0 (100%)	0 (100%)	0 (100%)	0 (100%)	50 (58%)	50 (58%)
	25-year	280	60 (79%)	95 (66%)	90 (67%)	115 (60%)	60 (79%)	60 (79%)	160 (43%)	170 (39%)
	50-year	480	190 (60%)	235 (51%)	240 (50%)	290 (40%)	180 (63%)	200 (58%)	320 (33%)	350 (27%)
	100-year	700	370 (47%)	430 (38%)	490 (30%)	540 (23%)	415 (41%)	440 (37%)	570 (19%)	605 (14%)
	Street Flooding Depth in feet (Minimum - Maximum)									
	10-year	0.3 - 2.2	0.0	0.0 - 0.8	0.0	0.0 - 0.8	0.0	0.0	0.0 - 2.2	0.0 – 2.2
	25-year	0.5 - 2.7	0.0 - 1.7	0.0 – 1.9	0.1 - 1.8	0.2 – 1.8	0.0 – 1.7	0.0 – 1.6	0.3 - 2.6	0.3 – 2.6
	50-year	0.6 - 3.0	0.0 - 2.2	0.0 – 2.3	0.5 - 2.3	0.5 – 2.3	0.3 – 2.2	0.0 – 2.2	0.5 - 2.9	0.5 – 2.9
	100-year	0.6 - 3.3	0.0 - 2.6	0.0 – 2.7	0.6 - 2.7	0.6 – 2.7	0.6 – 2.6	0.6 – 2.6	0.6 - 3.2	0.6 – 3.2
Costs	**Total Cost**	--	$75 Million	$65.8 million	$70 million	$63 million	$59.5 million	$53.0 million	$44 million	$39.1 million
	Cost per Structure Protected for 100-year event	--	$227,273	$243,700	$333,333	$393,750	$208,772	$203,846	$338,462	$411,579

Capital Projects - Benefits and Costs



Possible Phasing Scenario – Alternative 2.2



Phase 1 – Flood Storage (Years 1-2):	$10.6 million*
Phase 1a – Locust Road Storm Sewers (Years 2-4):	$7.0 million*
Phase 2 – Storm Sewers (Years 5 and beyond):	$34.6 million*
Total (with Locust Road Savings)	$52.2 million*

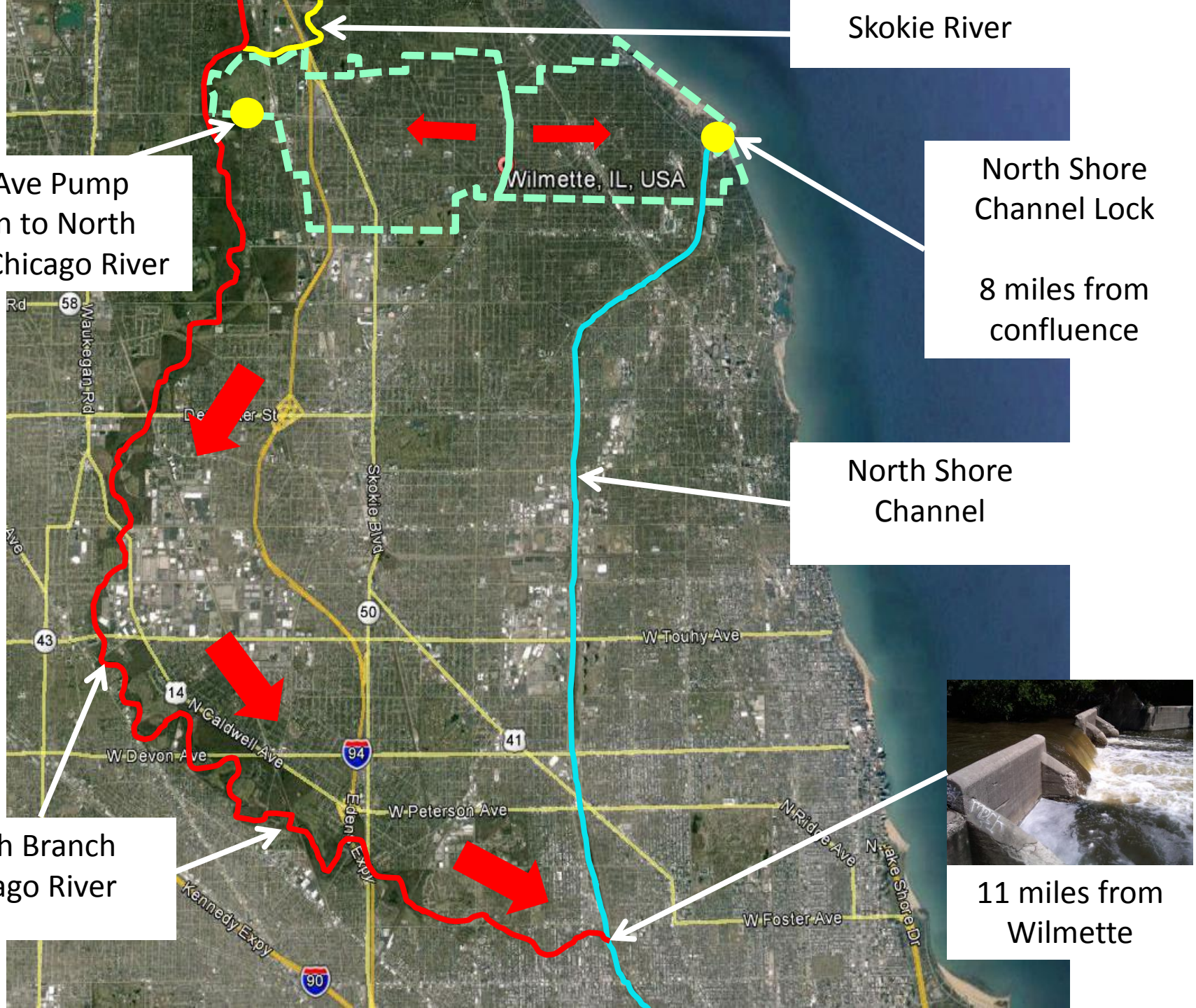
*2014 Dollars

End of Presentation

Questions

VILLAGE OF WILMETTE
STORMWATER
ACTION PLAN

THE VILLAGE OF
Wilmette
EST. 1872


Skokie River
Lake Ave Pump Station to North Branch Chicago River
Wilmette, IL, USA
North Shore Channel Lock
8 miles from confluence
North Shore Channel
Waukegan Rd
Skokie Blvd
W Touhy Ave
N Caldwell Ave
W Devon Ave
W Peterson Ave
Edens Expy
Kennedy Expy
N Ridge Ave
N Lake Shore Dr
W Foster Ave
North Branch Chicago River
11 miles from Wilmette