Staff Report: April 18, 2013 Flood Event
Prepared July 1, 2013

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I. Executive Summary

This report provides a summary and analysis of the April 17 & 18, 2013 storm event, key findings, and preliminary recommendations for future improvements and maintenance activities for the stormwater management system. To prepare this report, Village staff and consulting engineers analyzed information provided by residents and business owners through personal meetings, photos, emails, surveys, and videos. In July, the Village will host public meetings to discuss the report findings and obtain additional input. A final report with recommendations will be completed in August, in time for the 2014 budget process which begins in September.

Like much of northern Illinois, Downers Grove experienced significant flooding on April 17 & 18, 2013. The flooding occurred because heavy rain (6.7 inches in 24 hours) fell on ground that was already saturated from rain that fell in the preceding ten days.The saturated ground conditions reduced the amount of rain that could be absorbed into the ground, which caused it to run off into streams and creeks that were already at or above capacity due to previous rainfall.

Flooding occurred throughout the Village as the amount and intensity of rainfall exceeded the capacity of the stormwater management system. There was significant flooding throughout the village, including in homes, backyards and streets. Flooding was most severe in flood plains and in localized poor drainage areas. In flood plains, which are the areas adjacent to and including a body of water, the flooding occurred because creeks and streams overflowed. Flooding occurred in other areas outside flood plains because the stormwater exceeded what could be handled by existing stormwater infrastructure (pipes, ditches and culverts). Flooding was not caused by any clogs or malfunctions in infrastructure or equipment.

What's the Difference Between a Flood Plain and an LPDA?

Flood Plain - A designated area identified by the federal government as at higher risk of flooding than other areas. A flood plain is usually adjacent to a creek or other waterway.

Localized Poor Drainage Area (LPDA) - A low area not included within a federal flood plain but which still floods. An LPDA floods because it has inadequate drainage.

The 26 stormwater management projects built at a cost of over $20 million between 2008 and 2012 as part of the Village's plan for improvements to stormwater infrastructure worked as designed (See Attached List #1). These infrastructure improvements, intended to alleviate flooding in areas underserved by stormwater infrastructure or with persistent drainage problems, reduced the amount of flooding in the areas they serve.

The projects and policies described below are preliminary and may change based on resident input and further engineering analysis and design. Some new projects may begin as early as 2014; others will require further design and engineering to ensure they will provide the benefits that are anticipated. The implementation of planned projects is dependent on several factors, including the cost of the projects compared to the value of the improvements provided, available financial resources, technical feasibility and regulatory review.

Preliminary Recommendations

1. Continue to make the improvements listed in the Community Investment Program (CIP). (See Attached List #2, 22 Projects)
2. Make additional improvements similar to those listed in the CIP. (See Attached List #3, 19 Projects)
3. Consider making improvements to address flooding in flood plains. (See Attached List #4, 4 Projects)
    a. Remove houses from flood plains by acquiring properties and demolishing houses.
    b. Change the characteristics of the flood plain by acquiring land and building additional flood storage .
    c. Encourage property owners to flood proof homes that are located in the flood plain.
4. Prioritize improvements using cost benefit analysis.
5. Pursue partnerships with other governments and agencies to construct the recommended improvements.
6. Assess the condition of large diameter storm pipe that extends from Village Hall to Denburn Woods.
7. Complete comprehensive creek assessment to determine whether the creeks are operating at full capacity as conveyance channels in their current state.
8. Acquire streambank easements along creeks to access and maintain the banks of creeks and major drainage systems on private property.
9. Consider Cost Share Program modifications, including using Village funding for local improvements.
10. Consider regulatory changes that reduce runoff and demand on the system such as prohibiting sump pump and downspout connections to the system and requiring further runoff control best practices, in addition to current County regulations.

II. Purpose of Report

The purpose of this report is to provide a summary and analysis of the April 17 & 18, 2013 storm event, present key findings and develop preliminary recommendations for future improvements and maintenance activities for the stormwater management system. To prepare this report Village staff, along with three consulting engineers hired by the Village, analyzed information provided by residents and business owners through personal meetings, photos, emails, surveys and videos.

III. Summary of the Stormwater Management System

The Village manages stormwater in compliance with the federal Clean Water Act and in accordance with DuPage County stormwater regulations. Water that does not soak into the ground due to impervious surfaces becomes runoff and either flows directly into surface waterways or is channeled into storm sewers, which eventually discharge into local bodies of water. The Village manages this stormwater through a series of drains, ditches, pipes, stormwater basins, and other infrastructure in order to mitigate the potential effects of flooding, control erosion, and reduce the flow of pollutants to creeks and rivers.

What is a 'storage' system?
Storage systems are detention basins, ponds and permanent wetland areas that hold and slow runoff until it can make its way to a creek. Recently completed storage improvements include the dry basin at Washington Park and the 2nd and Cumnor detention area.

What is a 'conveyance' system?
A conveyance system is made up of ditches, culverts, pipes and creeks that carry stormwater until it drains into a larger body of water. The Village's stormwater drains into the East Branch of DuPage River.

The backbone of the Village's stormwater drainage system is provided by three creeks (see attached map):

- Lacey Creek, which is north of Ogden Avenue;
- St. Joseph Creek. which flows through the central portion of the Village; and
- Prentiss Creek, which is south of 63rd Street.

All three creeks drain westward and empty into the East Branch of the DuPage River. Storm drainage pipes, inlets, culverts, and ditches drain water from streets and properties to the three creeks.

IV. Summary of April 2013 Storm

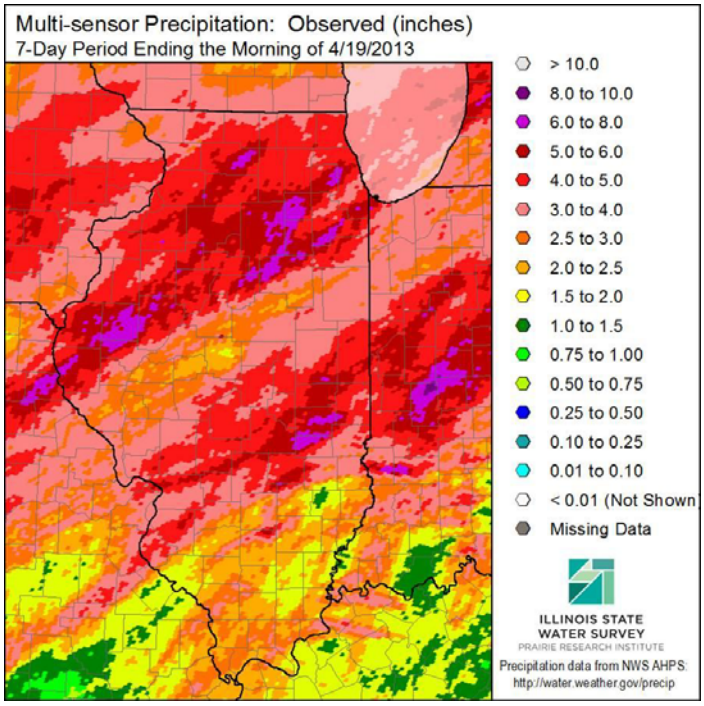
Guide to Acronyms

FEMA:	Federal Emergency Management Agency
NWS:	National Weather Service
cfs:	cubic feet per second
USGS:	United States Geological Survey
LPDA:	Localized Poor Drainage Area
CIP:	Community Investment Plan
BMP:	Best Management Practice

On Wednesday, April 17, and Thursday, April 18, 2013, several severe thunderstorms moved through all of DuPage County and northern Illinois, with the heaviest rainfall occurring early on April 18. During a 24-hour period, Downers Grove experienced 6.7 inches of rain. The storm exceeded the capacity of the Village's stormwater facilities and caused flooding to roadways, residential homes and businesses. The sanitary sewer system, owned and operated by the Downers Grove Sanitary District, surcharged due to the excess water, resulting in water backing up through sanitary drains, toilets and shower drains, which caused additional flooding to basements. Approximately 1,500 homes and businesses were affected by flooding. Nearly 400 residents have filed for federal assistance through the Federal Emergency Management Agency (FEMA). The attached map shows areas that reported the most flooding.

Rain Events Preceding April 17 and the Ground Conditions at Time of Storm

The storm's magnitude was itself significant, but flooding was exacerbated because the rain fell on saturated ground, a result of one of the wettest springs on record. The exhibit on the following page shows the amount of precipitation experienced in the region in the week leading up to the storm and through the day of the storm itself. The National Weather Service (NWS) reported that the Chicago area received a total of 15.6 inches of precipitation during the spring, which is 6.1 inches above normal. This ranks as being the third wettest spring on record in Chicago dating back to 1871. The NWS also reported that the month of April 2013 was the wettest April on record.



V. Comparison to 2006 Storm

In 2006, the Village experienced a major storm that caused significant flooding. The 2006 storm event prompted the Village to review the impact of the storm, analyze the condition of the stormwater management system and identify improvements to the system to reduce flooding and improve drainage. The Village constructed $20 million of improvements based on the analysis and recommendations stemming from the 2006 storm. (See Attached List #1)

The Village is responding to the April 2013 storm in a similar manner. Now that the Village has similar and up-to-date data for the April 2013 storm and resulting flooding, staff and the Village's consultants have compared the effects of the storms.

The purpose of this comparison between the 2006 and 2013 storms is to:

- Describe the difference between the storms to illustrate how they impacted the community differently;
- Determine if the projects in the current CIP should be constructed;
- Determine if new projects should be added to the CIP.

Based on data from the 2006 and 2013 storms, the events were different in terms of both total rainfall and ground conditions at the onset of the storm. The watershed improvements that have been completed since 2008 were effective, and will continue to be effective, for storms similar to the 2006 event. However, different stormwater mitigation and control projects may be required in the future to mitigate the impacts of storms similar to the 2013 event.

The Village compared total rainfall and runoff from both events. The storm that caused flooding in 2006 was characteristically different than the 2013 storm. The 2006 storm was shorter and more intense than the 2013 storm; in 2013, the storm event was much longer, lasting roughly 24 hours with nearly twice the total rainfall. The saturated ground conditions additionally exacerbated the effects of the 2013 storm by producing more runoff than would typically be expected from 6.7" of rain in 24 hours.

The Village is able to measure the amount of runoff by tracking the rate of the water flowing through creeks. The rate of water, measured in cubic feet of flow per second, at its peak in 2013 was double the rate in 2006. This means that significantly more water was flowing at a faster rate in 2013 than in 2006. According to the gage on St. Joseph's Creek (where it crosses under Ogden Avenue), the flow at its peak in 2006 was 975 cfs (cubic feet per second), while in 2013 it was more than double that amount at 2,210 cfs. This is a direct result of the volume of rainfall and the saturation of the ground. The result of increased runoff is that stormwater facilities could not keep up with the volume of water, which causes the water to back up as it enters conveyance channels, such as sewers.

The chart below shows how the peak flow in 2013 compared to peak flow in previous years. This year's event caused significantly more runoff than any storm that has been measured since 1990. Only one storm - in 1996 - caused runoff to reach 50% of the 2013 runoff.

Table 1: 10 Highest Peak Flow Measurements in St. Joseph's Creek Since 1990

Date	Peak Flow (Cubic Feet Per Second)
Apr. 18, 2013	2,210
Jul. 18, 1996	1,280
Oct. 02, 2006	975
May 09, 1990	938
Feb. 21, 1997	898
Feb. 26, 2009	886
Oct. 13, 2001	796
Sep. 14, 2008	764
Jul. 24, 2010	724
Nov. 27, 1990	715

Source: USGS National Water Information System website - http://waterdata.usgs.gov

The table below shows the differences between the 2006 storm and the 2013 storm in several key categories.

Table 2: Differences Between 2006 and 2013 Storms

Characteristic	October 2, 2006	April 17-18, 2013
Duration of Storm	Approximately 1 hour	Approximately 24 hours
Amount of Rain	Approximately 3.8”	Approximately 6.7”
Groundwater Conditions	Normal	Saturated
Peak Runoff (as measured on St. Joseph’s Creek at Ogden Ave)	975 cubic feet per second	2,210 cubic feet per second
Areas Primarily Affected	Localized Poor Drainage Areas (LPDAs) and Streets	Localized Poor Drainage Areas (LPDAs), Streets, Floodplain, and other areas
Number of Parcels Affected	Approximately 200	Approximately 1,500
Solutions Identified	Additional Stormwater Storage and Conveyance Improvements Designed Primarily to Improve Localized Poor Drainage Areas	See Section VI

VI. Consultant/Staff Preliminary Recommendations

Staff and the Village’s consultants have reviewed data and reports from key areas affected by flooding on April 18. The key areas reviewed were indicative of the Village’s overall storm experience; however, due to the limited timeline, not all areas affected by flooding were specifically studied in this report. Areas not included in the consultants’ review will continue to be addressed by Village staff. Additional projects may be identified at a later date as localized flooding will be addressed on a continual basis as part of streets and stormwater projects and the solutions may not be specifically addressed here.

The conclusions are summarized here. Further summaries of specific study locations are provided below. Additional information is available on each study area in the attached consultant reports.

General Conclusions

- Much of the stormwater system was not constructed to current standards that are in place to mitigate flooding. Older sewer systems do not provide volume and runoff control measures that would be incorporated into construction projects now.
- The existing system is capable of handling smaller and/or longer duration rains, but was overwhelmed by the runoff experienced in the April 17 and April 18 storm.

- Planned capital projects shown in the CIP reflect the desire to alleviate flooding in localized, poor drainage areas. These were the areas most affected in 2006 by the short-lived rainfall produced by that storm. The storm of 2006 did not necessarily cause a major flooding for creeks and floodplain areas.
- Projects constructed between 2008 and 2012 (See List #1) performed as designed and expected in the April 2013 storm event and mitigated flooding in the areas they serve.
- A combination of additional storage (stormwater basins) and conveyance improvements (larger, more efficient storm sewers and ditches) in key areas could help to alleviate flooding during storms like the April event.

Consultant Findings for Study Areas

St. Joseph's North & South Watersheds - The Village's consultant, Engineering Resource Associates, Inc. (ERA), assessed the following four areas that experienced flooding:

- St. Joseph Creek- Upstream of Downtown (Village Hall), between BNSF Railroad and 55th Street;
- St Joseph Creek Upstream of Downtown (Village Hall) between BNSF Railroad and Fairview Avenue;
- Deer Creek Subdivision at 56th and Fairview Avenue;
- Middaugh and Jefferson Avenue northwest & southwest corners.

The consultant's findings are summarized below. The detailed analysis and report is included as an attachment.

St. Joseph Creek Main Stem - Upstream of Downtown (Village Hall), between BNSF Railroad and 55th Street - Approximately 50 homes in the area between Park and Fairview Avenues and Maple and 55th St. reported some level of flooding on April 18, including 47 with flooding in the basement or in the basement and the first level.

ERA compared the capacity of the stormwater management system to the magnitude of the storm on April 18. The consultant concluded that the creek does not have enough capacity to handle the stormwater runoff from that event, causing it to overflow. The consultant also found that the conduit that carries St. Joseph's Creek under Hill and Grand is not sufficient for the volume of that storm. The sewer at Hill and Grand has a capacity of 566 cubic feet per second, but the actual runoff on April 18 is estimated at 643 cubic feet per second, which caused the water to back up into the surrounding floodplain.

Stormwater in this area also fills LPDAs, which flood because there are no established routes to carry the stormwater to the stormwater management system. The storm sewers that do exist also overflowed.

The Village's current CIP includes a project to replace the existing grate at Hill & Grand, which is confirmed by the consultant's report. The consultant report also recommends establishing overflow routes to convey the stormwater in the floodplain, as well as encouraging homeowners to use barrier flood proofing to protect basements and window wells.

St Joseph Creek Upstream of Downtown (Village Hall) between BNSF Railroad and Fairview Avenue - In this area, St. Joseph Creek flows through several conduits or culverts (at Austin, Fairview, Rogers and the BNSF). Both the culverts at Austin and Fairview are undersized for stormwater of this magnitude.

Additionally, flooding that occurred at the southwest corner of Rogers and Maple is due to stormwater overtopping the full conduit onto and over Rogers Street and into the commercial properties. The current structure at Rogers can convey only 86 cubic feet per second, while the storm of April 18 led to runoff of 638 cubic feet per second. After discharging from the other side of the Rogers conduit, the stormwater overflowed the banks of the open channel of the creek, which also does not have enough capacity to convey the water.

For this area, the consultant recommends considering the cost/benefit of replacing the structures at Rogers, Austin and Fairview, possibly building a flood control berm along the south side of the commercial properties, and encouraging flood proofing or flood mitigation measures. Some mitigation measures include constructing barriers or floodwalls around a home, elevating homes above the 100-year flood level, flood proofing non-residential buildings and flood insurance.

Deer Creek Subdivision at 56th and Fairview Avenue - This area saw street flooding, as well as backyard and basement and first floor flooding on April 18. A significant portion of this study area is within the 100-year regulatory flood plain limits. Overland flow routes along 56th Street and behind the homes along White Fawn Trail and Deerpath Lane are not adequate to safely convey the runoff during large storm events. The stormwater caused two detention basins to overflow in the Deer Creek Park subdivision in Westmont to the south of White Fawn Lane.

Recommendations for this area include moving the overflow points to a safe location and better defining the overland flow paths throughout the Deer Creek subdivision. Additional improvements should be considered in Westmont for establishing a defined overland flow path from the King Arthur Court Development to the east and raising the berms along the south portion of the Deer Creek subdivision.

Middaugh and Jefferson Avenue Northwest & Southwest Corners - Although not in a flood plain, an LPDA is located at the northwest corner and an overland flow path swale is located at the southwest corner. These contribute to the yard, basement, and garage flooding in this area. The small diameter outlets do not adequately drain the LPDA during large storm events, and the swale and sewer capacity at the southwest corner is undersized. Recommendations include local

improvements to the topography and storm sewer in this area, along with encouraging floodproofing measures.

St. Joseph's Watershed - The Village's consultant, Christopher Burke Engineering, assessed four areas that experienced flooding:

- Forest Avenue/Prince Street, between Prairie Avenue and north of Franklin Street
- Rogers Street at Bryan Place
- Washington Street north of Chicago Avenue
- Stanley Avenue between Lincoln Street and Grant Street.

The conclusions for each of the areas are found below:

Forest Avenue/Prince Street: This area saw street flooding, as well as backyard and basement flooding on April 18. The existing storm sewer will not be sufficient to handle runoff from the properties upstream of this area and additional drainage capacity should be added.

Rogers Street at Bryan Place and Whiffin Place - There was street and yard flooding in this area, caused by runoff that exceeded the capacity of the storm sewer. The storm sewer has capacity for drainage of 33 cubic feet per second (cfs); the April 18 storm event generated runoff of 129 cubic feet per second. However, the nearby improvements at Washington Park and the increased Rogers Street sewer capacity reduced the flooding that would have occurred without the improvements.

Washington Street, north of Chicago - This area is served by a 12-inch storm sewer. During the April 18 storm, the peak flow at this spot was 52 cubic feet per second, but the 12-inch storm sewer has capacity for 6 cubic feet per second. The Village's planned future improvement to this area is a 21-inch storm sewer on Chicago Avenue and extending into private rear yards. The consultant study confirmed that this project will reduce flooding.

Stanley, between Lincoln and Grant - This area has poor drainage because it has limited storm sewer infrastructure and existing storm sewers are undersized. Moreover, flooding behind the homes on Stanley occurred because there is no existing sewer. The area consists of two LPDAs; one to the west behind the homes on Grant and Elm, and one to the east behind the homes on Stanley and Lincoln. There have been some improvements in the area, including a 12-inch sewer along Elm. Proposed improvements include installing a pipe to drain the eastern LPDA, and a swale (ditch) to drain the western LPDA into the eastern one. The latter of these recommendations would be difficult, as the work would represent considerable re-grading of private property. The consultant considered an alternative sewer project, but found it would not provide any additional relief from flooding. The consultant recommended additional study to find a viable solution for the western LPDA.

Lacey Creek Watershed - The Village's consultant, V3, updated the hydrologic and hydraulic flood plain modeling for the Lacey Creek Subwatershed E area, generally located south of Lacey Creek, east of Highland Avenue, west of Fairview Avenue and north of Ogden Avenue. Specifically, they assessed the intersection of 40th Street and Washington Street. The consultant confirmed that improving stormwater conveyance from the Washington and 40th Street area to the wetland bank area east of Elm Street should provide flood relief to the residents in and adjacent to the flood problem areas. The report proposes larger storm sewers along Elm and Washington near 40th.

Preliminary Recommendations

Based on the consultants' recommendations (see attached memoranda), and staff's investigations, experience and interaction with residents and business owners, staff has prepared the following recommendations:

1. Continue to Make the Improvements Listed in the CIP (See Attached List) - The Village has a robust capital improvement and maintenance plan that incorporates Best Management Practices to update existing infrastructure and retrofit areas that do not have sufficient drainage and storage. A list of projects scheduled for construction between 2013 and 2017 is attached.

2. Make Additional Improvements Similar to Those Listed in the CIP - The Village should continue to make improvements in areas that are not located in or near floodplains, but still experienced flooding. Most of these properties could benefit by making improvements available through the Neighborhood Drainage Improvements Cost-Share Program.

3. Consider Making Improvements to Address Flooding in Flood Plains - Where feasible, the Village may explore acquiring land to create large-scale or small-scale storage facilities. Small-scale storage facilities strategically built throughout the stormwater system would reduce runoff volume, which would help mitigate flooding near waterways. Addressing flooding in the flood plain would consist of the following:

- Remove houses from flood plains by acquiring properties and demolishing homes
- Change the characteristics of the flood plain by acquiring land and building additional storage
- Encourage homeowners to floodproof homes that are located the flood plain

4. Prioritize Improvements Using Cost-Benefit Analysis - All potential projects should be reviewed to determine project costs and the value of the benefits the projects would provide. Since there are limited resources available to pay for the recommended projects, the results of the cost-benefit analysis should be considered when determining which projects should be constructed.

5. Pursue Partnerships - The Village should consider additional partnerships with other local government entities, such as the school district, that have space for storage or other projects.

6. Assess the Condition of Large Diameter Storm Pipe that Extends from Village Hall to Denburn Woods - The Village should perform a full assessment of the condition of the 11-foot diameter pipe carrying St. Joseph's Creek through Downtown. Planned maintenance improvements to this pipe will help mitigate the risk of unplanned and expensive emergency repairs or flooding in the case of failure.

7. Complete Comprehensive Creek Assessment - Review creeks and streams to determine whether the current state of the creek system is effective in conveying stormwater.

8. Acquire Streambank Easements Along Creeks - Many of the streambanks running through the Village are located on private property and are not accessible to the Village for maintenance and improvement. The Village should seek easements to access and appropriately control the banks of creeks and major drainage systems on private property.

9. Consider Cost Share Program Modifications - The Village has an existing cost-share program which provides partial funding for neighborhood drainage projects on private property. The Village could consider methods of maximizing the value of this program by covering a larger share of the cost and expanding the type of projects eligible for funding. Specific modifications could be the inclusion of neighborhood bioswales or rain gardens.

10. Consider Regulatory Changes - The Village should consider additional requirements for new and existing construction, including exploring a prohibition of connections from down spouts and sump pumps directly to the stormwater system. Additionally, the Village should explore additional requirements that would require on-site storage for new construction. Additional Best Management Practices, such as green roofs and permeable pavement should be considered.

VII. Next Steps and Schedule

In July, staff will hold a series of public meetings with residents and business owners, to present preliminary findings and gather additional input. Throughout July and August, staff will continue to review and assess the known flooded areas, and will determine the recommended course of action for each. Included in staff's assessment will be a re-evaluation of the existing CIP projects to determine if value engineering, modification or elimination of these projects would be prudent based on the experience of the April 2013 flood event. In September, staff will present a list of proposed stormwater and drainage projects for consideration with the 2014 budget.

ATTACHMENTS

Map of Self-Reported Flooding
Map of Watersheds
List #1 - Completed Stormwater Projects
List #2 - Projects Planned in Current CIP
List #3 - Additional Identified Local Drainage Improvements
List #4 - Potential Flood Plain Projects
Map of Completed and Planned Stormwater Infrastructure Projects
Map of Locations for Future Projects (Local Drainage and Floodplain)
Consultant Reports
Staff Report on Flooding in Vicinity of Lee and Ogden and Attachments

BUTTERFIELD RD
WOODCREEK DR
LACEY RD
31ST ST
HIGHLAND AVE
FINLEY RD
Lacey Creek
I-88
OGDEN AVE
WARRENVILLE RD
CROSS ST
I-355
St. Joseph's Creek
BELMONT RD
DUNHAM RD
55TH ST
MAIN ST
FAIRVIEW AVE
MAPLE AVE
63RD ST
Prentiss Creek
WOODWARD AVE
LEMONT RD
75TH ST

Self Reported Flooding

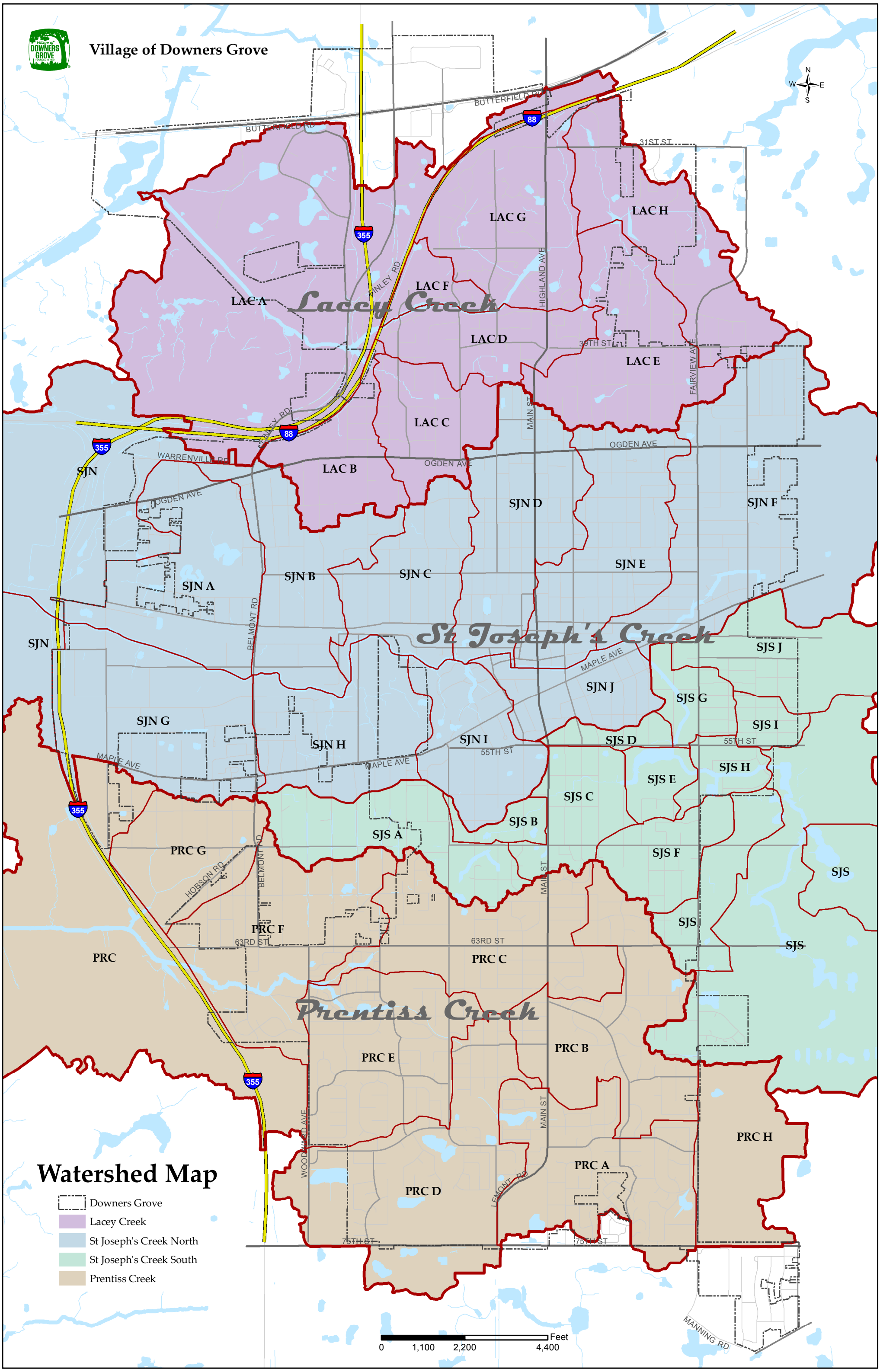
Streams

FloodWay

FloodPlain

Village of Downers Grove
Self-Reported Flooding
Heat Map

Village of Downers Grove



List #1 - Completed Stormwater Projects		
Project Name	**Obligated or Spent to Date**	**Status**
Storm Sewer Improvements – Carpenter St. from 59th to 63rd (SW-027)	$267,423	Completed - 2008
Parrish Court Drainage Improvements - LA-D (SW-029)	$197,028	Completed - 2008
Storm Sewer Replacement LA-G – Venard & Acorn (SW-030)	$92,510	Completed - 2008
Storm Sewer Replacement LA-G – Barneswood (Saratoga-Highland) (SW-031)	$50,887	Completed - 2008
Storm Sewer Improvements PR-E – Dunham Place (SW-032)	$124,868	Completed - 2008
Maple and Carpenter Storm Sewer Replacement (DR-008)	$861,173	Completed - 2008
St. Joseph Ck. Dredging - Mackie to Carpenter (DR-010)	$83,764	Completed - 2008
Storm Sewer Repairs - Fairmount from 62nd to 65th (DR-015)	$156,505	Completed - 2008
Watershed Improvements Sterling North – SJN-C (SW-033)	$602,172	Warren & Wallbank and Lee & Warren: Completed - 2010 Sterling North: To be re-evaluated
Watershed Improvements including McCollum Park – PR-B (SW-034)	$3,666,521	Completed - 2010
Watershed Improvements SJN-J - Around Randall Park (SW-036)	$1,455,446	Completed - 2010
Watershed Improvements SJS-I - 8th and Victor area (SW-038)	$1,828,707	Completed - 2010
Watershed Improvements including Washington Park – SJN-E (SW-042)	$4,430,352	Completed - 2010
Storm Sewer Improvements on Pershing north of Warren (SW-064)	$289,642	Completed - 2011

Project Name	Obligated or Spent to Date	Status
Storm Sewer Improvements on Davis Street from Douglas to Grant (SW-066)	$412,066	Completed - 2011
Storm Sewer Improvements on Washington, from Grant to south of Ogden (SW-065)	$290,215	Completed - 2011
Storm Sewer Improvements on Prospect from Chicago to Lincoln (SW-058)	$66,767	Completed - 2011
Watershed Improvements LA-G - Retaining Wall Replacement (SW-007)	$825,408	Completed - 2011
Watershed Improvements – SJS-J (SW-035)	$2,795,031	Completed - 2012
Storm Sewer Improvements at Wisconsin and Janes (SW-062)	$299,731	Completed - 2012
Green Streets/Sustainable Stormwater Program (Bio-retention pilot project on Washington north of 59th and Stormwater Improvements on Grove Street) (SW-069)	$115,558	Completed - 2012
Storm Sewer Improvements on Oakwood, north of Chicago (SW-070)	$382,035	Completed - 2012
Storm Sewer Improvements on Elm Street from Lincoln to Grant (SW-076)	$313,535	Completed - 2012
Saint Joe's North Branch Stabilization (DR-011)	$267,677	Completed - 2013
Saint Joe's South Branch Stabilization Phase I (DR-022)	$305,318	Completed - 2013
Fire Station #3 Bio-Swale (SW-063)	$117,727	Completed -2013
Total Obligated of Spent to Date:	**$20,298,066**	

List #2
CIP Projects 2013 – 2017

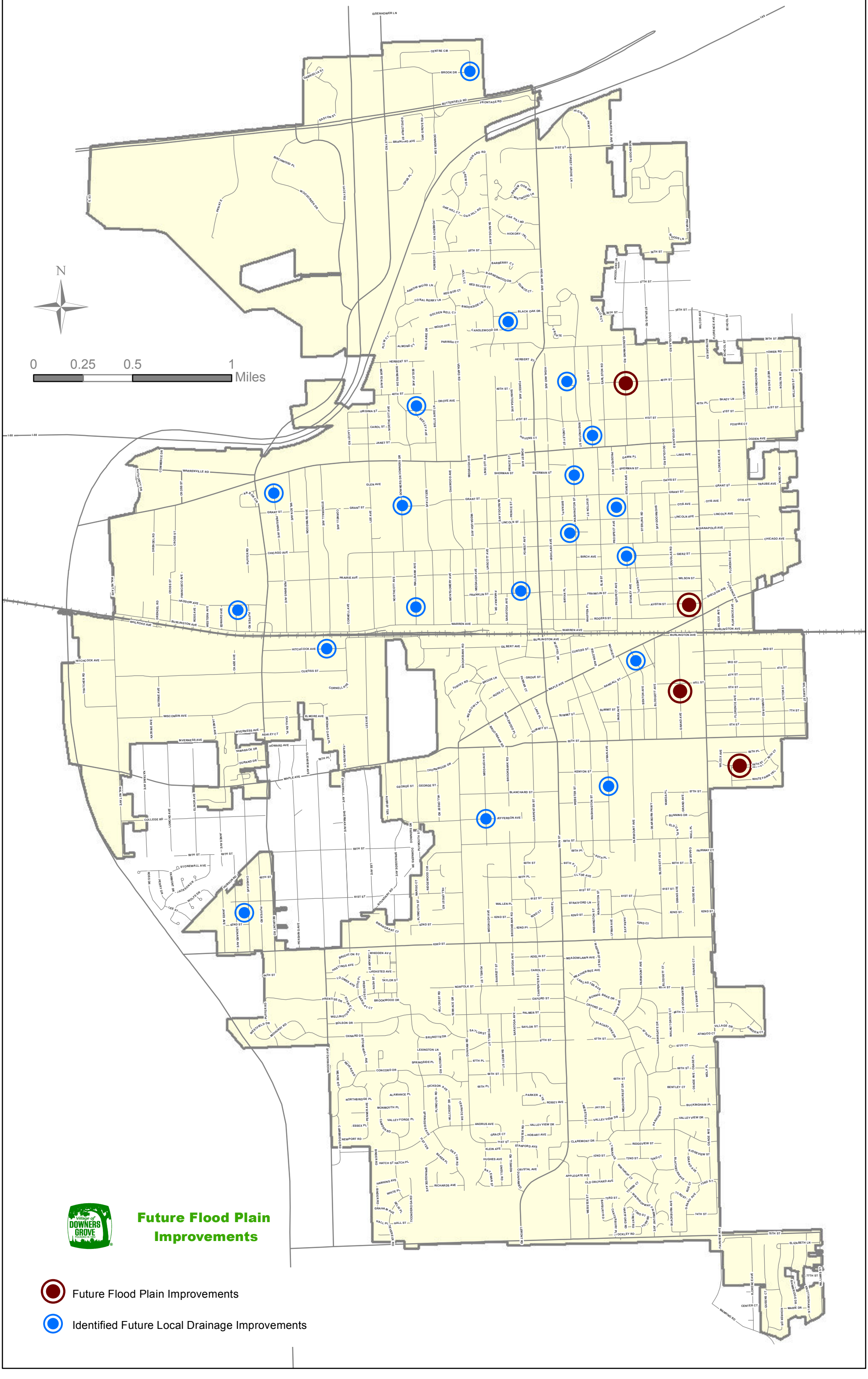
- Streambank Improvements – St. Joseph's South Branch (DR-022)
- Streambank Improvements – St. Joseph's Main Branch (DR-024)
- Drainage Improvements - Cumnor Rd between Sheldon and Chicago (DR-032)
- Barth Pond – Dredging (DR-034)
- Valley View Pond Improvements (DR-035)
- Existing Draintile Investigation (DR-037)
- Kensington Place Online Storage Improvements (DR-039)
- Streambank Improvements – Lacey Creek (DR-040)
- Water Quality Improvements at PW Parking Lot (ST-041)
- Watershed Improvements, St. Joseph Creek, North Branch Sub C (includes proposed Sterling Park Storm Water Facility and multiple local drainage improvements); to be re-evaluated based on 2013 storm event (SW-033)
- Downers Grove Estates Drainage Improvements; to be re-evaluated based on 2013 storm event (SW-039/040)
- Drainage Cost Share Program (SW-051)
- Drainage Improvements – Clyde Estates (SW-053)
- Headwall Replacement – Hill & Grand (SW-056)
- Headwall Replacement – Gilbert & Brookbank (SW-057)
- Drainage Improvements on 35th Street between Saratoga and Venard (SW-067)
- Green Streets/Sustainable Stormwater Program (SW-069)
- Annual Storm Sewer Replacements (SW-070)
- Downtown Business District Water Quality Enhancements (SW-073)
- Sterling Rd. Storm Sewer (SW-077)
- Headwall Replacement – Grand at 55th Street (SW-078)
- Washington Street Storm Sewer Replacement (SW-079)

List #3
<u>Identified Future Local Drainage Improvements</u>

- Middaugh & Jefferson
- 40th & Washington St.
- South of Prairie between Forest Ave. and Prince St.
- Washington Street North of Chicago Ave
- Stanley Avenue between Lincoln and Grant
- Benton & Elmwood between Maple & Randall
- Black Oak Dr between Saratoga & Candlewood
- Chase Ave between Haddow & Warren
- Debolt/Linden/Gierz
- Elm & Earlston between Ogden & 41st
- Grant & Downers Intersection
- Hobson triangle area
- Washington south of Ogden/Highland Ct.
- West Side of Lyman between Kenyon & Blanchard
- Downers Dr./Virginia St/Seeley Ave/40th St
- Hitchcock between Cornell and Glenview
- Wallbank north of Warren
- Pershing between Ogden and Grant
- Brook Drive and Centre Circle

List #4
Future Floodplain Improvements

- St. Joseph's Creek North of BNSF to Hummer Park
- St. Joseph's Creek south of BNSF to 55th Street
- Deer Creek from Fairview east to Village Limits
- 40th & Glendenning Wetland Complex


N
0
0.25
0.5
1
Miles
Future Flood Plain Improvements
Future Flood Plain Improvements
Identified Future Local Drainage Improvements

Map of Completed and Planned Stormwater Infrastructure Projects

Village of Downers Grove

N

0 0.25 0.5 1 Miles

SW-030
SW-067
SW-031
DR-040
SW-063
SW-029
SW-077
SW-065
SW-066
SW-076
SW-070
SW-058
SW-042
DR-011
DR-032
SW-064
SW-033
SW-057
DR-010
SW-079
SW-056
SW-035
ST-041
DR-024
DR-008
SW-073
SW-036
SW-078
SW-038
SW-062
SW-033
DR-034
SW-028
DR-022
SW-069
SW-053
SW-027
DR-015
SW-034
SW-039/SW-041
DR-039
SW-034
DR-035
SW-032

- Completed Stormwater CIP Projects 2008-2012
- Stormwater CIP Projects 2013-2017

Flood Study of April 17-18, 2013

Downers Grove, DuPage County, Illinois

Prepared for:

Village of Downers Grove
Public Works Department
5101 Walnut Avenue
Downers Grove, IL 60515

June 2013

ERA Project #130512

ENGINEERING RESOURCE ASSOCIATES, INC.
Consulting Engineers, Scientists & Surveyors

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Introduction

The Village of Downers Grove experienced significant flooding from a storm event that began on April 17th and ended on April 18th, 2013. The storm event's total rainfall amount was recorded throughout the Village at approximately 7-inches during a 24-hour time period. As a result of the flooding the Village of Downers Grove retained Engineering Resources Associates, Inc. (ERA) to study four areas that experienced significant flooding.

ERA studied the problem areas using the following data:

- DuPage County's FEQ hydraulic flood plain model
- Federal Emergency Management Agency (FEMA) Flood Plain Maps and Flood Insurance Study Profile
- Individual Assistance Damage Assessment for April 17-18, 2013
- Photos and videos of the extents of flooding from the April 17-18, 2013 storm
- Area observations on April 18th, 2013 by ERA
- GIS information with topography, regulatory flood plain limits, aerials, draft flood plain limits, localized poor drainage areas, storm sewer routing
- Previous watershed studies (e.g. Watershed Infrastructure Improvement Plan (WIIP), Westmont Stormwater Master Plan, etc)
- Rainfall data from the Downers Grove Sanitary District (DGSD) rain gages
- USGS gage data
- Engineering Plans of critical flood control or storm water management structures
- Flood Plain Mapping Report and Documentation for St. Joseph Creek (June 2012)
- Field Visits and Discussions with Village Staff and Residents

The report focuses on the following areas:

- St. Joseph Creek Main Stem – Upstream of Downtown (Village Hall), between BNSF Railroad and 55th Street
- Northeast Tributary of St. Joseph Creek (Reach 7) – Upstream of Downtown (Village Hall), between BNSF Railroad and Fairview Avenue
- St. Joseph Creek – Deer Creek Subdivision at 56th Street, east of Fairview Avenue
- Middaugh Avenue and Jefferson Avenue, northwest and southwest of intersection

For each area we have provided the following:

- A description and location map of the area
- A description of the extents and type of flooding experienced during the April 2013 storm event

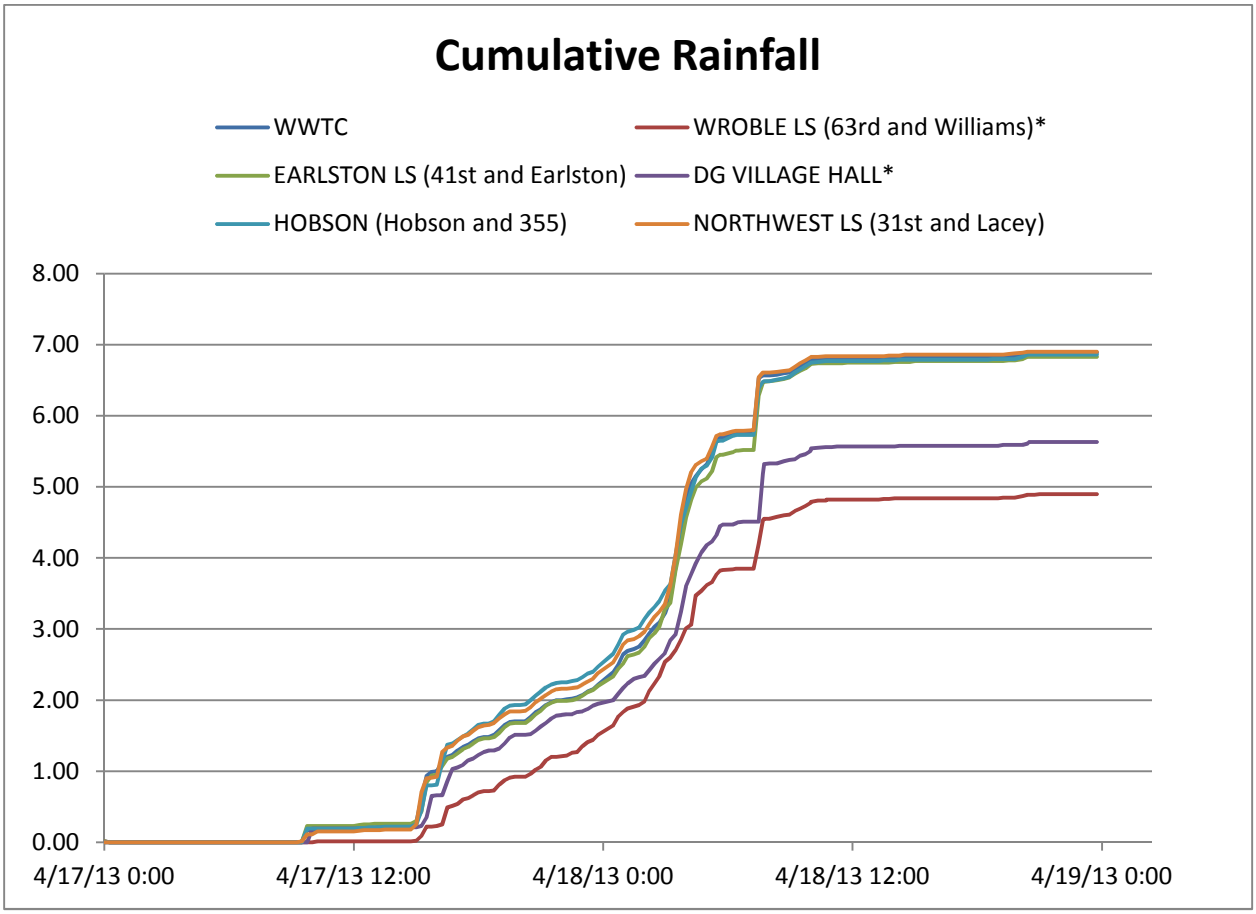
- Stormwater analysis to the causes of flooding
- Summary of previous watershed studies/storm water reports' recommendations
- Summary of flood control and drainage improvements constructed/implemented
- Recommendations

An overall summary of recommendations and general mitigation measures for the Village of Downers Grove is provided at the conclusion of this report.

RAINFALL AND DISCHARGE DATA ANALYSIS

Rainfall Data

There are six gages located in the Village of Downers Grove, maintained by the Downers Grove Sanitary District that recorded the precipitation from the April 17-18, 2013 storm event. The majority of the rainfall fell during a 24-hour stretch beginning in the afternoon on April 17th and ending by mid-morning on April 18th. The cumulative rainfall is shown in the graph below.



**Recorded rainfall totals from Wroble and DG Village Hall gages were significantly lower than the other four rain gages. The other four rain gages had recorded cumulative rainfall amounts that were within 0.1-ft of each other. The rain gages at WROBLE and DG Village Hall may have recorded lower totals because of geographical location or malfunction and have not been included in the analysis.*

The table below gives the cumulative rainfall in inches for each of the six gages located in the Village of Downers Grove. Many communities within DuPage County experienced heavy rainfall during the April 2013 storm event. The Village of Downers Grove was among a handful of communities located in the central portion of eastern DuPage County that had the highest cumulative rainfall amounts.

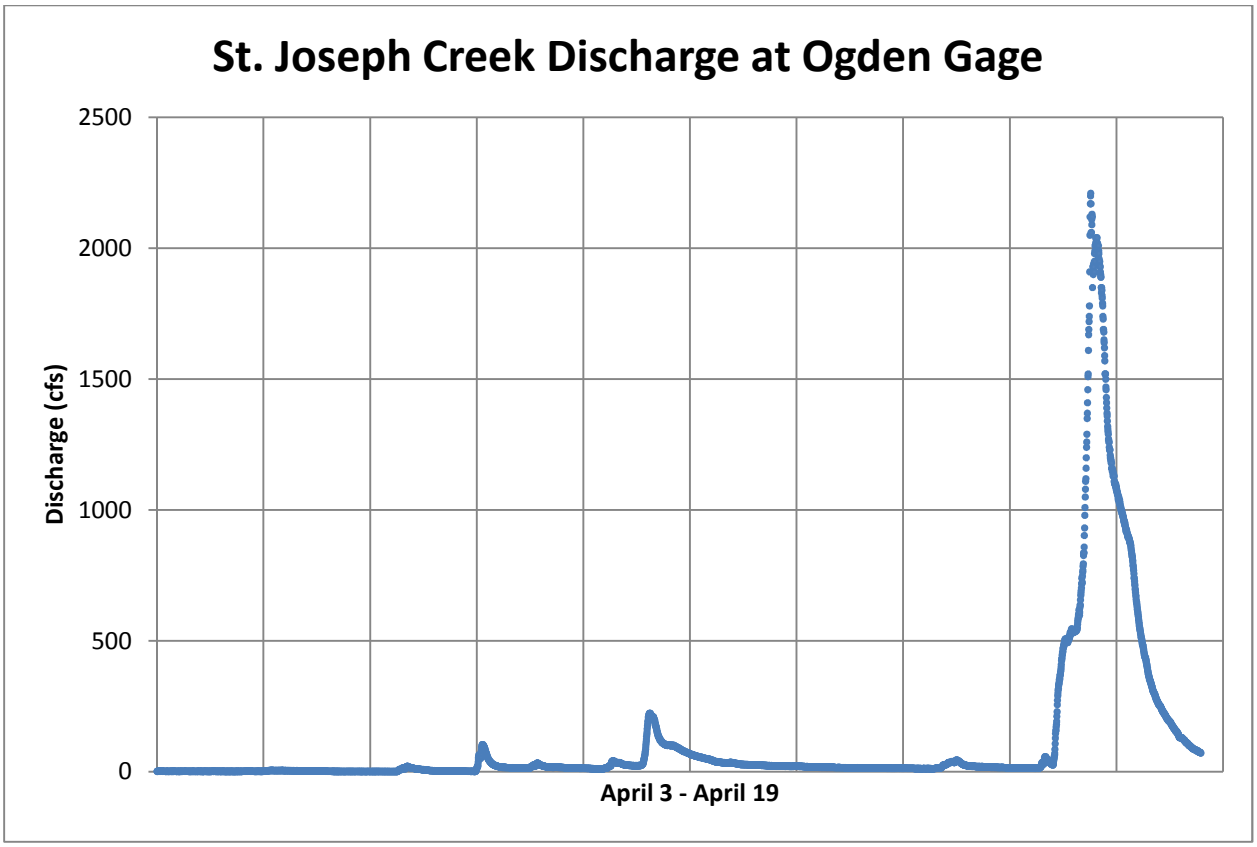
Gage Name and Location	Cumulative Rainfall (in)
WWTC, Walnut Avenue north of Curtiss	6.89
WROBLE LS, 63rd Street and Williams*	4.90
EARLSTON LS, 41st Street and Earlston Avenue	6.83
DG VILLAGE HALL, Duane Street*	5.63
HOBSON, Hobson Road and I - 355	6.86
NORTHWEST LS, 31st Street and Lacey Rd	6.90

***** *The rain gages at WROBLE and DG Village Hall may have recorded lower rainfall totals because of geographical location or malfunction and have not been included in the analysis.*

Discharge Data

St. Joseph Creek and its tributaries were flowing full by midnight on April 17th, measuring 9.5 feet in depth at the USGS gage station in Lisle at Ogden Avenue (USGS Gage 05540195). As the rain continued through the morning the creek elevation continued to rise, peaking at a record flood height of 14.73 feet at 6 a.m. on April 18th. Therefore, with the downstream receiving channel at record flood levels just prior to the intense rainfall at 7 a.m., the local drainage system of storm sewers, roadside ditches and overland flow paths were quickly overwhelmed. The flooding occurred throughout the system, primarily impacting depressional areas, properties along overflow paths and properties within designated 100-year and 500-year flood plains.

Stream flow data was extracted for the period from April 3 to April 19, 2013, at the Ogden Avenue USGS gage to determine base flow of St. Joseph Creek and the pre-storm flow rate on the creek was determined to have a base flow of 2.4-cfs. Prior to the April 17 storm event, several smaller events raised the discharge to approximately 15-cfs. This was the flow rate immediately prior to the April 17-18 storm event. During the event, a peak discharge of 2,210-cfs was recorded at this gage location.


St. Joseph Creek Discharge at Ogden Gage
2500
2000
1500
1000
500
0
Discharge (cfs)
April 3 - April 19

Historical Storm Events

The USGS maintains a stream gage at Ogden Avenue that recorded the gage height and discharge for the April 2013 storm event. The table below shows the gage heights for the top five peak storm events recorded at this location since 1994 (stream gage height record began in 1994). A comparison of storm events since 1994 clearly shows that the April 2013 reached historic flood levels. The discharge recorded for the April 17-18 storm event at the USGS gage at Ogden Avenue was 2,210-cfs.

Date of Flooding Event	**St. Joseph Creek Gage Height at Ogden Avenue***
April 18, 2013	14.73 ft
July 18. 1996	12.89 ft
October 2, 2006	11.48 ft
February 26, 2009	11.04 ft
September 14, 2008	10.41 ft

**Data available since 1994*

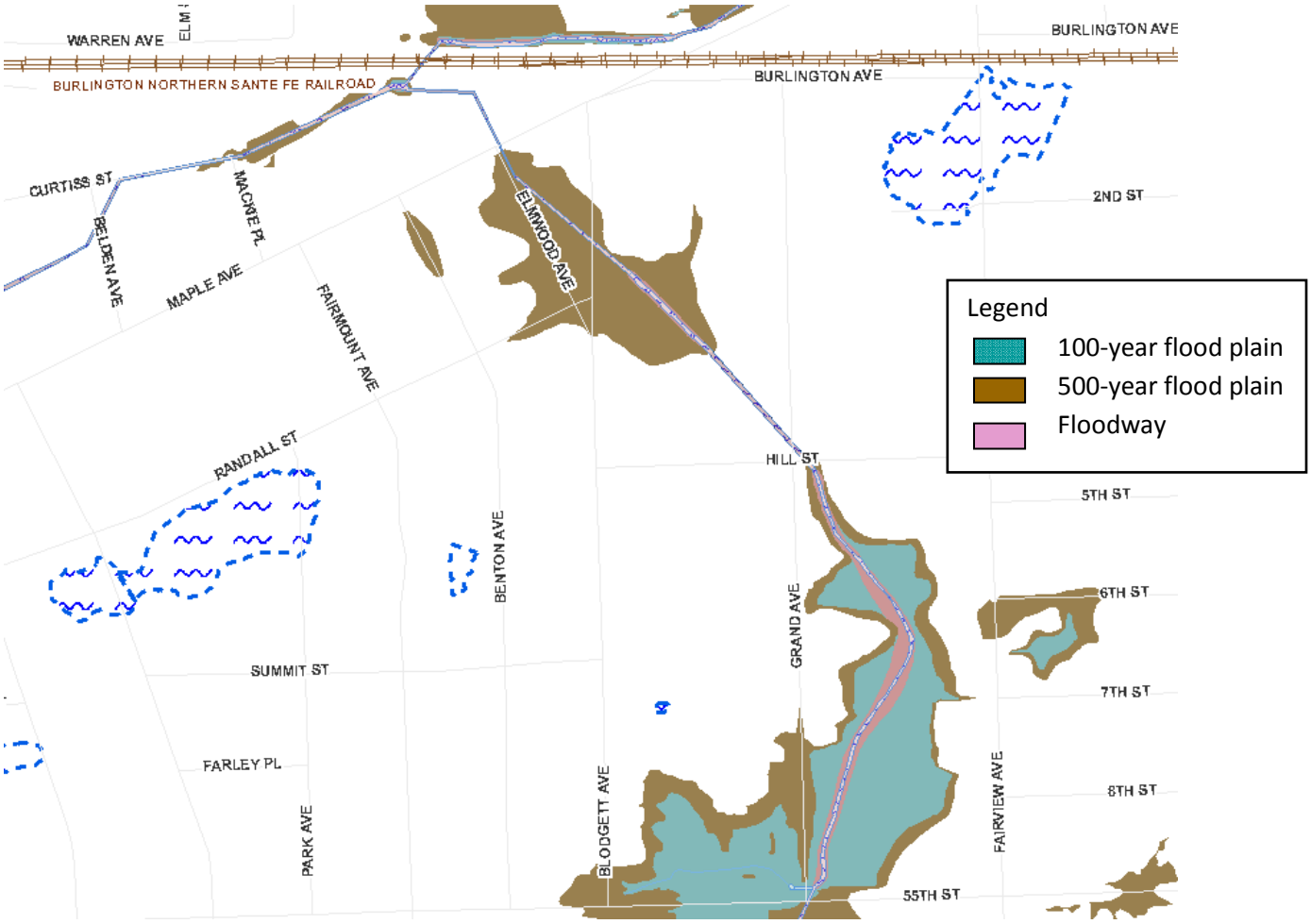
DuPage County maintains rainfall records for the FEQ flood plain model that contains 60-years of historical storm events from 1948-2008, totaling 157 storm events. In addition to the USGS Ogden stream gage which showed this was a historical storm event, the FEQ runoff series also shows that this was the 2nd largest storm event at Ogden Avenue. The largest storm event recorded in FEQ at Ogden Avenue along St. Joseph Creek was in August 1972 with a discharge of 2,320-cfs.

Each study area along St. Joseph Creek includes the water surface elevation from the top two storm events in the FEQ rainfall series (from 1948-2008). Rainfall does not always fall evenly throughout a watershed and therefore each study area may have identified different top storm events. Also included for each study area are observed high water marks from the April 2013 storm event and the FEQ and FEMA flood plain elevations.

Study Area:

St. Joseph Creek Main Stem – Upstream of Downtown (Village Hall), between BNSF Railroad and 55th Street

Location of Study Area



Description of April 2013 Flooding Extents

During the April 17-18 storm event, structural flooding was reported within the neighborhood between Park Avenue and Fairview Avenue, south of Maple Avenue and north of 55th Street. The streets in this area including Elmwood Avenue, Grand Avenue, Hill Street, 55th Street, 6th Street, Fairview Avenue, Randall Street and Benton Avenue were closed or reported flooded. Approximately 50 residential homes reported flooding through the Individual Assistance Damage Assessment survey. Location of flood damage occurred in back yards, detached

garages, basements and first floor living areas. Some damage was caused by sanitary sewer back up and others by overland flow routes, overbank flooding and depressional areas.
A review of the data shows:

- 2 homes had crawlspace flooding
- 43 homes had basement flooding with depths between 1 and 9 feet.
- 4 homes experienced flooding on two levels.
- 1 resident reported flooding in accessory structure (shed)

A significant portion of this area is within the 100-year regulatory flood plain limits as shown on the previous page. In the FEQ hydraulic model of St. Joseph Creek, the 100-year flood plain elevations are an average of 3 feet higher than the regulatory flood plain elevations. This increase reveals that the flood plain in this area impacts more structures and streets than the FEMA regulatory maps show. The observed high water marks of the flood extents of the April 17-18 storm event closely matched the FEQ 100-year flood plain elevations.

Flooding across 55th Street at Grand Avenue

The table on the following page includes observed high water marks (approximated from resident testimony, videos, pictures, and site visit), and the 100 year flood levels from the FEQ model and the existing FEMA model. Two additional columns in the table reflect the elevations determined by the FEQ model for the two largest historic storm events out of the 157 historical storm events between the years 1949-2008 in DuPage County in the study area. The storm event on April 17-18, 2013 is the largest storm event recorded in the 60-year record of historical storm events modeled in FEQ (1949-2008) in this study area based on the observed high water marks.

Description	*Peak Elevations (ft)*				
	April 2013 Observed High Water Marks	**FEQ 100-yr**	**Jul-57 Event**	**Jul-87 Event**	**FEMA 100-yr**
12 ft d/s 55th Street	719	718.72	717.08	717.17	716.83
964 ft d/s 55th Street	718.5	718.52	716.85	716.95	715.19
3 ft u/s Hill Driveway Br.	717.5	717.61	714.98	715.28	715.04
15 ft d/s Hill Driveway Br.	--	717.33	714.62	714.98	715.04
11 ft u/s Hill/Grand conduit	717.5	717.19	714.28	714.69	714.7
24 ft d/s Hill/Grand conduit	--	715.02	713.24	713.47	710.65
21 ft u/s Maple/Blodgett conduit	714.5	714.86	712.77	713.03	709.74
Blodgett Level Pool - Depression	714	713.02	710.38	713.02	--
12 ft u/s Curtiss conduit	--	712.05	710.56	710.56	708.07

Causes of Flooding

Flood Plain

A significant portion of this area is within the 100-year regulatory flood plain limits. The hydraulic models and topography of the area indicate that the majority of the flooding in this study area is a result of overbank flooding. The creek channel does not have sufficient capacity to convey the flood waters within the banks (i.e. channel) and therefore will utilize the flood plain storage in the overbank area where structures and buildings are located.

Hydraulic Structures

The 11-ft diameter closed conduit located at the eastern end of Curtiss Street behind the Village Hall, which conveys St. Joseph Creek under the downtown area, has limited capacity (750-cfs) to convey the 100-year flood plain flow (FEQ 915cfs).

Hill/Grand Avenue hydraulic structure is an 87” x 135” nominal-elliptical conduit, approximately 536-ft long. There is approximately 2-ft in water surface elevation change in the FEQ hydraulic flood model from the upstream to downstream for the 100-yr storm event. Invert change from upstream to downstream is approximately 1.1-ft. The 100-year discharge is approximately 643-cfs, which exceeds the conduit’s capacity under gravity flow of approximately 566-cfs. Therefore the conduit that conveys St. Joseph Creek under Hill/Grand does not have the capacity to carry the 100-year storm event and water will overtop the intersection or back up upstream during large storm events.

Topography (Depressional Areas and Overland Flow Routes)

There are a number of depressional areas and poorly defined major overland flow routes within this study area. Many of these depressional areas are outside of the flood plain, in areas where the creek has been filled in and replaced by storm sewer. The following depressional storage areas have been identified; some of these areas are identified by Downers Grove as Localized Poor Drainage Areas (LPDA's) and are subject to regulation:

- Along Curtiss Street between Belden Avenue and Mackie Place
- Along Benton Avenue between Maple Avenue and Randall Street
- Along Benton Avenue between Randall Street and Summit Street
- Between Fairmount Avenue and Benton Avenue, north of Summit Street
- Between Fairmount Avenue and Benton Avenue, north of Randall Street
- West of Blodgett Avenue between Hill Street and 55th Street
- Along Blodgett Avenue, south of Summit Street
- Blodgett Avenue and Elmwood Avenue
- West of Park Avenue, South of Randall Street
- Along Fairmount Avenue, north of 55th Street

Many of these depressional storage areas do not have clearly defined overland flow routes to convey the flood waters safely once they fill to capacity. Some areas may also be hydraulically connected to the flood plain via storm sewer. Storm sewers can surcharge, filling these depressions during high creek flow, and remain flooded until creek levels lower.

Recent Action

2007 Watershed Infrastructure Improvement Plan (WIIP)

In 2007 the Village performed a Village wide stormwater study. The study focused on localized flooding problems caused by high intensity, shorter duration flood events similar to that experienced in October 2006. The WIIP studied this area as part of the watershed St. Joseph Creek North Subwatershed J (SJN-J) and St. Joseph Creek South Subwatershed D & G (SJS-D & G). The WIIP mentioned four areas with recommendations for improvements.

SJN 517 - Flooding in the area identified as SJN517 (Blodgett Avenue and Randall Street) is due to flood plain elevations from the St. Joseph Creek. The flooding is confined mostly to the roadway. The study recommended excavation in a vacant parcel nearby to increase flood plain storage volume.

SJN 183/112 - Flooding in area identified as SJN183/112 (Benton, south of Randall) was classified in the Watershed Study as high priority. This is a depressional area that drains to an undersized outlet, which causes the street, yard, and house flooding. This area is tributary to parallel 18-inch and 12-inch storm sewers, which outlet to a single 18-inch sewer, which outlets into a 30-inch pipe to St. Joseph Creek. The study recommended that the Village create a voluntary buy-out program of land upstream of the flooding area to create a stormwater storage basin.

- <u>SJN 183/112 Improvements</u>
  The Village constructed an underground storage facility in 2010 at this location.

SJS 114 – Flooding in the area identified as SJS 114 (East of Summit and Blodgett) was identified to have reports of street flooding, backyard flooding and structural damage. The area was prioritized as low in the study with the recommendation to perform creek channel maintenance between Blodgett and Grand, north of 55th.

SJS 184 – This area is located south of 6th street between Fairview and Florence and was identified as a chronic problem of inadequate storm sewer capacity. The area was prioritized as low with the recommendation to increase storm sewer capacity and perform large creek channel maintenance.

Recommendations & Conclusions

<u>Flood plain Management</u>

A critical part of flood plain management is flood plain maintenance, including debris removal. The flood plain between 55th Street and Hill Avenue lies within large, privately owned residential parcels, where flood plain maintenance, like removal of debris and dead vegetation from the creek channel and overbanks is the responsibility of the private landowner. This is critical for this area as the creek channel is served by a long conduit which must be kept clear of debris. There is a grate at the entrance to the conduit, which has the dual purpose of keeping people from entering the conduit and keeping the conduit clear of debris.

Grate on Hill Ave conduit; looking downstream

The photo of the grate on Hill Avenue shows that it is a vertical grate at the face of the culvert. It is recommended to revise the grate design to be at a slope, rather than vertical, to allow for debris to be easily pushed up the grate by flowing water. This design also aids in quicker debris removal by Public Works crews during storms.

Overland Flow Routes and Storm Sewer Backflow

A review of the depressional areas is required to determine if overflow routes between homes can be created to allow water to safely flow between homes. Barrier flood proofing techniques may be useful to protect vulnerable window wells.

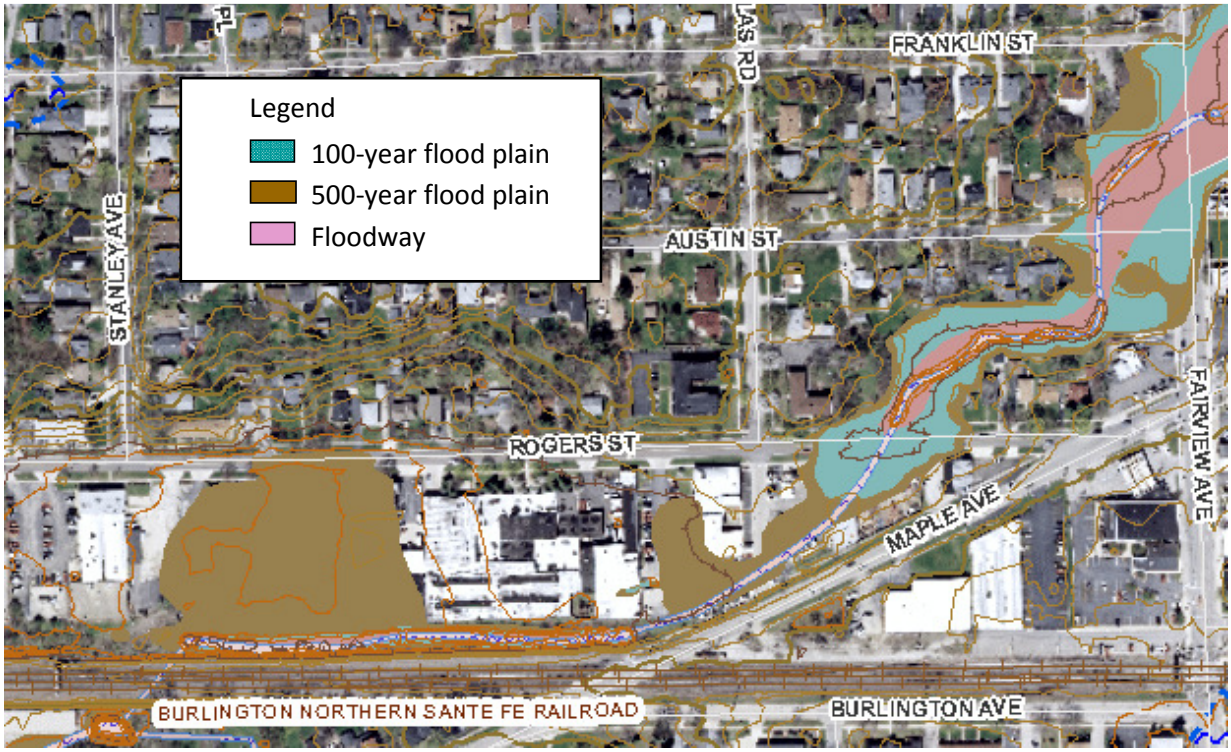
Two homeowners reported water filling their basements 8 feet in a matter of minutes when the stormwater surged through manholes in the street. Therefore, the use of back flow preventers on storm sewers may be necessary in low lying areas outside of the designated flood plain. In addition, improving the overflow of depressional storage areas to follow an overland flow path that safely conveys the water to the open channel is recommended. Some of these depressional areas may meet the requirements to be classified as localized poor drainage areas, limiting fill and improvements to the structures.

Flood Insurance

Many of the flooded homes are outside of the flood plain and although eligible to purchase, most homeowners do not choose to carry flood insurance policies. Residents should be informed of the ability to purchase a policy, whether they are in a flood plain or not. For homeowners with basements flood insurance policies can cover a portion of the cleaning costs, purchase or rental of dehumidifiers, and the replacement of a furnace, water heater, air conditioner and freezer.

Study Area:
Northeast Tributary of St. Joseph Creek (Reach 7) - Upstream of Downtown (Village Hall) between BNSF Railroad and Fairview Avenue

Location of Study Area



Description of April 2013 Flooding Extents

Flood damage along The Northeast Tributary of St. Joseph Creek - Reach 7 was reported by at least seven businesses located along Roger Street between Prospect Avenue and Maple Avenue through the Individual Assistance Damage Assessment survey. This stretch along St. Joseph Creek is open channel, just upstream of the railroad before it goes under the tracks and converges with the main reach (Reach 1) of St. Joseph Creek, behind Village Hall. During the April 17-18 storm event, Rogers Street, Prospect Avenue and Stanley Avenue were closed due to flooding. Various businesses and residential homes reported flooding in their basement or first floor from sanitary sewer back up and flood waters from overland flow.

Based on observed high water marks, the April 17-18 flooding closely follows the current regulatory 500-year flood plain. The FEQ hydraulic model of St. Joseph Creek has 100-year flood

plain elevations that more closely match the existing 500-year flood plain near the southeast corner of Stanley Avenue and Rogers Street. Approximately nine commercial buildings are located within the existing 500-year flood plain.

Fifteen property owners reported flooding through the Individual Assistance Damage Assessment. A review of the data shows:

- 3 multi-family apartment buildings reported first floor flooding
- 6 commercial business were flooded between 2 and 4 feet on their first floors
- 6 homes experienced basement flooding
- Commercial businesses lost equipment and vehicles

The table below includes observed high water marks, the 100 year flood levels from the FEQ model and the existing FEMA model. Two additional columns in the table reflect the elevations determined by the FEQ model for the two largest historic storm events out of the 157 historical storm events between the years 1949-2008 in DuPage County in the study area.

	Peak Elevations (ft)				
Description	**April 2013 Observed High Water Marks**	**FEQ 100-yr**	**Jul-53 Event**	**Jul-87 Event**	**FEMA 100-yr**
4 ft u/s Fairview Avenue	723	722.26	721.96	721.88	722.487
just d/s Fairview Avenue	722.9	722.08	721.60	721.52	722.42
10 ft u/s Austin Street	--	722.04	721.56	721.49	722.29
39 ft d/s Austin Street		722.02	721.40	721.27	722.16
11 ft u/s Roger Street Conduit	721.4	721.53	721.08	720.98	721.90
12 ft d/s Roger Street Conduit	--	717.54	716.16	715.91	716.05
126 ft u/s BNSF RR Embankment	715.5	714.22	711.23	711.61	713.19
9 ft u/s BNSF RR (app. sect.)	715.5	714.08	710.76	711.32	711.58

Causes of Flooding

Flood Plain

In contrast to the open space and large parcel residential areas to the north, once the Northeast Tributary of St. Joseph Creek crosses Austin Street, the flood plain and its associated creek channel are compressed into a series of culverts and narrow open channels between residential structures. The creek then flows into an elliptical conduit (6'span x 4'rise) under Rogers Street and commercial properties. Once the capacity of the culvert is exceeded and Rogers Avenue is overtopped the flood waters encompass the commercial properties south of Rogers Street. The road overtopped during the April 2013 storm event. Surveyed watermarks at the southwest corner of Maple Avenue and Rogers Street indicate that the elevation of flooding was approximately 721.4-ft. The FEQ 100-yr flood plain elevation for this area is at approximately 721.53-ft, indicating that the inundation of flood waters south of Rogers Street during the April 2013 storm event is directly related to the flood plain of the northeast tributary of St. Joseph Creek.

Rogers Street at creek, flood elevation approximately 721.4'

At the downstream outlet to the Rogers Street conduit it discharges into a narrow channel that runs along the north side of the railroad tracks. Once the capacity of this open channel is exceeded, the flood waters come out of the channel banks and into the overbank area which includes parking lots and buildings along the north side of the tracks.

Overbank Flooding Area: Upstream of BNSF Culvert

Hydraulic Structures

Within this reach of the Northeast Tributary of St. Joseph Creek is conveyed through four hydraulic structures. These are located at Fairview Avenue, Austin Street, Rogers Street, and under the BNSF railroad.

Fairview Avenue and Austin Street have box culverts with relatively flat slopes that have insufficient capacity to convey the 100-year storm event of approximately 605-cfs. The 100-year water surface elevation will overtop Fairview Avenue and Austin Street. When these roads overtop the water is no longer contained within the banks of the open channel and spreads out in the overbanks where residential and commercial structures are located.

The concrete conduit at Rogers Street is an elliptical pipe with a 6' span and 4' rise. The pipe has the capacity to convey approximately 86-cfs. During the 100-year storm event there is approximately 638-cfs of flow at this location. The conduit does not have the capacity to convey this flow and therefore will overtop Rogers Street and flow southwest through the parking lots until it joins with the open channel at the outlet of the conduit. The conduit has the design capacity for the 2-yr recurrence interval, which is approximately 100-cfs in flow before it is no longer operating on gravity flow and is at risk of overtopping Rogers Street.

Rch7: just u/s Roger Road, view d/s

The hydraulic structure which conveys the Northeast Tributary of St. Joseph Creek under the railroad appears to be adequately sized at a 9-ft diameter concrete pipe. It has the capacity to convey approximately 1250-cfs which is significantly more flow than the 100-year discharge of 680-cfs. The flooding in the overbanks just upstream of this structure is due to the commercial properties being at the same elevation as the 100-year base flood elevation. In addition this area appears to be a natural depressional area with overland drainage feeding it from the north, west and east.

Topography (Depressional Areas and Overland Flow Routes)

Flooding that occurred at the southwest corner of the intersection of Rogers Street and Maple Avenue, is due to the overtopping of Rogers Street and Maple Avenue. The topography of this area causes any overtopping at Rogers Street to flow southwest through multiple different parking lots at an elevation between 720 and 722-ft. The area encompassed by these elevations is substantial, including the various business structures and parking lots. As the flood waters flow overland they eventually flow into the open channel at the downstream outlet of the Rogers Street conduit, adjacent to the BNSF railroad. Surveyed watermarks at this location (southwest corner of Maple and Rogers St) indicate that the elevation of flooding was approximately 721.4-ft. The FEQ 100-yr flood plain elevation for this area is at approximately 721.53-ft. The flooding that occurred in this area appears to match the hydraulic modeling indicating that it is directly related to the flood plain.

Recent Action

2007 Watershed Infrastructure Improvement Plan (WIIP)

In 2007 the Village performed a Village wide stormwater study. The purpose of the study was to evaluate flooding problems throughout the Village. The study focused on localized flooding problems caused by high intensity, shorter duration flood events similar to that experienced in October 2006. The WIIP included the study area within subwatershed J of the Northeast Tributary of St. Joseph Creek and identified the following problem area:

SJN 516 – Area SJN-516 was identified during the Watershed study as a flood plain impact area, and was classified as low priority. XP-SWMM modeling for the storm sewer system in this area showed that the system does have adequate capacity to handle 100-year events. Thus, the conclusion reached in the report was that the inlets in this area were either undersized or blocked. The recommendation for flooding mitigation was to replace several inlets along Fairview Avenue and provide regular maintenance of these inlets.

Recommendations & Conclusions

Flood Plain Map

Regulatory flood plain maps do not always reflect the limits of flooding during the 100-year storm. The Village of Downers Grove may want to consider educating the owners of structures that are in the regulatory flood plain by elevation even though the flood plain maps may not show that they are within the flood plain limits. For example, the mapped flood plain limits for the area at the southwest corner of Rogers Street at the hydraulic structure shows that the water will overtop Rogers Street road during the 100-year and inundate portions of the parking lot and commercial structures on the south side of Rogers Street (see location map at the beginning of this section). The topography of this area reveals that the 100-yr flood plain limit encompasses more area than the current FEMA flood plain maps show based on the FEMA 100-year flood plain elevation of 721.9-ft.

Conveyance and Flood Plain Storage

The flood plain elevation in this study area is controlled by restrictive hydraulic structures at Rogers Street, Austin Street and Fairview Avenue. The Village of Downers Grove may want to consider investigating the cost/benefit of replacing these restrictive hydraulic structures. Any improvements in conveyance will require flood plain storage to offset the increase in flows per the DuPage County Flood Plain and Stormwater Ordinance. Locations for flood plain storage could come from properties in the flood plain and/or experienced flood damage properties that participate in a voluntary buyout program, and/or in the open space at Hummer Park located upstream of Fairview Avenue.

Localized Poor Drainage Area Designation

The commercial properties just upstream of the BNSF hydraulic structure are at risk of flooding because it is a low area. The Village of Downers Grove may want to consider performing a stormwater analysis of this area to determine if it meets the requirements to be designated as a Localized Poor Drainage Area (LPDA).

Flood Control Berm

The commercial properties just upstream of the BNSF hydraulic structure are not currently in the flood plain. However, the FEQ model indicates that the flood profile is higher in this location, subjecting these properties to overbank flooding. Since the BNSF culvert appears to have sufficient capacity, the Village could provide a detailed stormwater analysis at this location to consider building up a flood control berm at the north end of the channel (south side of the properties) to keep the base flood elevation contained within the channel. Fill within the 100-year flood plain requires compensatory storage at an overall ratio of 1.5:1 cut to fill. It should be noted that there is a significant amount of area tributary to these commercial properties, whose stormwater runoff will need to be safely routed to the open channel and not blocked by the flood control berm.

Inlet Replacement

The WIIP recommended replacing several inlets along Fairview Avenue and to provide regular maintenance of these inlets.

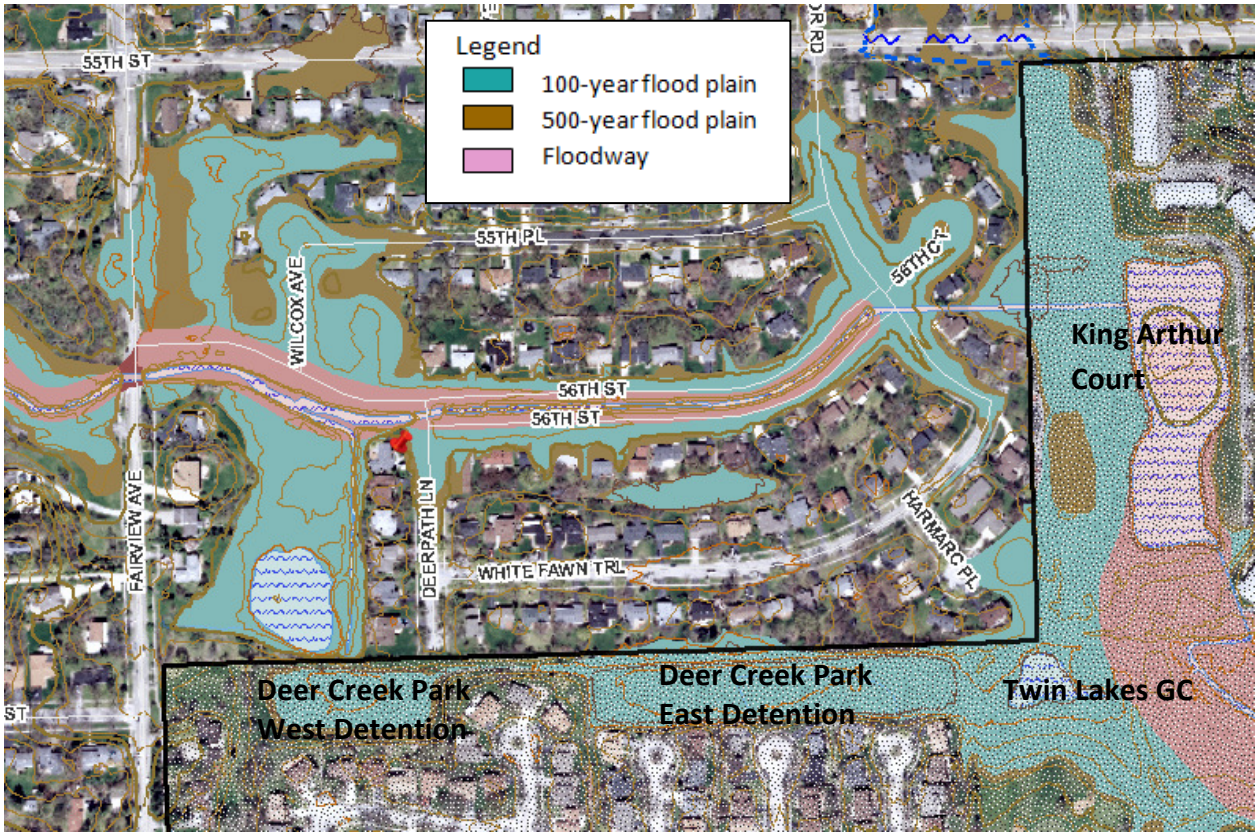
Overhead Sewer Rebate – Make residents aware of the rebate program offered by the Downers Grove Sanitary District for a 50-50 reimbursement, up to $3000, for the installation of an overhead sewer or backflow preventer. Provide a service by the Village staff to inspect homes for recommended solutions.

Floodproofing - In addition the Village can support individual property owners looking to protect themselves through the following types of mitigation, which are explained in further detail under the last section titled general mitigation review:

- Constructing barriers or floodwalls around a home
- Elevating homes above the 100-year flood level
- Floodproofing non-residential buildings
- Flood insurance

Study Area
St. Joseph Creek – Deer Creek Subdivision at 56th and Fairview Avenue

Location of Study Area



Description of April 2013 Flooding Extents

During the April 17-18 storm event, structural flooding was reported in the Deer Creek neighborhood, located on the eastern edge of the Village, south of 55th Street and east of Fairview Avenue. The entire area was inaccessible as the main entrances to the subdivision were inundated with flood waters and closed. These included the entrances at Fairview and 56th Street and the entrance at Cumnor Road and 55th Place.

Thirty-two property owners reported flooding through the Individual Assistance Damage Assessment and an additional five property owners reported home or yard flooding on April 18. In general, the homes have either partial or full basements, with many tri – level or quad - level homes. A review of the data shows:

- 9 homes with basement seepage or flood depths less than six inches

- 3 homes with sanitary backups
- 5 homes with crawlspace flooding, depths between 1 and 4 feet
- 10 homes had basement flooding with depths between 1 and 8 feet
- 3 homes experienced flooding on two levels. The first had twelve feet of water. The other two had 6 feet on their lowest basement level and between 2 and 3 ft on their next level
- 2 homes reported no flooding

A significant portion of the study area is within the 100-year regulatory flood plain limits as shown on the previous page. The FEQ hydraulic model of St. Joseph Creek shows an average increase of approximately 0.4-feet in elevation compared to the existing regulatory flood plain maps. The observed high water marks of the flood extents of the April 17-18 storm event closely matched the FEQ 100-year flood plain elevations.

Flooding across Fairview Avenue north of 56th Street

The table on the next page includes observed high water marks (approximated based on videos, photos, site visits and resident testimony), and the 100 year flood levels from the FEQ model and the existing FEMA model. Two additional columns in the table reflect the elevations determined by the FEQ model for the two largest historic storm events out of the 157 historical storm events between the years 1949-2008 in DuPage County in the study area.

Description	*Peak Elevations (ft)*				
	April 2013 Observed High Water Marks	**FEQ 100-yr**	**Aug-72 Event**	**Aug-87 Event**	**FEMA 100-yr**
King Arthur Court Pond	722	721.74	721.40	721.42	724.52
15 ft d/s Cumnor/KAC pipe	721.5	721.43	720.31	720.60	721.09
10 ft u/s Deerpath Lane	719	720.64	719.25	719.66	719.80
20 ft d/s Deerpath Lane	719	720.13	718.64	719.23	719.76
22 ft u/s Fairview Avenue	718.5	719.79	718.44	718.95	719.49
57 ft d/s Fairview Avenue	718.5	719.43	717.50	718.12	719.27
just u/s Patriot Park Bridge	718	718.94	716.98	717.36	718.15
127 ft d/s Patriot Park Bridge	--	718.90	716.91	717.31	717.82

Causes of Flooding

Flood Plain

A significant number of residential structures are located within the 100-year flood plain limits. The hydraulic models and topography of the area indicate that a majority of the flooding in this location is a result of overbank flooding. Overland flow routes for stormwater runoff flows along 56th Street and behind the homes along White Fawn Trail and Deerpath Lane are not adequate to safely convey the 100-year flows.

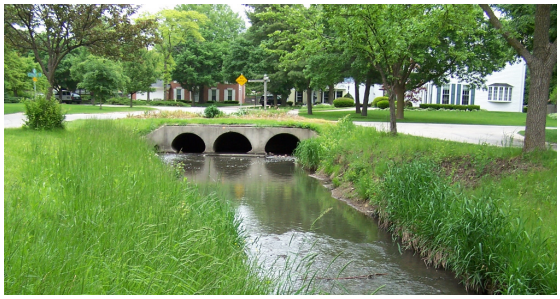
The FEMA regulatory 100-year flood plain elevations in this study area are mostly lower than the FEQ flood plain model of St. Joseph Creek. On average the regulatory 100-year flood plain is 0.4 feet lower in elevation in the Deer Creek subdivision between Fairview Avenue and Cumnor Road. This difference reveals that the 100-year flood plain in this area may impact more properties and structures than the current FEMA regulatory maps show.

Hydraulic Structures

Four hydraulic structures are located within or located just downstream and upstream of the Deer Creek subdivision. Beginning downstream, a 12-ft by 5-ft box culvert conveys St. Joseph Creek under Fairview Avenue. Based on the regulatory flood profile there appears to be a rise in the flood plain elevation of approximately 1.0 foot just downstream of the Fairview crossing. It should be noted that a significant increase in flow from the south enters the creek between Fairview Avenue and Deerpath Lane, which may contribute to the abrupt increase in the flood profile.

The next upstream structure is a 10-ft by 4-ft box culvert which conveys St. Joseph Creek under Deerpath Lane. Based on a review of the regulatory and FEQ models, this hydraulic structure does not appear to significantly restrict flows in the 100-yr event.

Moving upstream St. Joseph Creek is conveyed through a conduit from the King Arthur Court pond west to the outlet location at the intersection of Cumnor Road and 56th Court. Based on a review of the regulatory and FEQ models, this culvert does not appear to significantly impact flood elevations.



Conduit outlet from King Arthur Court at 56th St and Cumnor Rd; looking upstream

The final hydraulic structure is a 202-ft long 48-inch circular conduit beginning at the northern property line of the Westmont Park District's Twin Lakes Golf Course. The culvert conveys flows from St. Joseph Creek under the King Arthur Court's development and into the development's main pond. The FEMA flood profile and the FEQ model shows that the flood plain elevation increases 3-ft to 4-ft from downstream to upstream. The flood plain elevations on the upstream side of the culvert cause the two detention ponds directly west to fill up and overtop the detention pond berm; the stormwater than flowed onto the properties along White Fawn Trail and Deerpath Lane.

<u>Topography (Detention Facilities and Overland Flow Routes)</u>

Flooding occurred along White Fawn Trail and Deerpath Lane. The flooding appears to be caused by the overtopping of two detention facilities just south of the subdivision in Deer Creek Park. Deer Creek Park's detention facility's overflow location is designed at the north side of the west detention facility to discharge into the open channel located behind the backyards of the properties on Deerpath Lane. There is a secondary overflow weir on the west basin at the right-of-way to Deerpath Lane. In addition, the eastern detention facility was overtopped during the April 2013 which caused flood waters to overflow onto residential properties located on White Fawn Trail. This was likely due to settling of the detention basin berm and/or insufficient overflow weir capacity at the west basin. Water was reported to have flowed towards the homes and exit through their side yards. One homeowner reported water breaking the glass block in their window wells and flooding their crawlspace.

Deer Creek Park's detention facilities are hydraulically connected to St. Joseph Creek's flood plain. Therefore during large storm events, like the one seen on April 2013, the detention facilities (both east and west basins) fill up due to flood waters from St. Joseph Creek which reaches the basins after inundating the Twin Lakes Golf course in Westmont. Overtopping of the detention basins caused by St. Joseph creek overbank flooding is more severe than when this occurs from direct tributary runoff (storm sewer from Westmont and Downers Grove into the Deer Creek Park basins) because overbank flooding brings higher water surface elevations, higher flow rates over and more volume of water to the area.

Overflow from the King Arthur Court's detention basin was also reported to have flooded the rear yards and homes along 56th Court. One homeowner reported that the water surged into their rear yard, went over their top of foundation and flooded down the foundation wall into the basement.

Sanitary Back up

Three homes also reported sanitary back up. One owner was able to install a standpipe in the floor drain.

Recent Action

2007 Watershed Infrastructure Improvement Plan (WIIP)

In 2007 the Village performed a Village wide stormwater study. The study focused on localized flooding problems caused by high intensity, shorter duration flood events similar to that experienced in October 2006. The WIIP delineated the Deer Creek subdivision as subwatershed H with a contributing subwatershed I and large offsite tributary area from Westmont. The WIIP identified the following problem areas:

SJS 415 – Located in the general area of Wilcox Avenue and 56th Street. The WIIP identified that problems in this area are caused by St. Joseph Creek overbank flooding during extreme events. Flooding problems were directly related to the flood plain elevations and therefore were classified as a low priority and not looked at in detail under the WIIP.

SJS 416 – Located south of 56th Street at the end of Deerpath Lane. The WIIP identified that problems in this area are caused by overflow from the west detention facility directly to the south. The WIIP analyzed the direct tributary runoff overflow in detail using XPSWMM modeling. The detention pond was found to have an approximate 10-year level of protection from overtopping caused by direct runoff. The recommended solution was to enhance the overflow path from the detention pond north to St. Joseph Creek. In addition, it was recommended that an overflow storm sewer be constructed within the Fairview ROW from just north of 59th Street to the St. Joseph Creek crossing approximately 1,700 feet to the north. This area was given a moderate priority as basement flooding was reported.

SJS 417 – Located east of Deerpath Lane on 56th Street. The WIIP identified that problems in this area are caused by St. Joseph Creek overbank flooding during extreme events. Flooding problems were reported to include structural and basement flooding. Damages were directly related to the flood plain elevations and therefore given a moderate priority as flooding was related to flood plain and no further analysis was performed.

SJS 418 – Located at the southeast corner of the Deer Creek subdivision on Harmarc Place. The WIIP identified that problems in this area are caused by the flood plain of St. Joseph Creek. Floodwaters overtop into the King Arthur Court area causing water to encroach upon residential property on Harmarc Place. Flooding problems were directly related to flood plain elevations and therefore were given a moderate priority and not looked at in detail under the WIIP.

SJS 125 – Located north of 55th Street, south of 8th Street, east of Cumnor, and west of Victor Street. The WIIP identified that problems in this area are caused by storm sewer capacity limitations and backwater from St. Joseph Creek. The recommended solution was to purchase 8 properties in the flood prone area and construct a 6 acre-foot detention basin.

- SJS 125 Improvements

  The Village performed recommended improvements in SJS 125 in 2010. The improvements consisted of purchasing 4 homes and creating a flood storage facility. These improvements benefited the Deer Creek subdivision by removing impervious surfaces and creating additional upstream storage and reducing runoff rates.

2011 Westmont Stormwater Master Plan - The Village of Westmont completed a stormwater master plan in 2011. Deer Path Park detention facilities were noted as a potential flooding source and recommended re-establishing/redefining the emergency overflow weir and paths and to investigate moving the overflow weir to align with Deerpath Lane rights-of-way.

Recommendations & Conclusions

This section reviews and recommends possible remedial action to be taken by the Village. Based on pictures, debris lines, and information provided by residents, the April flooding closely mimicked the FEQ 100-year flood elevations.

Detention Pond Overland Flow Path Improvements

This work would consist of improving the overland flow paths of the two detention facilities located immediately south of the Deer Creek subdivision. Improvements should consider moving the overflow points to a safe location and better defining the flow paths. Preliminary overflow path improvement ideas include the following:

Rear Yards Fairview-Deerpath Lane – Improvements may consist of improving the Deer Path Park west detention facility's existing emergency overflow weir and establishing a well defined overland flow path at the location of the existing channel in the rear yards of properties along Deerpath Lane. Channel capacity improvements will likely be necessary to control and convey overland flows due to St. Joseph Creek overbank flooding. Channel stabilization improvements will likely be necessary to mitigate for higher velocities.

Deerpath Lane ROW – Improvements may consist of establishing a well defined overland flow path in the western detention basin at the Deerpath Lane ROW. It may be necessary to lower the profile of Deerpath Lane in order to adequately convey overland flow with sufficient freeboard to low entry points of the adjacent residential structures on Deerpath Lane. A review of home's low entry elevations along Deerpath Lane will be required to determine if this option is feasible.

King Arthur Court Development – Improvements may consist of establishing a well defined overland flow path at the location of King Arthur Court's western parking lot. The parking lot would convey the overland flow to the Cumnor Avenue and White Fawn Trail intersection and then north along Cumnor Avenue to St. Joseph Creek. It may be necessary to lower the profile of Cumnor Avenue and White Fawn Trails to adequately convey overland flow. A review of home's low entry elevations along the overflow path will be required to determine if this option is feasible.

Detention Pond Berm Improvements – This work would consist of raising the detention berms adjacent to the Deer Creek subdivision. The berms would likely be constructed in addition to overland flow path improvements in order to protect residences from flooding while eliminating any negative impacts to upstream flood plain elevations.

Analyze Fairview Crossing Area – It should be determined what is causing the abrupt 1.0-foot increase in water surface elevations in the Fairview Avenue area. If this is caused by a flow restriction, considerations should be made to reduce this flood plain elevation increase.

Analyze King Arthur Court Culverts – Based on the regulatory flood profile and the FEQ mapping there appears to be an approximate 3.0 to 4.0 foot increase in flood plain elevations from Cumnor Road upstream through the King Arthur Court development and to the northern boundary of Twin Lakes Golf Course. The culverts, control structures, and topography should be analyzed in detail to determine why this occurs and whether any improvements can be made to reduce this increase in flood plain elevation. The difference in flood plain elevations causes the two Deer Creek Park detention ponds to fill up and overtop their banks impacting the properties on Deerpath Lane and White Fawn Trail.

Regional Storage Options – The Village should work with DuPage County and the Village of Westmont in considering areas to implement an upstream regional storage facility. Prior to identifying potential storage areas the approximate volume requirement should be determined to identify whether a storage option is feasible. This would likely be done by modifying the FEQ model.

Fairview Overflow Storm Sewer – The 2007 WIIP analyzed the Downers Grove storm sewer system and direct tributary runoff to the western Deer Creek Park detention pond south of the Deer Creek subdivision. The WIIP identified implementing an overflow storm sewer from just north of 59th Street approximately 1,700-feet north to the St. Joseph Creek crossing. These improvements would provide significant flood relief during storms similar to October 2006 and would provide minimal relief during storms similar to April 2013. This option should be considered in combination with several other recommendations.

Buy Out Program – There is one repetitive loss property within the Deer Creek subdivision as defined by the National Flood Insurance Program. DuPage County's buyout program ranks properties based on repetitive losses. The Village may wish to pursue a buyout of this property with the County. A review of claims data and the value of the structure would be needed to determine if this is a viable solution. Floodproofing may be more applicable, depending on the nature of the flooding.

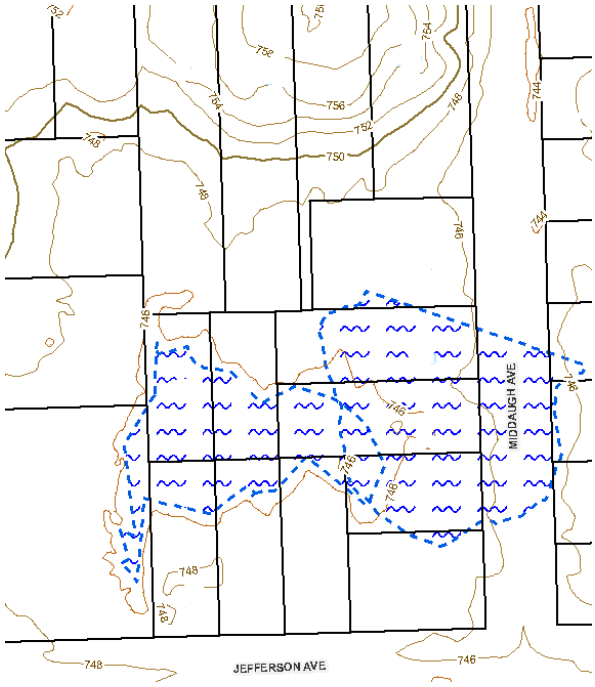
Overhead Sewer Rebate – Make residents aware of the rebate program offered by the Downers Grove Sanitary District for a 50-50 reimbursement, up to $3000, for the installation of an

overhead sewer or backflow preventer. Provide a service by the Village to inspect homes for recommended solutions.

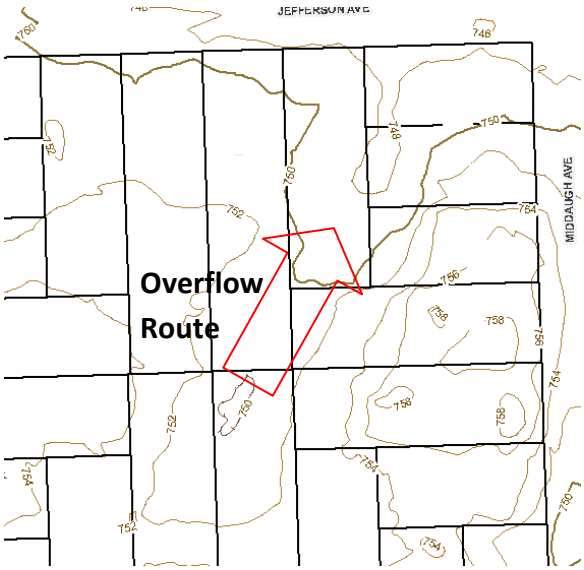
Floodproofing - In addition the Village can support individual property owners looking to protect themselves through constructing barriers or floodwalls around a home, as described in the mitigation method section of this report.

Study Area:
Middaugh Avenue and Jefferson Avenue (Northwest and Southwest Corners)

Location of Study Area



Northwest Corner Jefferson and Middaugh avenues



Southwest Corner Jefferson and Middaugh avenues

Description of April 2013 Flooding Extents

During the April 17-18 storm event, flooding was reported at the northwest and southwest corners of Middaugh and Jefferson avenues. These areas, shown above, are not located within the regulatory flood plain. Flooding in the area was reported to be basement, garage, and yard flooding. The Village topography shows a LPDA at the northwest corner and an overflow path for local drainage at the southwest corner.

Causes of Flooding

Local Poor Drainage Area

Flooding at the northwest corner of Middaugh and Jefferson avenues is directly related to the presence of a local poor drainage area identified as problem area SJS 58 in the 2007 WIIP. Based on the WIIP analysis the tributary area is approximately 8.5 acres and is drained by a 6 & 8-inch pipe. The overtopping elevation was estimated at approximately 747.0-ft (± 0.5-ft) based on two foot topography. The small diameter outlets do not adequately drain the LPDA during large storm events causing the LPDA to fill up and flood adjacent properties.

Rear Yard Swale

Flooding at the southwest corner of Middaugh and Jefferson Avenue is related to an overland flow path swale that runs southwest to northeast through the rear yards of residential properties. The swale has an approximate tributary area of 6 acres and drains into an existing sewer on Jefferson Avenue. The apparent cause of flooding at this location is the swale and sewer capacity at the location where the rear yard swale enters the right-of-way.

Flood Plain

The Middaugh/Jefferson flood prone area is not shown to be within the regulatory flood plain. These areas are drained by storm sewer which outlet to the flood plain just downstream of 59th Street. The regulatory flood plain elevation at the discharge location is approximately 746.73 and 745.48 in the FEQ flood mapping model. These elevations create a tailwater condition on the storm sewer outlets reducing their capacity and contributing to the flooding problems in the neighborhood. In addition, at an elevation of 746.73 the flood plain from the St. Joseph Creek South Branch would actually encroach upon the intersection.

Recent Action

2007 Watershed Infrastructure Improvement Plan (WIIP)

In 2007 the Village performed a Village wide stormwater study. The purpose of the study was to evaluate flooding problems throughout the Village. The study focused on localized flooding problems caused by high intensity, shorter duration flood events similar to that experienced in October 2006. The WIIP included the Middaugh/Jefferson area within subwatershed B of St. Joseph Creek South and identified the following problem area:

SJS 58 – Located at the northwest corner of Middaugh and Jefferson Avenue. The WIIP identified that problems in this area are caused by the lack of an overflow path and an outlet

impacted by the tailwater of the South Branch of St. Joseph Creek. A TR-20 model was used to analyze the LPDA and provided estimated 10-year and 100-year high water elevations of 746.02 and 746.76 respectively. This area was identified as a low priority in the WIIP.

2010 Streambank Stabilization Project – The Village completed a streambank stabilization project just downstream of the 59th Street crossing. The project helped to clean up this stream reach from debris and overgrowth that may have impeded flow. Improvements also included the removal of the high point in the creek bottom to provide additional capacity.

Village Pumping Efforts – During large storm events the Village has pumped down LPDA SJS 58 to prevent structural flooding to residences located adjacent to it.

Recommendations & Conclusions

Flooding in the area is caused by the local topography and made worse by the tailwater impacts of the downstream flood plain on the storm sewer system. Reducing the tailwater impacts will require a regional solution to reduce flood plain elevations downstream of 59th Street and should be considered only as a larger watershed improvement project.

It is recommended that local improvements be considered to the topography and storm sewers in the Middaugh/Jefferson area. Local improvements may help in reducing the frequency and severity of flooding. The following are a list of local improvements the Village of Downers Grove should consider. In order to evaluate the potential impacts of the recommended solutions a detailed topographic survey should be performed of the LPDA area, the rear yard swale southwest of the intersection, Middaugh Avenue from Jefferson Avenue to Blanchard Street, Jefferson Avenue from 200 feet west of Middaugh to the path located in the Brookbank Road ROW.

LPDA Improvements – The high water elevations established in the 2007 WIIP for the LPDA located at the northwest corner of Middaugh and Jefferson were developed off of a detailed storm sewer outlet survey and an assumed storage volume and overflow elevation estimated from two foot contour maps. The WIIP analysis should be modified to include the new survey information. The survey information should be used to provide recommended LPDA overland flow improvements and/or outlet pipe improvements.

Rear Yard Swale Improvements – Using the detailed topographic survey a hydrologic/hydraulic analysis should be performed on the ditch located southwest of the Middaugh and Jefferson intersection. The analysis should determine whether or not the swale is sized appropriately to convey stormwater to the Jefferson Avenue ROW.

Right-Of-Way Improvements – The topography of the Middaugh and Jefferson area is shown to be extremely flat. Based on two foot contour data it appears that Jefferson Avenue from 200 feet west to 450 feet east of Middaugh Avenue is at elevation 746.0. Middaugh Avenue from Jefferson to 500 feet north is also at elevation 746.0. LPDA and rear yard swale improvements should consider the capacity of the ROW drainage system as a whole. ROW improvements should be considered to handle LPDA and rear yard swale improvements.

Floodproofing - In addition the Village can support individual property owners looking to protect themselves through the following types of mitigation, which are explained in further detail under general mitigation measures at the end of this report:

- Constructing barriers or floodwalls around a home
- Elevating homes above the 100-year flood level
- Flood insurance

Summary of General Mitigation Recommendations

Residents and businesses within flood plain limits or in areas prone to flooding have several mitigation measures available at their disposal. Also, the Village has various options available to help mitigate the damage caused by flooding for their residents and businesses.

- Watershed Plan for regional improvements
- Local drainage improvements
- Constructing barriers or floodwalls around a home
- Elevating homes above the 100-year flood level
- Buying out and removing buildings
- Flood proofing the house
- Public Information
- Flood insurance

Watershed Plan for Regional Improvements

Many of the flood problems identified in the April 2013 storm event are within or near regulatory flood plains. Flooding issues associated with regulatory flood plains are caused by extremely high flow rates and water volumes, therefore, solutions to reduce flood impacts often require a regional approach and a combination of several improvements. Solutions that resolve flooding with improved conveyance in the upstream portion of a watershed can just increase flooding downstream. Therefore, a watershed plan approach should be considered.

A watershed plan is typically undertaken and/or sponsored by multiple municipalities and DuPage County. Often the plan recommends a series of projects required to protect a larger region rather than specific local areas. The plan essentially acts as a large variance to the county ordinance in order to accomplish regional benefits. A watershed plan of this nature is quite different than the 2007 WIIP in that the WIIP focused on localized flooding and this plan would look into regional flood plain solutions.

The Village may want to consider collaborating with DuPage County, Westmont, Lisle, and/or Downers Grove Park District to develop a watershed plan. These watershed plans go through a vigorous review process that involves proper public engagement and review. An approved watershed plan opens the door for the Village to obtain funding for large scale capital improvements in the flood plain to benefit the residents and business of the community.

Local Drainage Improvements

Local drainage improvements are applicable in areas flooded due to locally poor drainage conditions. These can be a result of poor storm sewer capacity, sanitary sewer back up, natural depression or lack of a defined overland flow route for floodwater. Often storm sewer

extensions, upcoming road improvement projects, downstream grading and sanitary sewer projects can help reduce the frequency of flooding if not eliminate the problem. The costs for these projects vary greatly depending on the scope of work. The Village's WIIP identified multiple local drainage improvements and have ranked them by priority for implementation. The Village may want to consider re-evaluating the priority ranking of these improvements based on the recent April 2013 storm event.

Barriers

Small floodwalls and berms can be used to keep floodwaters from reaching a building. They are useful only in areas subject to shallow flooding. They can surround the entire building, tie into high ground, or be as small as a low floodwall built around a stairwell to protect a basement or split-level home.

Floodwall around basement window

Care must be taken in locating barriers. They must be placed so as not to create flooding or drainage problems on neighboring properties. All barriers must be kept out of the regulatory floodway.

The cost of barriers varies depending on the size, required engineering and material used. Where sufficient area is available, landscape berms can provide a low cost alternative to a concrete or brick floodwall. Simple floodwalls around basement windows and low entry points can also be low in cost. Floodwalls for protection from moving floodwaters versus areas of ponding or low level flooding may require design by a structural engineer.

Elevating

Raising a house will allow the flow of floodwater under the home, causing little or no damage to the structure or its contents. If the height needed for flood protection is low, the result is similar to putting a house on a two or three-foot crawlspace.

This house was elevated one foot above the base flood elevation of the Des Plaines River.

Elevating homes on an existing crawlspace is the easiest, however almost any home can be elevated. A 1000 square foot house

generally costs between $10,000 and $30,000 to elevate. The cost depends on the type of home, brick versus wood frame, as well as the type of foundation.
This is the only mitigation measure that can reduce flood insurance costs.

Buyouts

Acquisition and relocation are more cost-effective measures to take in areas subject to severe flood hazards, where there is repetitive flooding, or where other property protection measures are not feasible. Acquisition, followed by demolition, is most appropriate for buildings that are too expensive to move, such as large homes with slab foundations and masonry structures.

The long term care and ownership of vacant parcels must be considered prior to pursuing buyouts. Sometimes a park can be created but in areas where buyouts occur in a piece meal fashion, the area can have a blighted look. If federal money is used for acquisition, the property is often restricted to open space uses in the future. This means the property is removed from the tax rolls while still requiring tax dollars to maintain the property.

Floodproofing

If a building cannot be removed from or elevated above the hazard, it can be protected on site. A building or yard can be modified or "retrofitted" to minimize or even prevent damage.
In areas of low flood threat, such as infrequent low velocity shallow flooding, barriers and dry and wet floodproofing can be efficient approaches. These approaches can also be less disruptive to a neighborhood. However, floodproofing a residential building does not qualify for a flood insurance premium reduction and is not allowed if the project is a substantial improvement or repair of substantial damage.
There are additional shortcomings to floodproofing:

- the building may be isolated and without utilities during a flood
- electricity may be required to operate pumps, or a generator or battery backup would be needed
- streets, utilities and other infrastructure that serve the property will still be exposed to flood damage
- access in and out of the structure may be limited
- human intervention is often required, impacting travel for the property owner
- periodic maintenance is required to check for cracks in the walls and ensure waterproofing compounds do not decompose
- floodproofing may not work if there are any cracks in the foundation, which may be difficult to determine with slab foundations

Dry floodproofing means a building is sealed against floodwaters. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, sewer lines and vents, are closed, either permanently with removable shields, or with sandbags. The flood protection level should be no

more than 2 or 3 feet above the top of the foundation because the building's walls and floors may not withstand the pressure of deeper water. The example on the following page shows a home in Texas that was protected using this technique.

Using sealants and shields is applicable for buildings on a slab foundation. Any heating and ventilation ducts and utilities in the slab would also require protection. Retrofitting the building with forced air or waterproofing the ducts and utilities would also be necessary.
Buildings may also be temporarily wrapped with a polyethylene film. However, this technique requires advanced notice of the flood to allow time for installation. It can be used in cases where the flooding depth will not exceed one foot and the flood duration is generally 12 hours or less.

An alternative to dry floodproofing is wet floodproofing. This approach is usually considered a measure of last resort as floodwaters are intentionally allowed into the building to minimize pressures on the structure. Wet floodproofing can be as simple as moving valuable items or elevating them higher, to rebuilding the floodable area. It is most commonly done for garages, crawlspaces and commercial buildings.

The front wall, showing the apron.

The wall continues in front of the entranceway.

The entranceway has concrete posts on each side and along the bottom, with bolts sticking out. The bolts are covered with 2X6s and a 2X4 along the bottom. These can be pulled off easily.

When the 2X6 and 2X4 boards are removed, the bolts are exposed.

This is the back side of the cover for the entrance-way opening. It is stored around the corner in the garage. It has two rows of foam rubber to seal the board to the concrete posts and floor.

The cover is installed over the concrete posts at the entranceway. The bolts are screwed tight with wing nuts. The board must be over 40 years old, but fit like a glove over the bolts.

Dry floodproofed home

Public Information

The Village should continue to use a public information strategy using direct mail, public hearings and Village newsletters to provide property owners with information on:

- their flood risk
- basic facts about flood insurance
- contents coverage
- Increased Cost of Compliance (ICC) coverage
- requirements for building permits after a flood
- property protection measures
- sources of financial assistance

Flood Insurance

Although flood insurance will not reduce property damage, it may be the only way for property owners with shallow depth, repetitive flooding to receive assistance with the cost to clean up and repair their homes. For properties where flood protection from smaller floods is provided through a floodwall, flood insurance provides coverage for the large flood events. Contents coverage is also available to homeowners. Renters can also buy contents coverage even if the building is not covered by the owner.

Under the flood insurance program, insured structures in the flood plain, that have been substantially or repetitively damaged by a flood, can be elevated, floodproofed, demolished or relocated using Increased Cost of Compliance (ICC) coverage. **ICC will pay up to $30,000 to help pay for the cost to bring a flood plain structure into compliance with the Village's flood plain regulations.**

In Downers Grove, a structure, with a flood insurance policy, is eligible to file a claim for ICC coverage if the Village determines that a home or business is damaged by flood to the point that repairs will cost 50 percent or more of the building's pre-damage market value, which is called substantial damage.

MEMORANDUM

June 26, 2013

TO: Andy Sikich, PE – Assistant Director of Public Works

FROM: Darren T. Olson, PE
David E. Vogel, PE

SUBJECT: April 17-18, 2013 Storm Event
St Joseph Creek Watershed
(CBBEL Project Number 13-0260)

As requested, Christopher B. Burke Engineering, Ltd. (CBBEL) has completed an investigation of the April 17-18, 2013 storm event within the St Joseph Creek Watershed (Watershed). Approximately 6.7 inches of rain fell over a 24-hour period resulting in flooding throughout the Village of Downers Grove (Village). CBBEL reviewed the following information that was provided by the Village for the April 2013 storm event:

- Rainfall data from 6 Village gages;
- Village road closure map;
- LPDA call log map;
- Reported first floor flooding map;
- 2013 vs 2006 storm event call log map;
- Individual assistance damage assessment spreadsheet;
- Storm complaints spreadsheet;
- As-built plans for SJN-E improvements.

Rainfall Analysis

Rainfall data for the April 17-18th storm event was provided by the Public Works Department for several gages located throughout the Village. The gages are operated and maintained by the Sanitary District. A summary of the rainfall data is provided in Table 1 below.

Table 1 – Rainfall Gage Summary

	WWTC	WROBLE LS (63rd and Williams)*	EARLSTON LS (41st and Earlston)	DG VILLAGE HALL*	HOBSON (Hobson and 355)	NORTHWEST LS (31st and Lacey)
	Inches	Inches	Inches	Inches	Inches	Inches
April 17th	2.22	1.51	2.21	1.95	2.47	2.38
April 18th	4.67	3.39	4.63	3.68	4.39	4.52
TOTAL	**6.89**	**4.90**	**6.84**	**5.63**	**6.86**	**6.90**

* Gage not used in analysis.

As can be seen in Table 1, rainfall totals for the 'Wroble LS' and 'DG Village Hall' gages were significantly lower than totals collected at other area gages. The remaining four gages are within 0.1 inches of one another. It is not clear whether the differences were due to a collection malfunction or possibly the geographical location of the gage. Since 'Wroble LS' and 'DG Village Hall' were so different from the remaining gages, these two gages were not used in the analysis.

CBBEL analysis of the provided rainfall data determined that the peak return interval rainfall occurred from 4/17 9:30AM – 4/18 9:30AM with approximately 6.7 inches of rainfall over the 24-hour period. This is between a 50-year and 100-year design storm event based on the Illinois State Water Survey (ISWS) Bulletin 70 rainfall depths. Due to saturated ground conditions prior to the storm event, the runoff generated from this rainfall may have exceeded what would be expected under typical ground moisture conditions.

Previous Modeling

CBBEL previously prepared XP-SWMM hydrologic and hydraulic models of the Watershed as part of the 2009 Village of Downers Grove Watershed Infrastructure Improvement Plan (WIIP). The St. Joseph Creek North Subwatershed E (SJN-E) WIIP models were used as the base for the current study.

XP-SWMM Analysis

Three XP-SWMM models were created to represent the Subwatershed at different levels of drainage improvement completion. Rainfall data for the April 17-18th, 2013 storm was taken from the '41st and Earlston' rain gage due to its close proximity to the study areas.

Model #1: Pre-Improvement Condition

The WIIP existing conditions model was used without modification as the pre-improvements condition model. This model represents the Subwatershed prior to construction of WIIP drainage improvements.

Model #2: Existing Conditions

The existing conditions model used the WIIP proposed conditions model as a base and modified it to include only drainage improvements that have been constructed to date. Modeled improvements were updated based on design plans and as-built plans where available. The existing condition represents the state of stormwater drainage within the Subwatershed at the time of the April 2013 storm event. The following improvements are included in the model:

- Washington Park stormwater storage basins;
- Washington Street storm sewer improvements (between Washington Park and Chicago Avenue);

- Sherman Street and Prospect Avenue storm sewer improvements;
- Rogers Street storm sewer improvements (between Bryan Place and Elm Street);
- Grant Street and Stanley Avenue storm sewer improvements.

Model #3: Proposed Conditions

The proposed conditions model includes additional improvements within the Subwatershed to further reduce peak flood elevations and provide an increased level of protection from future flooding. The existing conditions model was used as the base model.

Study Areas

Four study areas were evaluated:

1. Forest Avenue/Prince Street between Prairie Avenue and north of Franklin Street;
2. Rogers Street at Bryan Place;
3. Washington Street north of Chicago Avenue;
4. Stanley Avenue between Lincoln Street and Grant Street.

Forest Avenue/Prince Street between Prairie Avenue and north of Franklin Street (SJN-71)

The Forest Avenue study area was analyzed in XP-SWMM for the April 2013 rain event. Based on information received from the Village, street, basement, and backyard flooding occurred. The existing 21-inch diameter storm sewer that drains this area has a maximum capacity of approximately 22 cfs. Detailed XP-SWMM modeling indicates that during the April flood event, there was a peak runoff rate of approximately 60 cfs from the 34 acres of upstream drainage area which is 38 cfs greater than the storm sewer capacity. Excess runoff not collected in the storm sewer flows overland to the south down Forest Avenue and through the rear yards to the low spot at LPDA SJN-71. The XP-SWMM existing conditions model confirmed street and backyard flooding and overland flow that was seen during the April 2013 storm event. Based on the XP-SWMM model results, the flooding was likely due to the runoff rate exceeding the capacity of the storm sewer system. Review of the draft DuPage County flood maps shows that this study area is not mapped as 100-year floodplain. A plan view of the study area is provided as Exhibit 1.

Reconstruction of Prairie Avenue at Forest Avenue did not increase April 2013 flooding. Under existing conditions, DuPage County 2-foot aerial topography shows that stormwater runoff flowing from north to south down Forest Avenue continues flowing south at Prairie Avenue to the low point on Forest Avenue, midway between Prairie Avenue and Franklin Street. Even a slight rise in the finished grade of Prairie Avenue west of Forest Avenue would not alter the existing drainage path.

No drainage improvements were proposed for this area in the WIIP. It is recommended that this area be studied in more detail to develop drainage improvements that can reduce the risk of future flooding. Table 2 below summarizes peak flood elevations at this study area.

Table 2 – Forest Avenue April 2013 XP-SWMM Model Results

Location	Ground Elevation (ft)*	Peak Water Surface Elevation (ft)
		Existing
Forrest Ave between Prairie & Franklin (SJN71)	718.0	718.7

* Based on DuPage County aerial topography

Rogers Street at Bryan Place (SJN-82/83) and Whiffin Place (SJN-92)

The Bryan Place study area was analyzed in XP-SWMM for the April 2013 rain event. Based on information received from the Village, street, basement, and yard flooding occurred. The existing 36-inch diameter storm sewer draining west from Bryan Place has a maximum capacity of approximately 33 cfs. Detailed XP-SWMM modeling indicates a peak runoff rate of approximately 129 cfs from the 116 acres of upstream tributary area, which is 96 cfs greater than the storm sewer capacity. Excess runoff that cannot be collected in the storm sewer collects on Bryan Place. The XP-SWMM existing conditions model confirmed street and yard flooding at Bryan Place during the April 2013 storm event which was caused by the runoff rate exceeding the storm sewer capacity. Review of the draft DuPage County flood maps shows that this study area is mapped as 100-year floodplain. The mapped floodplain area is larger than the April 17-18th inundation area. A plan view of the study area is provided as Exhibit 2.

Drainage improvements that have already been constructed include the Washington Park stormwater storage basins located upstream of Bryan Place and upsizing of the existing storm sewer line on Rogers Street. Detailed XP-SWMM modeling shows that Washington Park improvements and Rogers Street storm sewer upsizing created a 0.1 foot decrease in peak flood elevations at Bryan Place for the April 2013 storm event and a 0.9 foot decrease in flood elevations at Whiffin Place.

No future improvements are shown in the WIIP. Table 3 below summarizes peak flood elevations at this study area.

Table 3 – Bryan Place April 2013 XP-SWMM Model Results

Location	Ground Elevation (ft)*	Peak Water Surface Elevation (ft)	
		Pre-Improvement	Existing
Rogers Street at Bryan Place (SJN82/83)	708.8	710.6	710.5
Rogers Street at Whiffin Place (SJN92)	713.6	715.6	714.7

* Based on DuPage County aerial topography.

Washington Street at Chicago Avenue (SJN-86)

The Chicago Avenue study area was analyzed in XP-SWMM for the April 2013 rain event. Based on information received from the Village, street, basement, and yard flooding occurred. The XP-SWMM existing conditions model confirmed street and yard flooding at this study area during the April 2013 storm event. WIIP improvements have been constructed on Washington Street downstream of this study area which resulted in a 0.1 foot decrease in the peak flood elevation. The 12-inch diameter storm sewer on Chicago Avenue has a maximum capacity of approximately 6 cfs. XP-SWMM modeling indicates a peak runoff rate of approximately 52 cfs from the upstream 19.8 acres of tributary area. The XP-SWMM model results indicate that the flooding is caused by the runoff rate exceeding the storm sewer capacity resulting in water ponding on the roadway and the low area behind homes on Chicago Avenue. Review of the draft DuPage County flood maps shows that this study area is not mapped as 100-year floodplain. A plan view of the study area is provided as Exhibit 3.

WIIP improvements have been completed downstream of the Chicago Avenue study area. A new 30-inch diameter storm sewer was installed under Washington Street from Washington Park north to the Chicago Avenue intersection. The 12-inch diameter storm sewer draining the low spot on Chicago Avenue and the rear yards does not have the capacity to convey the runoff draining to it.

Future improvements include completing the WIIP improvements at Chicago Avenue (SJN-86). The WIIP improvements include extending a 21-inch diameter storm sewer west down Chicago Avenue and into the rear yards. This will require work on private property. XP-SWMM modeling of the April 2013 storm event shows that the proposed WIIP improvements lower peak flood elevations at SJN 86 by an additional 2.0 feet from existing conditions. The flood storage in the north lobe of Washington Park was designed to store this water. Table 4 below summarizes peak flood elevations at the Chicago Avenue study area.

Table 4 – Chicago Avenue April 2013 XP-SWMM Model Results

Location	Ground Elevation (ft)*	Peak Water Surface Elevation (ft)		
		Pre-Improvement	Existing	Proposed
Washington Street north of Chicago Ave (SJN86)	728.0	731.0	730.9	728.9

* Based on DuPage County aerial topography.

Stanley Avenue between Lincoln Street and Grant Avenue (SJN-99/103/105)

The Stanley Avenue study area was analyzed in XP-SWMM for the April 2013 rain event. Based on information received from the Village, street, basement, and yard flooding occurred. The XP-SWMM existing conditions model confirmed street and yard flooding at the Stanley Avenue study area during the April 2013 storm event. The 6-inch diameter storm sewer draining the rear yards (SJN-103) has a maximum capacity of approximately 1 cfs. XP-SWMM modeling indicates a peak runoff rate of approximately 21 cfs from the 8 acres of upstream tributary area. This is 20 cfs more than the existing storm sewer capacity. The results of the XP-SWMM model indicate that flooding is caused by the runoff rate exceeding the storm sewer capacity that results in stormwater ponding in the low area behind homes on Stanley Avenue. Similarly, there is no storm sewer outlet from SJN-99/105 and the peak XP-SWMM runoff rate is 10 cfs. Flooding is caused by stormwater runoff ponding in the low area behind homes on Stanley Avenue that has no sewer outlet. Review of the draft DuPage County flood maps shows that this study area is not mapped as 100-year floodplain.

WIIP improvements have not been completed at Stanley Avenue between Lincoln Street and Grant Avenue. However, the Village stated that a 6-inch diameter drain pipe was installed at SJN 103 through a cost-share program and a 12-inch diameter storm sewer line was installed on Elm Street that extends north from the existing storm sewer line on Lincoln Street.

Future improvements include completing the WIIP improvements at Stanley Avenue (SJN-99/105). WIIP improvements include installing a 12-inch diameter storm sewer from SJN-99 to SJN-105 and then out to Stanley Avenue along with creating an overland flow swale between SJN-99 and SJN-105. Based on discussions with the Village, construction of the proposed storm sewer and swale from SJN-99 to SJN-105 would be very difficult because these are located on private property. The WIIP proposed 12-inch diameter storm sewer from SJN-105 to Stanley Avenue remains.

As an alternative to the proposed overland flow swale in the WIIP, CBBEL also evaluated installing a proposed 12-inch diameter storm sewer from SJN-99 to the Elm Street storm sewer system. XP-SWMM modeling shows that the hydraulic grade line of the Elm Street storm sewer is high enough that it makes the proposed storm sewer ineffective. Further study of this area is warranted.

XP-SWMM modeling of the April 2013 storm event shows that the proposed improvements lower peak flood elevations at SJN-105 by an additional 1.4 feet. Peak flood elevations at SJN-103 remain unchanged. CBBEL had also developed drainage plans for these areas in 2009. Table 5 below summarizes peak flood elevations at this study area.

Table 5 – Stanley Avenue April 2013 XP-SWMM Model Results

Location		Ground Elevation (ft)*	Peak Elevation (ft)		
			Pre-Improvement	Existing	Proposed
Stanley Ave between Lincoln & Grant	SJN 99	728.0	730.1	730.1	--
	SJN 105	726.3	729.6	729.5	728.1
	SJN 103	730.0	731.9	731.9	731.9

* Based on DuPage County aerial topography.

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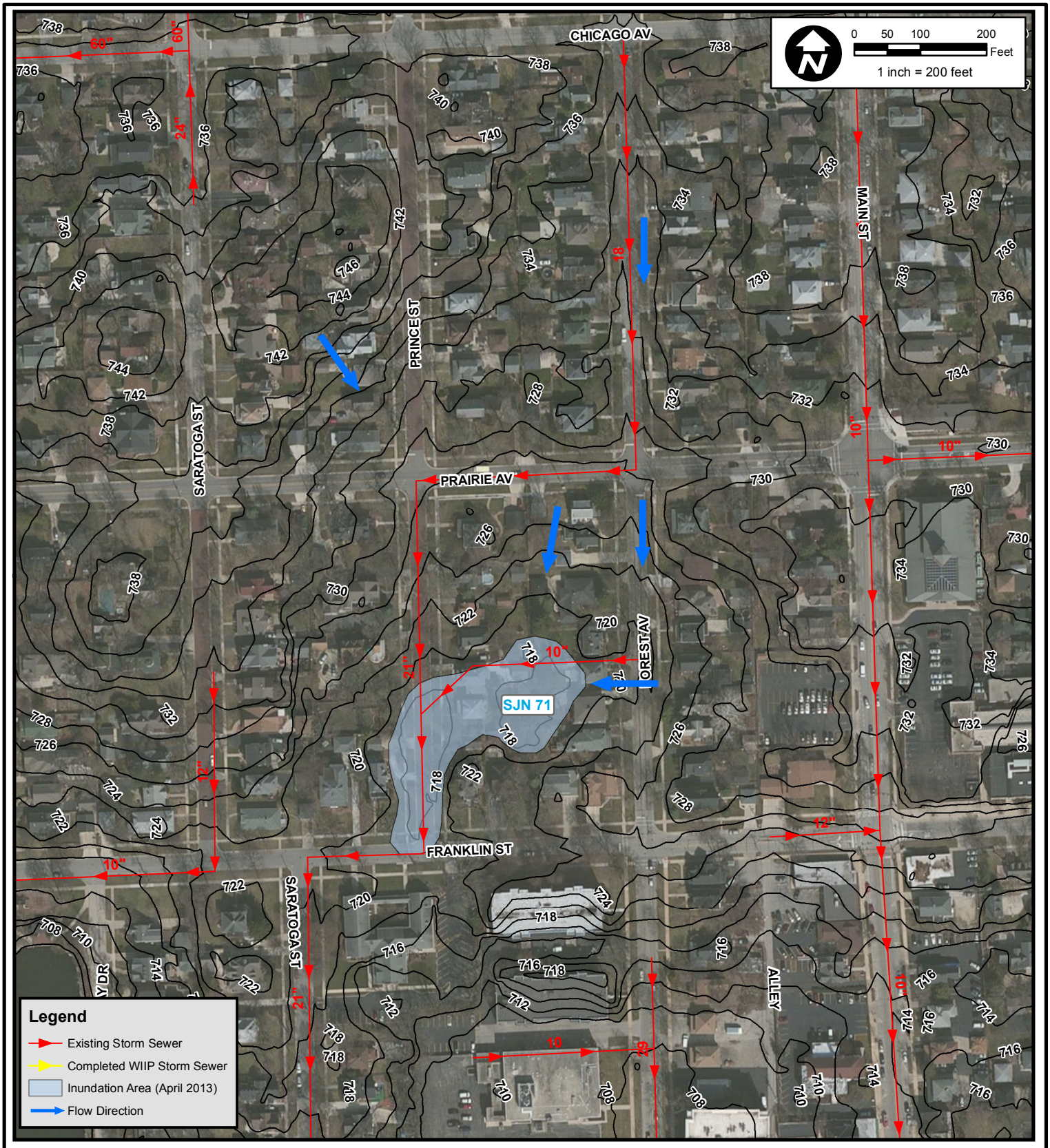

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DSGN.	DEV	CHKD.	

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Rosemont, IL 60018
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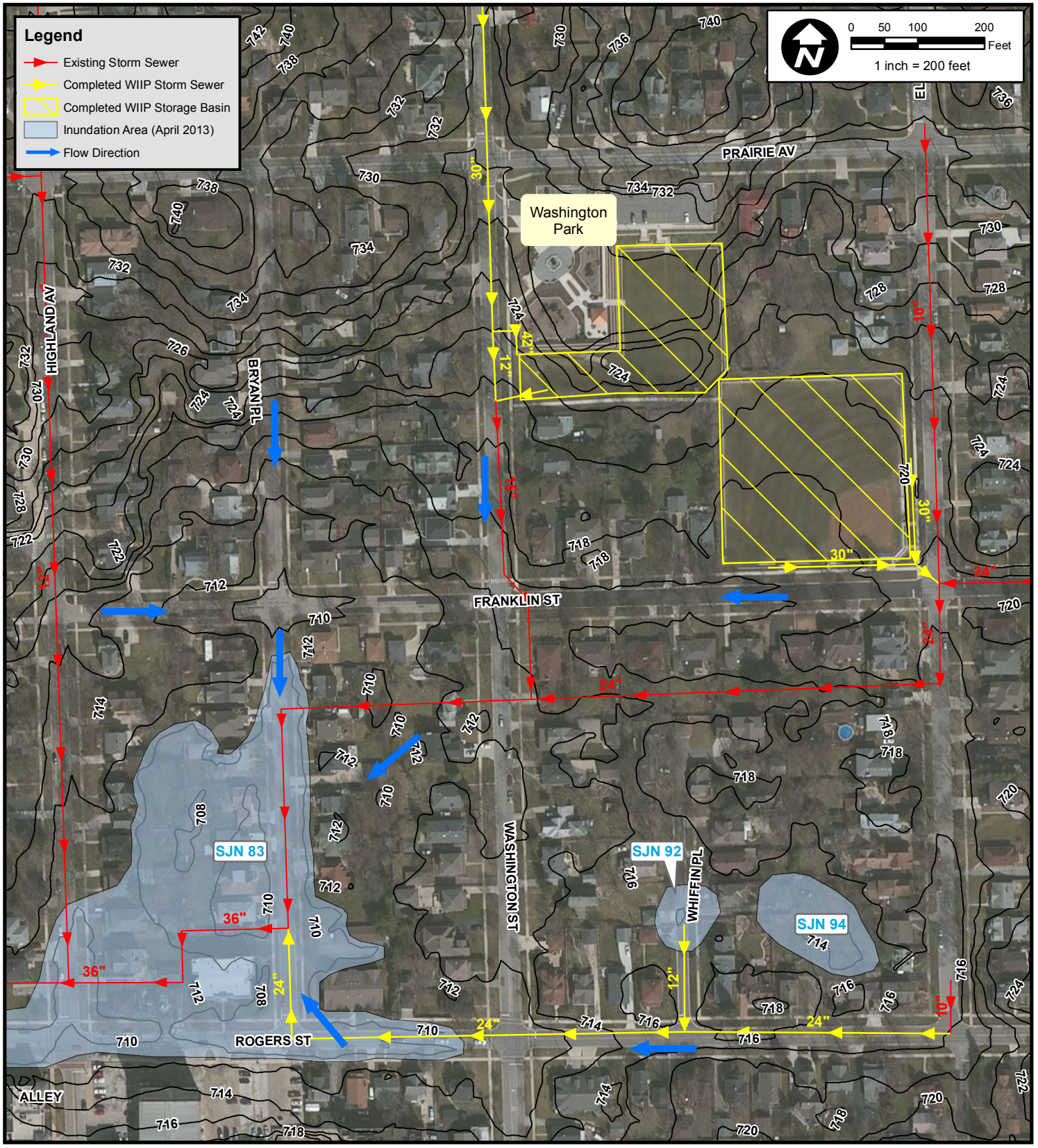
CLIENT	JOB#	
VILLAGE OF DOWNERS GROVE	13-0260	

TITLE	DATE
FOREST AVENUE/PRINCE STREET BETWEEN PRAIRIE AVENUE AND FRANKLIN STREET STUDY AREA	06/19/13
	EXHIBIT 1



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DSGN.	DEV	CHKD.	

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CLIENT	JOB#	
VILLAGE OF DOWNERS GROVE	13-0260	

TITLE	DATE
ROGERS STREET AT BRYAN PLACE STUDY AREA	06/19/13
	EXHIBIT 2

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DSGN.	DEV	CHKD.	

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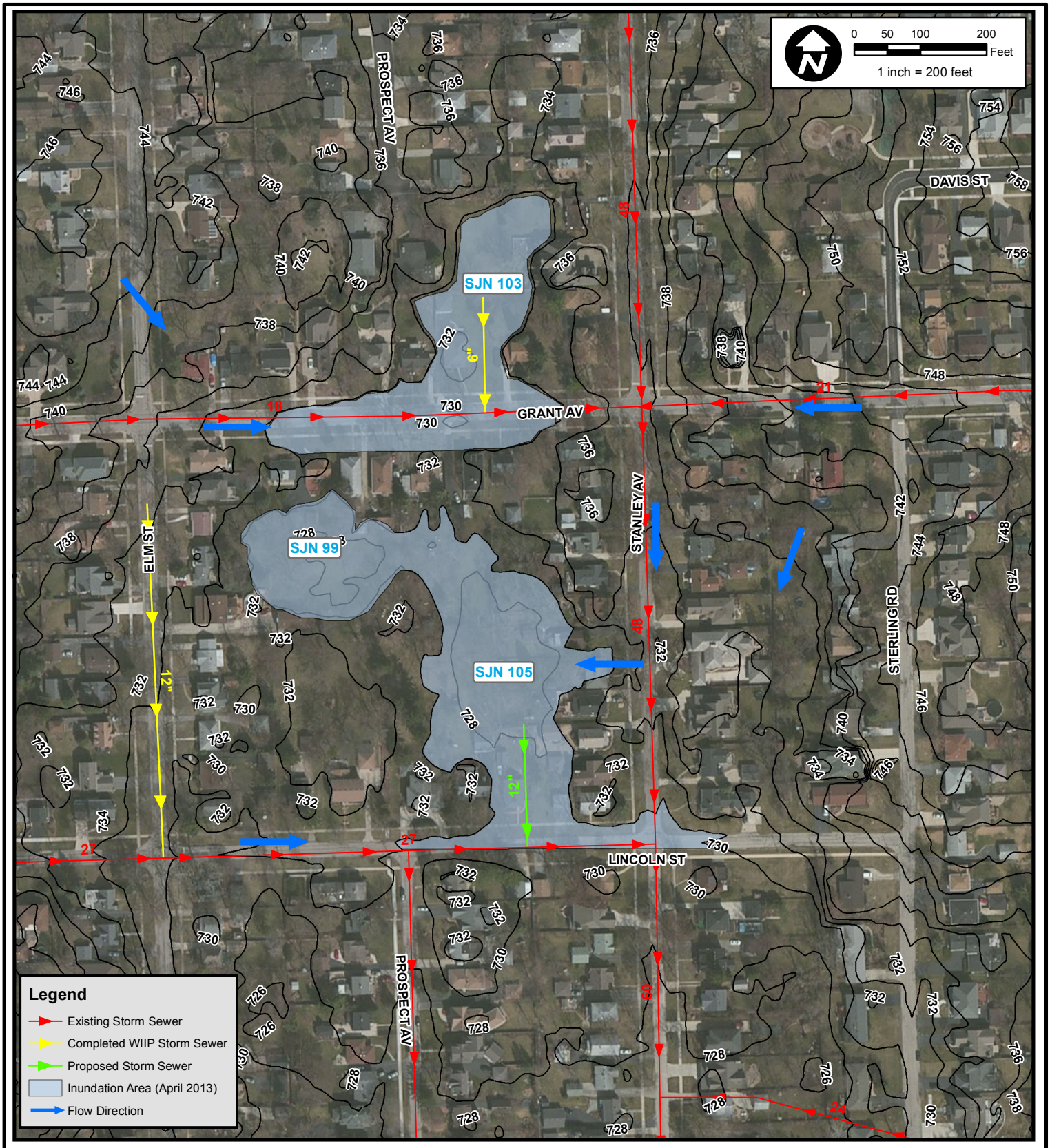
CLIENT	JOB#	
VILLAGE OF DOWNERS GROVE	13-0260	

TITLE	DATE
WASHINGTON STREET AT CHICAGO AVENUE STUDY AREA	06/19/13
	EXHIBIT 3



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CLIENT	JOB#	
VILLAGE OF DOWNERS GROVE	13-0260	

TITLE	DATE
STANLEY AVENUE BETWEEN LINCOLN STREET & GRANT AVENUE STUDY AREA	06/19/13
	EXHIBIT 4

MEMORANDUM

June 25, 2013

TO: Andy Sikich, PE – Village of Downers Grove, Assistant Director of Public Works

FROM: Darren Olson, PE

SUBJECT: Belmont Road Underpass at the Burlington Northern Railroad
April 17-18 Storm Event
(CBBEL Project 130260)

The purpose of this memorandum is to summarize the Christopher B. Burke Engineering, Ltd. (CBBEL) review of the flooding of the Belmont Road Underpass that occurred on April 17-18, 2013. The following items were supplied for review:

- April 24, 2013 Letter from Michael Delemont, PE, SE of URS to Joe Ott of Metra
- URS Engineering Plans (Plan Sheets 90-102 and 417) for the Belmont Road Grade Separation at Downers Grove, IL, dated 3-24-2009

Based on our review of the above material, we understand that a 12-inch diameter storm sewer was temporarily installed on the 48-inch diameter Belmont Road storm sewer that was under construction south of the underpass as part of the DuPage County intersection improvement project at Curtiss Street and Belmont Road. This 48-inch diameter storm sewer is the receiving system for the Belmont Road Underpass pump station and the adjacent gravity storm sewer system. It is also the receiving system for the gravity storm sewer system on Hitchcock Avenue. Based on our review of the 2009 Watershed Infrastructure Improvement Plan (WIIP) there is a significant portion of Subwatershed SJN-B (approximately 300 acres) that is tributary to the gravity storm sewer system on Hitchcock Avenue. The 48-inch storm sewer system on Belmont Road drains south and ultimately outlets to St. Joseph Creek on the downstream (west) side of the Belmont Road Bridge. An exhibit showing the approximate locations of these storm sewer systems is attached to this memorandum.

It is our understanding that the 12-inch storm sewer was installed on the 48-inch diameter Belmont Road storm sewer system to provide temporary drainage during construction due to a utility conflict. The temporary 12-inch diameter storm sewer that was installed significantly reduced the conveyance capacity of the 48-inch storm sewer and resulted in a surcharged storm sewer system downstream of the underpass. The photographs in the URS letter indicate that water surcharged out of the storm sewer system at the intersection of Hitchcock Avenue and Belmont Road. Upon our review of the information provided, we generally concur with the findings in the April 24, 2013 URS letter and offer the following comments:

- The photographs in the URS letter and review of the local topography indicate that water from the downstream surcharged storm sewer system flowed out of the manhole(s) at the intersection of Hitchcock Avenue and Belmont Road and drained north overland into the underpass. The water flowing out of the manholes included water from the nearly 300 acres of tributary area in Subwatershed SJN-B and water being pumped out of the underpass that was likely re-circulating back down into the underpass.
- The URS letter indicated that the underpass pumps were running throughout the storm event. As part of our review, a detailed review of the underpass pump station was not completed to verify the adequacy or performance of the pump station during the storm event.
- Based on our review of the URS letter and the USGS provisions stream gage information for St. Joseph Creek, it is our opinion that floodwater from St. Joseph Creek did not backflow into the underpass.

It is our recommendation that the hydrologic and hydraulic modeling of Subwatersheds SJN-A, SJN-B and SJN-C from the WIIP be updated to include the April 2013 storm event and the recently completed storm sewer improvements in the subwatersheds, including the 48-inch diameter Belmont Road storm sewer system.

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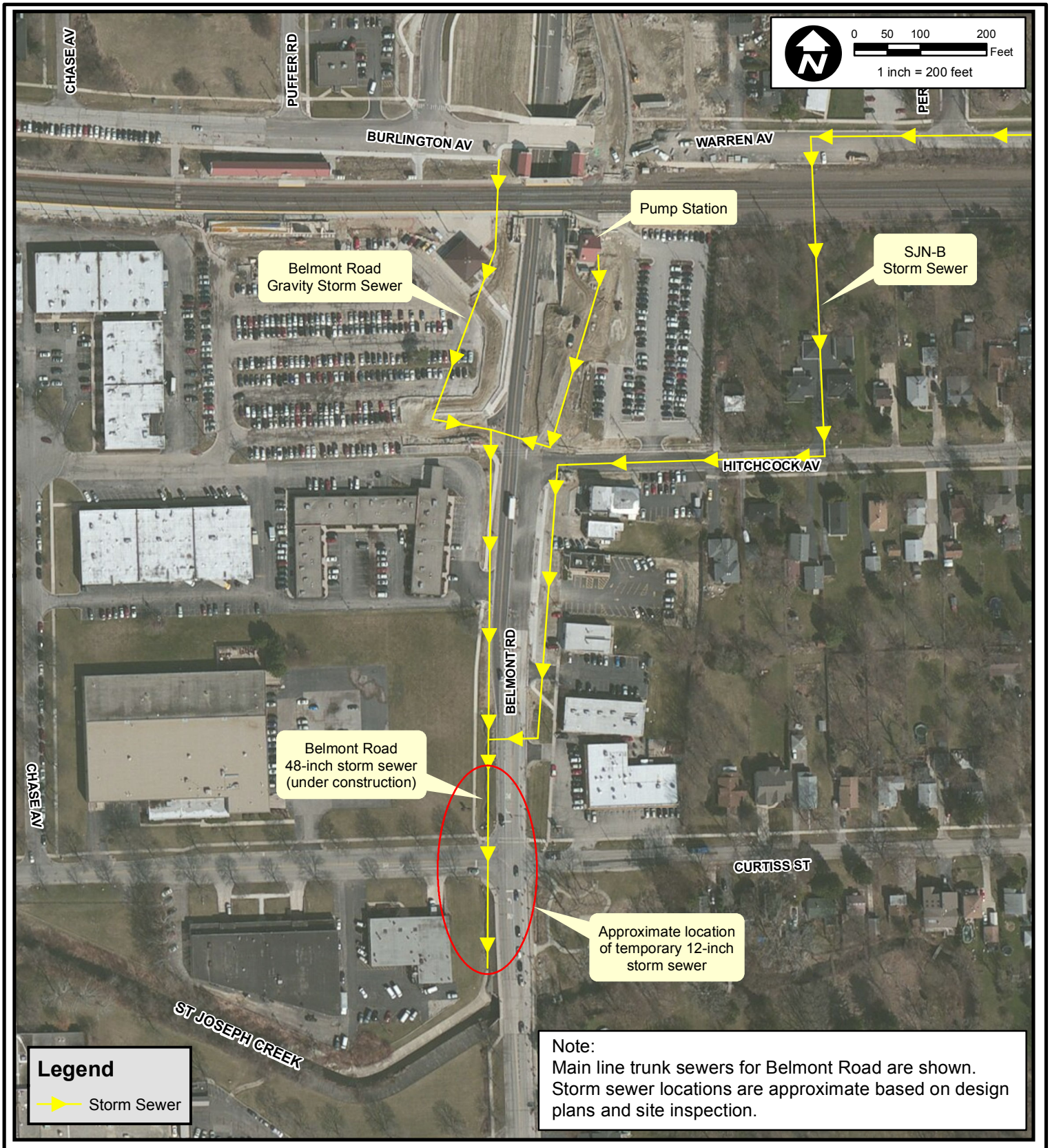

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DSGN.	DEV	CHKD.	

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(847) 823-0500 / FAX (847) 823-0520

CLIENT	JOB#	
VILLAGE OF DOWNERS GROVE	13-0260	

TITLE	DATE
BELMONT ROAD UNDERPASS STUDY AREA	06/19/13
	EXHIBIT 1

April 24, 2013

Metra
547 West Jackson Blvd.
Chicago, IL 60661-5717

Attn. Joe Ott
Director of Construction

Ref: Belmont Road Grade Separation at Downers Grove, IL

Subject: Underpass and Pedestrian Tunnel Flooding

Joe:

On the morning of April 18, 2013, Metra contacted URS regarding flooding of the Belmont Road Grade Separation highway underpass and the pedestrian tunnel. URS visited the site that morning and observed these conditions with representatives of the DuPage County Division of Highways, Metra's Construction Department, the Metra's resident engineer for the grade separation project, and the County's Phase III consultant for its Curtiss Street / Belmont Road Intersection improvement. Based on our site inspection and follow-up correspondence with several of the others who visited the site, following is URS' understanding of the root cause of the problem:

Two new closed drainage storm sewer systems were provided as part of the Belmont Road Grade Separation Project. They collect stormwater from the project and convey water from adjacent areas through it. The first one handles stormwater from Belmont Road between Prairie Avenue and Haddow Avenue, Burlington Avenue, Warren Avenue and the northwest and southwest parking lots. The sump pumps for the pedestrian tunnel also discharge into this gravity fed system. The second one collects stormwater from Belmont Road between Haddow Avenue and Hitchcock Avenue and the southeast parking lot. As part of this second system, water on Belmont Road is lifted by the pump station and discharged into a detention system under the southeast parking lot where it in-turn flows south to Hitchcock Avenue and then west under Belmont Road to join with the first system at Manhole MH20. A 30-inch storm sewer carries the combined flow from these two systems south along the west side of Belmont Road.

Another storm sewer system which existed prior to the Belmont Road Grade Separation project carries stormwater from east of the grade separation project limits along the south side of Hitchcock Avenue, south along the east side of Belmont Road, and then west under the highway to join with the previously noted 30-inch storm sewer from the grade separation project. In the vicinity of where those two systems join, DuPage County has been constructing a large 48-inch trunk line sewer southward along Belmont Road to outfall at St. Joseph's Creek as part of its Curtiss Street intersection improvement project.

We understand that recently a temporary 12-inch PVC pipe was installed in place of segment of the County's proposed 48-inch pipe in the vicinity of Curtiss Street to address an unexpected utility

conflict. This temporary 12-inch pipe was scheduled to be replaced with the permanent 48-inch pipe within the next several weeks once the conflicting utility was relocated. This 12-inch pipe greatly restricts how much flow can be handled as the receiver of the above noted storm sewer systems. It did not have the capacity to accommodate the heavy rainfall event that began on April 17th and lasted into the morning of the 18th and resulted in pressurized water backing up in the storm sewer systems feeding it. This was evidenced by water flowing out of the top of several manholes including the one for Manhole "A" at the corner of Hitchcock Avenue and Belmont Road that handles flow that comes from east of the grade separation project (see Photo 1). At seen in the photo, that outflowing water in-turn flowed north along Belmont Road into the depressed roadway of the grade separation.

With this pressurized situation down-line, water discharging from the pump station for the roadway underpass and from the sump pumps for the pedestrian tunnel also had nowhere to go. Water collected in the Belmont Road underpass, making it impassable (see Photo 2). Based on the data history of the pumps provided to the County through the SCADA monitoring system of the pump station, the pump station remained operational throughout the storm. Low level pumps ran continuously and high level pumps turned on at the following times: 6:55 a.m., 8:54 a.m., 9:46 a.m., 10:15 a.m., 10:30 a.m. and at 10:48 a.m. Based on the SCADA system data, though the pumps turned on, the water level only dropped minimally and then quickly rose again after they were on. After 10:48 am the SCADA system data indicated a normal water level, and the underpass was fully dewatered shortly thereafter (see Photo 3). This time likely corresponds to when the water that had been backed up in the downstream received 48-inch storm sewer had been able to fully pass though restricted 12-inch pipe.

As-designed, water flowed into the sump basins within the pedestrian tunnel from the underdrains that were providing along the back-side of the tunnel walls. However with no place for the sump pumps handing this water to freely discharge to with the full and pressurized downstream storm receiving sewer systems, water in the tunnel reached an estimated depth of 16 inches during the early morning. By 11:00 a.m., the water level had been pumped down to approximately six inches (see Photo 4). By 1:30 p.m. the tunnel was completely dewatered (see Photo 5).

Extensive flooding occurred throughout the suburban region and record high water levels recorded in some places. It has been estimated that the water level of St. Joseph's creek may have approached an elevation 691.0 (see Photo 6). Based on DuPage County FEMA maps, this would correspond to an elevation somewhere between a 50-year water elevation of 690.5 and a 100-year one of 691.8. However, with no direct storm sewer connection to the low point of the underpass and tunnel, water could not flow into either from the waterway.

Once the temporary 12-inch pipe is replaced with the intended properly-sized 48" pipe at Curtiss

Street, the downstream restriction of the storm sewer system will be eliminated and a repeat of flooding issues at the underpass and pedestrian tunnel should not occur again.

Very truly yours,

URS Corporation

Michael Delemont, P.E., S.E.
Senior Project Engineer

encl.

Photo 1 – Manhole “A” at the corner of Belmont Road and Hitchcock Avenue (looking east)

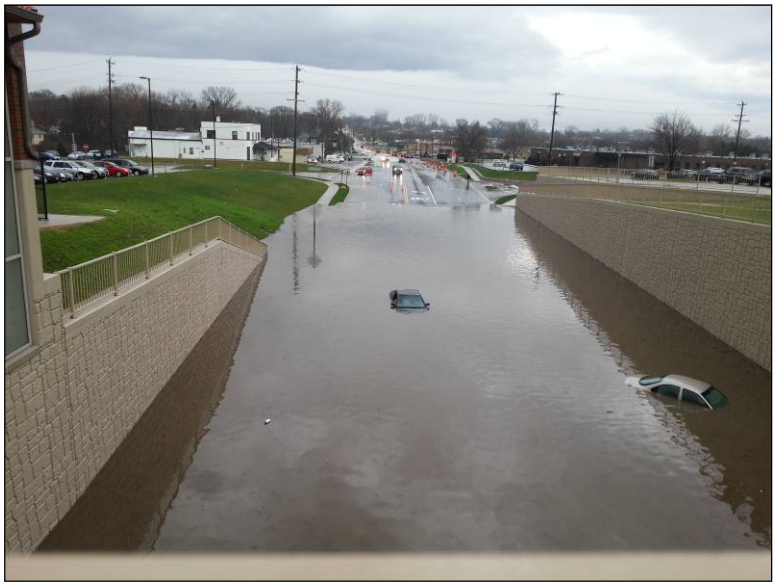


Photo 2 – Belmont Road underpass with approximately 3.5’ of water

Photo 3 – Belmont Road underpass fully drained

Photo 4 – Pedestrian tunnel with approximately 6” of water

Photo 5 – Pedestrian tunnel fully drained

Photo 6 – Bridge at St. Joseph's creek – west side

MEMORANDUM

DATE: June 27, 2013

TO: Andy Sikich, Village of Downers Grove

FROM: Derrick Martin, V3 Companies

CC: Jennifer Maercklein, V3

RE: Stormwater Modeling of April 2013 Storm Event in Lacey Creek Subwatershed E

As a follow up to the April 17 – 18, 2013 storm event and associated flooding, the Village is in the process of re-evaluating previously calculated flood elevations and potential flood mitigation alternatives for known problem areas. The new evaluation is based on available rainfall information for the April 2013 storm event and an understanding that the absorption capacity of the ground was significantly reduced as the result of an unusually wet spring (according to the National Weather Service, April 2013 was the wettest April on record for the Chicagoland area).

As part of the Village-wide re-evaluation process, V3 was requested to update the hydrologic and hydraulic floodplain modeling for the Lacey Creek Subwatershed E area generally located south of Lacey Creek, east of Highland Avenue, west of Fairview Avenue and north of Ogden Avenue (see Figure III Subbasin Map). The Subwatershed E area was originally analyzed by V3 in the late 90's during the design of the County's Wetland Bank located in this area. This area was looked at again in 2007 during the development of the Village's Watershed Infrastructure Improvement Plan (WIIP), which was intended to provide a village-wide general overview of the Village's existing drainage conditions with the goal of identifying potential projects to improve the stormwater system in terms of conveyance, storage, and water quality.

As a follow up to the WIIP planning effort, in 2009 the Village looked at the WIIP-identified mitigation alternatives in more detail (concept level design) in an effort to select the most feasible and cost-effective alternatives. The 2009 alternatives evaluation focused on Subbasins LA14 and LA16, which are located north of Ogden Avenue, south of 39th Street, east of Highland Avenue and west of Fairview Avenue (see Figure III Subbasin Map). The evaluation included a more detailed analysis of both existing conditions and proposed mitigation alternatives than what was originally prepared for the WIIP.

The goal of this latest Subwatershed E evaluation was to update the previously created hydrologic and hydraulic modeling with April 2013 storm information to see how the April 2013 existing conditions model results compared to previously calculated existing conditions design flood elevations and observed flood elevations associated with the April storm. Specifically, the analysis

evaluated the impact of the April 2013 storm event on the Wetland Bank located along 40th Street between Sterling Avenue to the east and Elm Street to the west and the impact to known problem areas located at or near the intersection of 40th Street and Washington Street.

Although several mitigation alternatives were previously identified and modeled for this study area, the current evaluation focuses on the mitigation alternative for the area located at or near the intersection of 40th Street and Washington Street (identified in the 2009 evaluation as Alternative C: Storm Sewer Improvements Near Washington and 40th). This mitigation alternative was selected since this problem area received some of the most significant flood damages and the Village determined this mitigation alternative to be the most feasible and cost-effective alternative of those previously evaluated.

The following summarizes the assumptions and information used in the hydrologic and hydraulic analyses as well as a discussion of the calculated discharges and high water levels associated with the April 2013 storm event and the typical 100-year, 24-hour design storm event.

Hydrologic Evaluation

The hydrology for Subwatershed E was previously calculated with both TR-20 and XPSWMM (both use SCS methodology) to compute critical duration discharges. The TR-20 model was originally created to primarily evaluate the Wetland Bank so it is more of a big picture evaluation of the watershed that utilizes larger tributary subbasins (the TR-20 discharges are then input into a FEQ hydraulic model to calculate high water levels). The XPSWMM hydrologic evaluation considers smaller tributary areas so isolated problem areas and/or storm sewers can be evaluated using the hydraulic mode of XPSWMM.

The previous evaluation used typical rainfall depths from Table 13 of Bulletin 70: Frequency Distributions and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois by Floyd A. Huff and James R. Angel, 1989. The standard 100-year, 24-hour rainfall design depth for this area is 7.58 inches. The rainfall distributions used were from Circular 173: Time Distribution of Heavy Rainstorms by Floyd A. Huff, 1990 (commonly referred to as the Huff Distributions). The hydrologic modeling also used an average antecedent soil moisture condition (AMC II), which is the typical condition recommended for hydrologic analyses.

The Village provided rain gage information for the April 17-18 storm event from six different rain gage locations within the Village. V3 used the gage information from the Earlston LS gage located at 41st Street and Earlston Street since the gage is located only blocks away from the study area. The rain gage recorded cumulative rainfall information in 15 minutes increments for the 48-hour period from midnight April 17th through midnight April 18th. Although the total cumulative rainfall depth for the 48-hour period was 6.83 inches, the data indicates that the majority of the rainfall (6.73 inches) fell over a 24-hour period from approximately 10 am on April 17th to 10 am on April 18th, with the remaining 0.1 inches falling over the last 14 hours of the 48-hour period.

In an effort to simplify the comparison between the April storm event and a typical 100-year, 24-hour design storm, the hydrologic evaluation of the April event used the rain gage data that produced a rainfall depth of 6.73 inches in 24-hours. Additionally, the antecedent moisture condition was changed from AMC II (average soil moisture condition) to AMC III (saturation soil moisture condition) for the TR-20 analysis and the runoff curve numbers were adjusted in the XPSWMM model to also represent the saturated soil condition. The soil moisture condition

impacts how much rainfall can be initially absorbed into the ground during a storm event so a saturated soil moisture condition allows little to no absorption, which results in more stormwater runoff.

A comparison of the TR-20 modeling results indicate that the April 2013 storm produced peak discharges from individual subbasins that are two to three times greater than the peak discharges previously calculated for the standard 100-year, 24-hour design storm. For the subbasins directly tributary to the Wetland Bank, the sum of the peak discharges for the April 2013 event is 212 cfs as compared to 104 cfs when using typical design parameters. The higher peak discharges are the result of the storm's natural distribution, which included 2 to 3 short periods of relatively high intensity rainfall (as opposed to the more consistent Huff Distribution – See Hydrograph Comparison Graph). Although the peak discharges more than doubled, the total runoff volume from subbasins directly tributary to the Wetland Bank only increased approximately 6% from 64 acre-feet to 69 acre-feet. Similarly, a comparison of the XPSWMM hydrologic results indicate that the April 2013 storm produced peak discharges from individual subbasins that are two to three times greater than the peak discharges for the 100-year, 24-hour design storm but the increase in average runoff depth is only 13% +/- (see Hydrology Results Summary Table for both TR-20 and XPSWMM hydrology results).

The hydrologic results suggest that the 6.73 inches of rainfall from the April 2013 storm event produced slightly more runoff volume than what is expected from a typical 7.58 inch design storm. Intuitively this makes sense given the saturated ground condition due to the wet spring weather. The increased peak discharges are the result of the storm's natural distribution and although the peak discharge rates likely lasted for only short durations, they may have contributed to localized / isolated flood damages in situations where runoff conveyance is critical due to the lack of available storage. For example, a side yard swale may have enough capacity to convey the peak flow from a 100-year, 24-hour storm without overtopping into adjacent window wells but the peak flow from a shorter, more intense storm (or portion of storm) may result in overtopping. The extent of flood damage typically depends on how long the peak elevation remains above the elevation that results in flood damages.

Hydraulic Evaluation

As indicated above, the Wetland Bank located within Subwatershed E was previously evaluated with a FEQ hydraulic model that used calculated discharges from the TR-20 hydrologic model. As such, the TR-20 calculated discharges for the April 2013 storm event were used to update the FEQ hydraulic model. A comparison of the FEQ results indicate that the high water level in the wetland complex only increased a tenth of a foot from 735.4 to 735.5 for the April 2013 storm event. The fact that the modeled elevation in the Wetland Bank only increased a tenth of a foot is not surprising given that this system is a volume based system (large storage area with limited outlet) and the total runoff volume from the April 2013 storm event is not significantly more than the runoff volume from the typical 100-year, 24-hour design storm.

In addition to the FEQ evaluation of the Wetland Bank, the XPSWMM hydraulic model used to evaluate Subbasins LA14 and LA16 was updated. The original model included a conceptual evaluation of the Wetland Bank and the LPDA on Washington Street located north of the intersection of Washington Street and 40th Street. The original model calculated an existing high water elevation for the Wetland Bank that was approximately 1.2 feet lower than FEQ model results (735.4 FEQ vs. 734.2 XPSWMM). For the LPDA on Washington Street, the original XPSWMM

model provided a basic evaluation of the existing storm sewer system that was then revised to reflect proposed storm sewer improvements designed to increase the conveyance capacity in these problem areas to meet Village identified design goals. As a result of the April 2013 storm event and associated flooding, especially at the intersection of 40th Street and Washington Street, the XPSWMM model was updated to provide more detail related to overflow routes within the overall model and to identify storm sewer surcharging / ponding in the isolated low areas at or near the intersection of 40th Street and Washington Street.

The updated XPSWMM model also included an evaluation of the Wetland Bank and the hydraulic results for the standard 100-year, 24-hour 7.58 inch design storm show a high water level of 734.9, which is within 0.5 feet of the FEQ calculated high water level (735.4). Given the complexities of the models, a 0.5 foot difference is generally acceptable and is less than the previous 1.2 foot difference due to the additional detail added to the model. In addition to the standard design storm, the updated XPSWMM model evaluated the impacts of the April 2013 storm event on the Wetland Bank; the results indicate a high water level of 735.21, which is within 0.3 feet of the FEQ calculated elevation of 735.50.

The XPSWMM model was also updated to better define the functionality of the storm sewer system that drains the area in the vicinity of the LPDA located north of 40th and Washington Streets, specifically the low area along 40th Street west of Washington Street. The updated model used available topographic information to quantify localized storage areas and associated overflow routes (often multiple overflow routes) for the main structures within the storm sewer system. The existing model also added a "dummy" Node (structure) in the low area along 40th Street west of Washington Street to better represent the flooding condition associated with the April 2013 storm event.

The XPSWMM results for the April 2013 storm event indicate a high water level of 741.24 for the low area along 40th Street west of Washington Street. Based on a comparison of this elevation and the available topography for 40th Street, almost the entire length of 40th Street west of Washington Street would have been inundated at this elevation with a maximum flooding depth of approximately 7 inches (at the roadway crown). In an effort to calibrate the model, V3 reviewed several photographs of 40th Street flooding provided by the Village. Based on a comparison of available topography and the flood photograph titled *908 40th St_Driveway _Flood_April 18_2013* that shows street flooding, driveway flooding at 904 and 908 40th Street, and driveway and yard flooding at 4030 Washington Street, it appears that the water surface elevation in the photo is approximately 740.9, which is within 4 inches of the calculated high water level 741.24.

An evaluation of the hydrograph for the XPSWMM Node that represents this area (Node – 40th) suggests there were two shorter periods of time when the elevation was over 741.00 and a longer time frame when elevations in this area were over 740.50 (See Node-40th Hydrograph). Although we only have survey information up to the ROW for the two driveways at 904 and 908, it seems reasonable that the high water elevation would have reached 741.0 – 741.2, especially considering the volume needed to fill the depressed driveway at 908 40th Street (which suggests the photo didn't capture the peak flooding condition). Although additional high water mark information for other Node areas would be beneficial for calibrating other key areas within the model (Washington Street north of 40th for example), the calculated water surface elevations for the Wetland Bank and 40th Street area suggests the model provides a reasonable representation of flooding conditions.

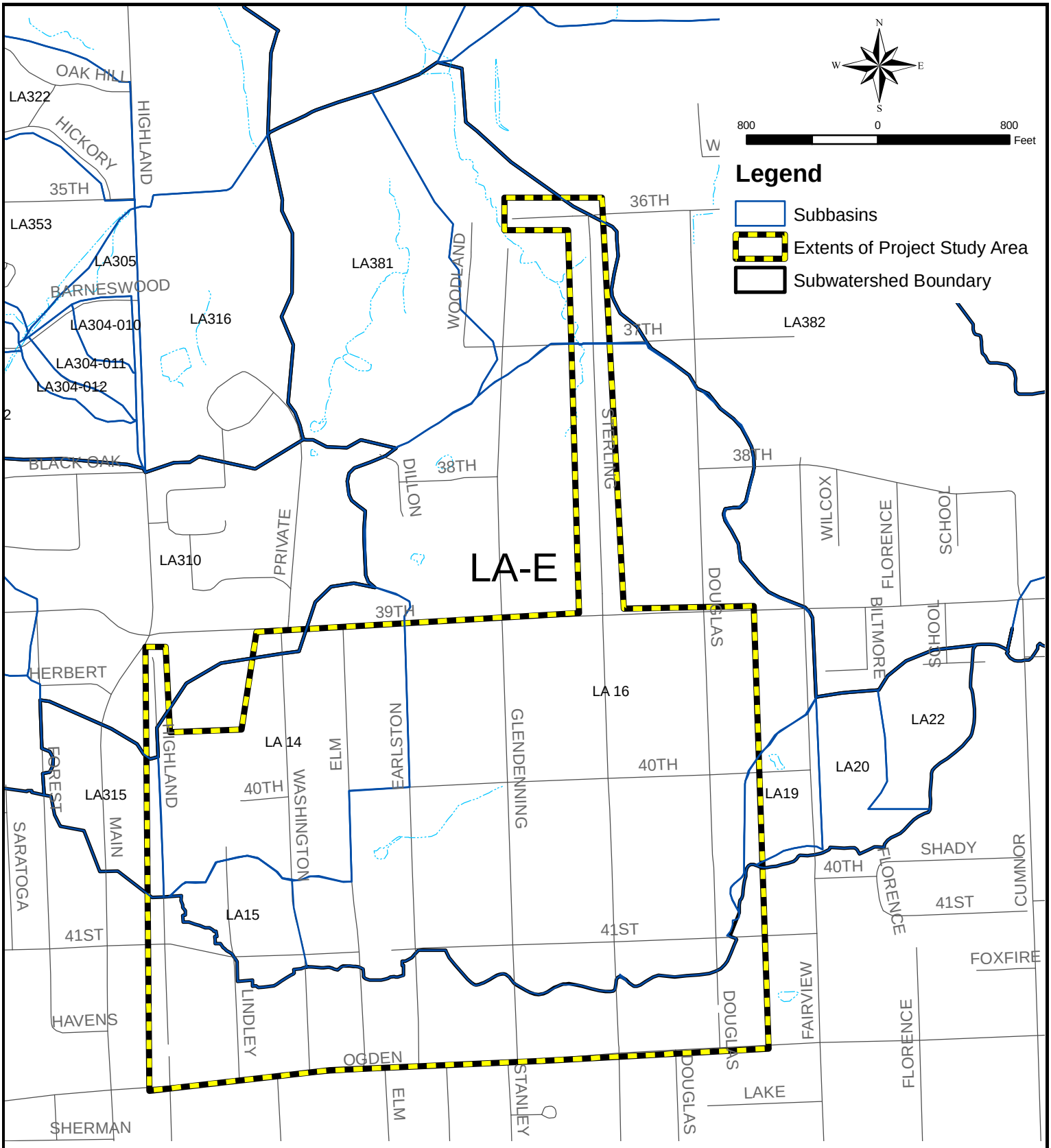
Once the model was determined to be a good representation of anticipated flooding conditions at key locations at or near the intersection of 40th Street and Washington Street, the proposed storm sewer improvements previously identified (Subwatershed E Alternative C) were evaluated. The storm sewer sizes were kept the same but the entire system was lowered slightly based on the tie-in elevation at Elm Street. In addition, the Alternative C modifications were revised to include the installation of storm sewer along 40th Street west of Washington Street. Although not considered in the XPSWMM analysis, the detailed evaluation of this area identified some potential cost saving modifications to Alternative C that involve less storm sewer installation and more roadway / open ditch construction.

The included XP-SWMM Hydraulic Results Summary Table shows the existing and proposed water surface elevations for the standard 100-Year, 25-Year, 10-Year, and 5-Year (1-Hour and 24-Hour) storm events as well as the existing and proposed condition water surface elevations associate with the April 2013 storm event. As shown in the table, the proposed storm sewer improvements result in water surface elevation reductions for all areas at or near the intersection of 40th Street and Washington Street (if a detailed design for this area proceeds, it is likely that additional alternatives or alternative modifications can be considered that would result in even lower maximum water surface elevations along 40th Street west of Washington Street). The results do show some increases in water surface elevations from existing to proposed conditions at the Wetland Bank for some standard design storm scenarios but the increases are at elevations well below the maximum high water elevation. For the April 2013 storm event, the existing and proposed results are essentially the same (see XP-SWMM Hydraulic Results Summary Table).

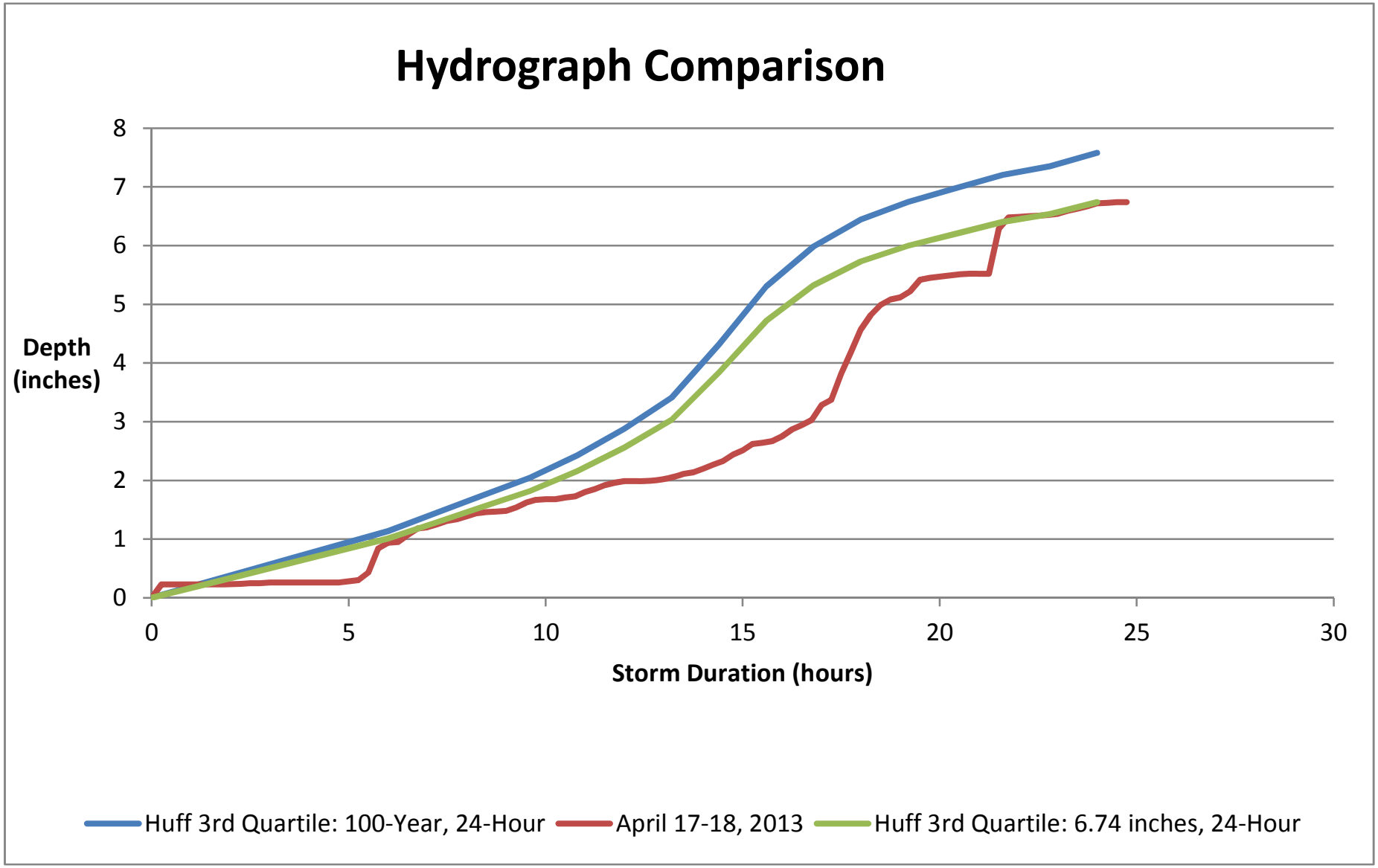
Conclusion

Based on the hydrologic and hydraulic analyses discussed above, it appears that the April 2013 storm event produced flood elevations in Lacey Creek Subwatershed E that are very similar to the flood elevations associated with a standard 100-year, 24-hour design storm. Although the April storm produced peak discharge rates that are 2 to 3 times greater than the peak discharge rates associated with the standard design storm, the calculated runoff volume form the April event is similar to what would be expected from a design storm event. Since the overall system is a storage based system, it is not surprising that the water surface elevations calculated for the Wetland Bank showed minimal change from standard design storm elevations.

The stormwater analysis did include revisions to the XPSWMM model to better define the flood prone areas near the intersection of 40th Street and Washington Street. The XPSWMM hydrologic results showed the same tendencies as described above. Based on available topographic information and flooding photographic information, it is appears the XPSWMM hydraulic results demonstrate a reasonable match between modeled flood elevations and actual observed flood elevations. The XPSWMM analysis also confirmed that improving stormwater conveyance from the Washington and 40th Streets area to the Wetland Bank area east of Elm Street should provide flood relief to the residents in and adjacent to the flood problem areas. See the attached Revised Alternative C Storm Sewer Replacement Exhibit that shows the general location of the flood problem areas near 40th and Washington Streets (light blue cross hatch areas) as well as the proposed conceptual storm sewer improvements.



V3 Companies 7325 Janes Avenue Woodridge, IL 60517 630.724.9200 phone 630.724.9202 fax www.v3co.com	TITLE: **Subbasin Map**	PROJECT AND SITE LOCATION: **Lacey Creek Subwatershed E**		
	BASE LAYER: StreetMap USA (2006)	PROJECT NO. 07022.LSE	FIGURE: III	SHEET: 1 OF: 1
	CLIENT: **Village of Downers Grove Public Works Deparmtent 5101 Walnut Avenue Downers Grove, Illinois 60515**	QUADRANGLE: n/a	DATE: 11/11/09	SCALE: nts

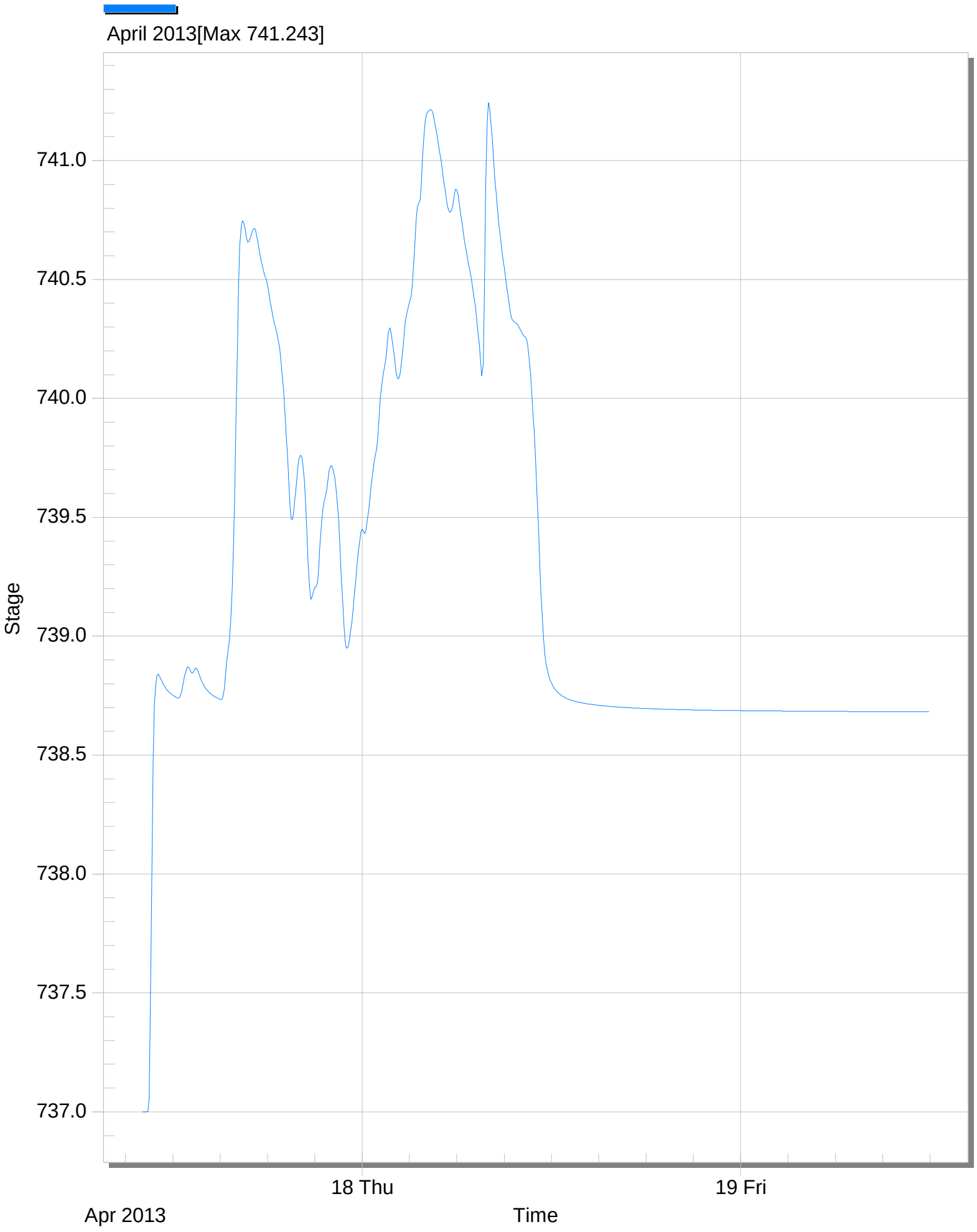

Hydrograph Comparison
Depth (inches)
8
7
6
5
4
3
2
1
0
0
5
10
15
20
25
30
Storm Duration (hours)
Huff 3rd Quartile: 100-Year, 24-Hour
April 17-18, 2013
Huff 3rd Quartile: 6.74 inches, 24-Hour

HYDROLOGY RESULTS SUMMAY TABLE (TR-20 & XPSWMM)

Wetland Restoration Project TR-20 Subbasin Description	TR-20 ID	Design Storm 7.58"; AMC II 100-YR, 24-HR Peak Discharge (cfs)	Design Storm 7.58"; AMC II 100-YR, 24-HR Runoff Volume (acre-feet)		April Storm 6.73"; AMC III 24-HR FLOOD Peak Discharge (cfs)	April Storm 6.73"; AMC III 24-HR FLOOD Runoff Volume (acre-feet)
Tributary Area West of Earlston	153	46.38	29.19		81.6	31.12
Tributary Area North of 40th Street Between Earlston & Glendenning Road	154	5.81	3.49		15.03	3.76
Tributary Area South of 40th Between Earlston & Glendenning Road	155	13.64	8.27		40.1	8.74
Tributary Area South of 40th Between Glendenning Road & Douglas Road	156	19.58	11.85		41.77	12.86
Tributary Area East of Sterling Road North and South of 40th Street	157	18.92	11.87		33.83	12.66
	Totals	104	65		212	69

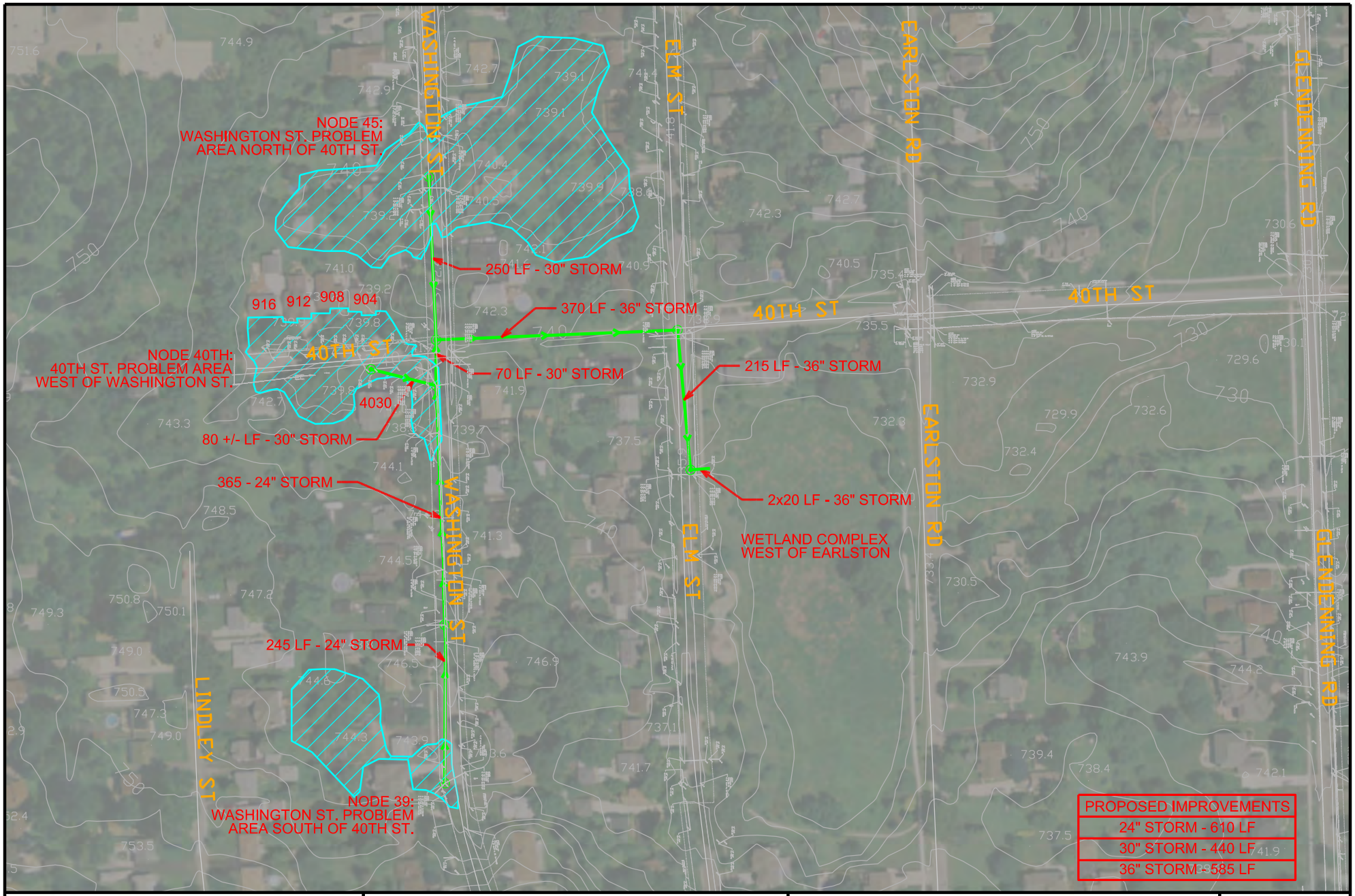
Lacey Creek Subwatershed E Evaluation Alternatives XPSWMM Subbasin Description	XPSWMM Node ID	Design Storm 7.58"; AMC II 100-YR, 24-HR Peak Discharge (cfs)	Design Storm 7.58"; AMC II 100-YR, 24-HR Runoff Depth (inches)		April Storm 6.73"; AMC III 24-HR FLOOD Peak Discharge (cfs)	April Storm 6.73"; AMC III 24-HR FLOOD Runoff Depth (inches)
Tributary Area to Storm Sewer on South Washington Street	39	5.99	5.55		21.73	6.24
Tributary Area to 40th Street West of Washington Street	40th	9.03	5.42		27.99	6.22
Tributary Area to Storm Sewer at Intersection of 40th & Washington Street	42	7.74	5.25		22.41	6.04
Tributary Area to Storm Sewer at Intersection of 40th & Elm Street	43	7.37	5.50		24.35	6.16
Tributary Area to Storm Sewer South on Elm (Discharge to Wetland)	44	3.51	5.38		11.20	6.03
Tributary Area to Storm Sewer on North Washington Street	45	5.76	5.50		14.46	6.22
		Total	Average		Total	Average
	Totals	39.40	5.43		122.14	6.15

Node - 40th


April 2013[Max 741.243]
741.0
740.5
740.0
739.5
739.0
738.5
738.0
737.5
737.0
Stage
18 Thu
19 Fri
Apr 2013
Time

XP-SWMM Hydraulic Results Summary Table (100-YR, 24-HR; 100-YR, 1-HR; APRIL 2013 STORM)								
			Twenty-Four Hour Storm Elevations					April
Location	XP-SWMM Node ID		100-year	25-year	10-year	5-year		2013
Washington St. Problem Area North of 40th	Node 45	Existing Elev.	740.53	739.94	739.49	738.88		740.53
		Proposed Elev.	**735.79**	**734.86**	**734.52**	**734.30**		**739.60**
		Difference	***-4.74***	***-5.08***	***-4.97***	***-4.58***		***-0.92***
40th St. Problem Area West of Washington St.	Node 40th	Existing Elev.	741.00	740.84	740.69	740.29		741.24
		Proposed Elev.	**735.95**	**735.43**	**735.30**	**735.21**		**740.55**
		Difference	***-5.05***	***-5.41***	***-5.39***	***-5.08***		***-0.70***
Washington St. Problem Area South of 40th	Node 39	Existing Elev.	744.17	743.41	741.54	740.35		744.53
		Proposed Elev.	**742.33**	**738.78**	**738.07**	**737.97**		**744.37**
		Difference	***-1.85***	***-4.63***	***-3.47***	***-2.38***		***-0.16***
Wetland Complex (W of Earlston)	Node 1	Existing Elev.	734.87	733.66	733.51	733.32		735.21
		Proposed Elev.	**734.81**	**733.97**	**733.59**	**733.34**		**735.23**
		Difference	***-0.07***	***0.32***	***0.08***	***0.02***		***0.01***
Wetland Complex (W of Sterling)	Node 5	Existing Elev.	734.87	733.42	732.88	732.47		735.21
		Proposed Elev.	**734.81**	**733.38**	**732.87**	**732.48**		**735.23**
		Difference	***-0.07***	***-0.04***	***-0.01***	***0.01***		***0.01***

	XP-SWMM		One Hour Storm Elevations			
Location	Node ID		100-year	25-year	10-year	5-year
Washington St. Problem Area North of 40th	Node 45	Existing Elev.	740.48	740.25	739.99	739.70
		Proposed Elev.	**740.13**	**739.17**	**736.59**	**735.42**
		Difference	***-0.35***	***-1.08***	***-3.39***	***-4.29***
40th St. Problem Area West of Washington St.	Node 40th	Existing Elev.	741.39	741.13	740.90	740.67
		Proposed Elev.	**741.15**	**739.94**	**736.87**	**735.72**
		Difference	***-0.24***	***-1.19***	***-4.03***	***-4.95***
Washington St. Problem Area South of 40th	Node 39	Existing Elev.	744.58	744.37	744.21	743.92
		Proposed Elev.	**744.56**	**744.32**	**744.04**	**741.52**
		Difference	***-0.02***	***-0.05***	***-0.17***	***-2.41***
Wetland Complex (W of Earlston)	Node 1	Existing Elev.	733.51	733.17	732.98	732.83
		Proposed Elev.	**734.41**	**733.65**	**733.23**	**732.96**
		Difference	***0.90***	***0.48***	***0.25***	***0.14***
Wetland Complex (W of Sterling)	Node 5	Existing Elev.	732.62	731.89	731.45	730.86
		Proposed Elev.	**732.66**	**731.96**	**731.56**	**730.94**
		Difference	***0.04***	***0.07***	***0.11***	***0.08***



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Vision, Vertere, Virtute... "The Vision to Transform with Excellence"

LACEY CREEK SUBWATERSHED E

DOWNERS GROVE ILLINOIS

REVISED ALTERNATIVE C STORM SEWER REPLACEMENT EXHIBIT

SCALE: 1" = 200'

E:\2007\07022\07022.FLOOD\Drawings\Mstn\E04\EXHproject_C_REV_061313_pipes.dgn 6/27/2013 4:59:00 PM

EXHproject_C_REV_061313_pipes.dgn 6/27/2013 4:59:01 PM

Staff Report - Lee and Ogden Flooding

On April 18, five residential properties on the 4400 block of Lee Avenue experienced varying levels of water damage, including damage to the first flood of at least one residence. The street was impassable between Ogden Avenue and Glen Avenue for more than 24 hours.

This area is located within a LPDA-LA3 and was studied in January 2004 in connection with a public storm sewer that was installed on the west side of Lee Avenue. In that study the following information was outlined:

- The tributary area to the LPDA is 92 acres and generally encompasses the area between Ogden Avenue to the north, Woodward Avenue to the west, Grant Avenue to the south and Downers Drive to the east.
- This area drains to the northwest through a storm sewer in the Ogden Avenue right-of-way that has limited capacity.
- The drainage area includes undeveloped property west of Lee Avenue. This property contains depressional storage as well as a wetland.
- There is not a sanitary sewer on this block of Lee Avenue because the elevation of the street and the homes in relation to the rest of the system precludes gravity sewers. As a result the properties on this street have private septic systems. These septic systems are typically not operable in events of the nature that occurred on April 18 .
- The commercial property to the east of the 4400 block of Lee Avenue was developed prior to 1984 and consists of a high percentage of impervious area. The runoff from this area drains through the residential properties on Lee Avenue, and in typical rain events is managed by grading and low-flow pipe systems.
- Lee Avenue and the properties to the east of Lee Avenue are inundated when water from the tributary area to the west reaches an elevation between 731 and 732, which occurs in a rainfall frequency of approximately a 10 year storm.
- As a result of the 2004 study a 15" public storm sewer was installed on the west side of Lee Avenue. This replaced the existing series of private drain tiles that were in a poor condition and were not providing a reliable outlet for this drainage area.

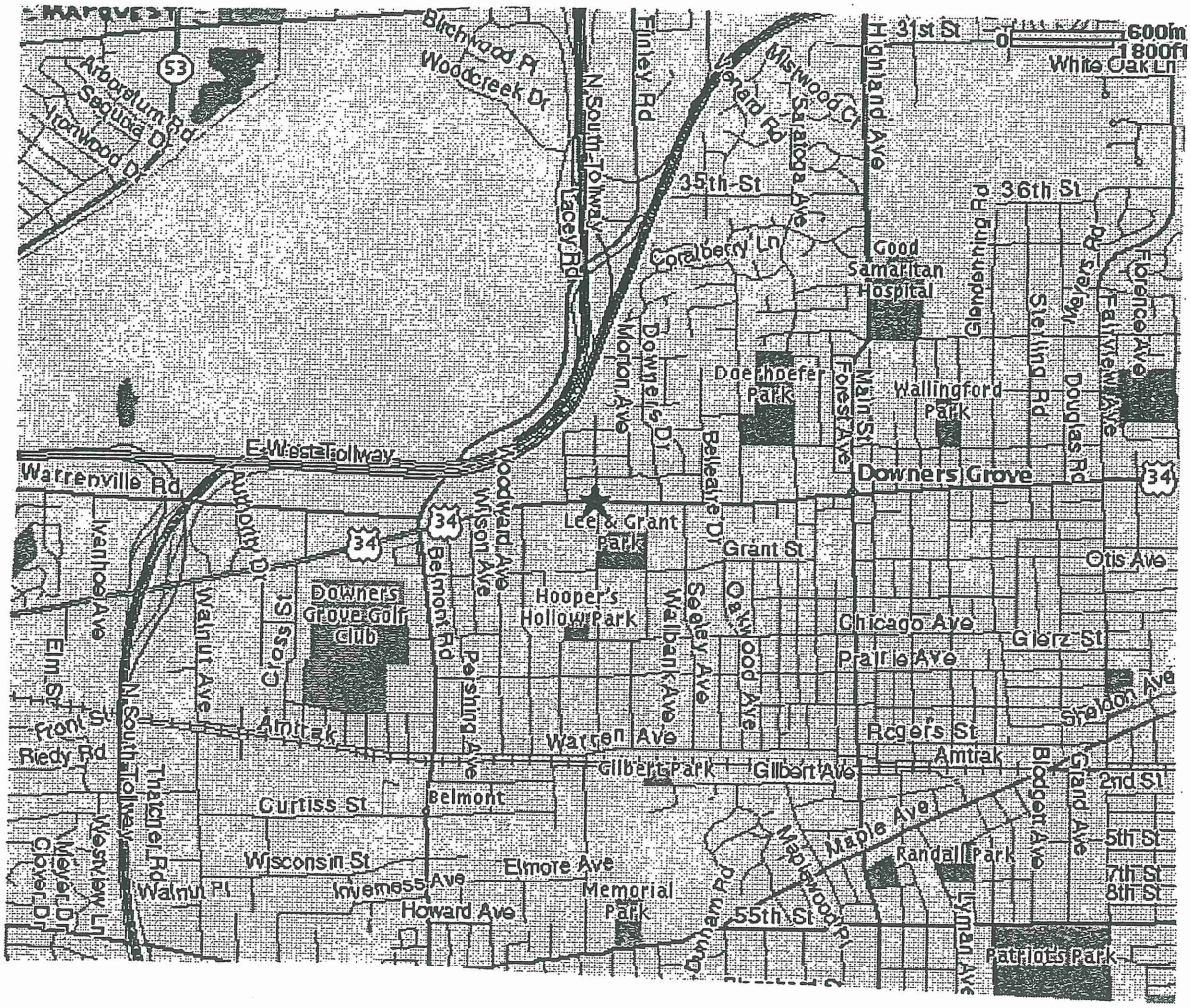
The recommendations for this drainage area include short term and long term steps. In the short term, staff recommends purchasing properties from homeowners who experienced flooding who are interested in relocating. In the long term, staff recommends pursuing opportunities to provide additional detention in this drainage area when the undeveloped property to the west of Lee Avenue is proposed for development.

ATTACHMENTS

Area Map

Topographic Map

Location Map



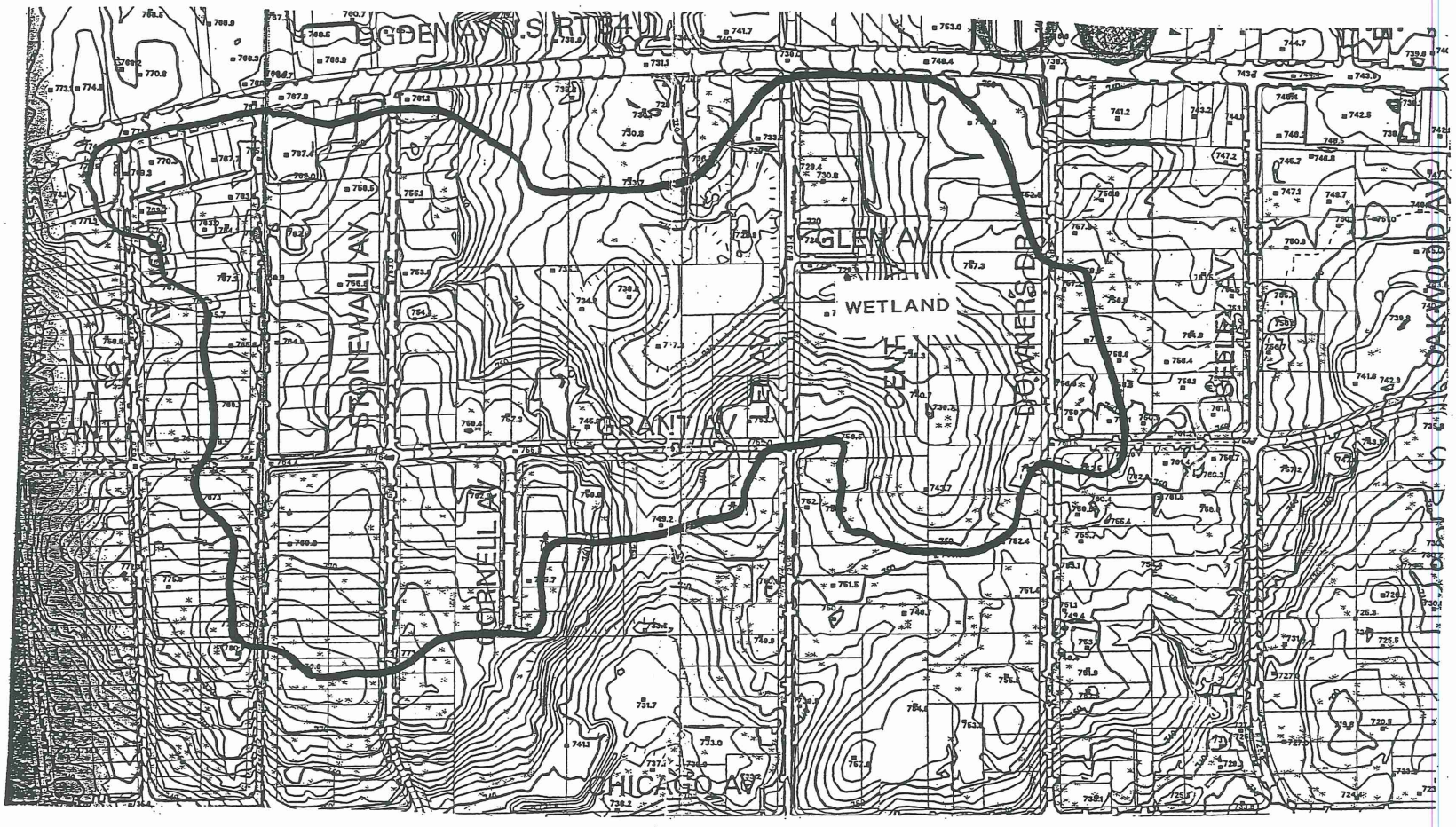
Lee & Ogden Drainage Improvement Project
Downers Grove, Illinois

ENGINEERING RESOURCE ASSOCIATES, INC.
Consulting Engineers & Surveyors
214 West Willow Avenue
Wheaton, Illinois 60187
(630) 668-5995

NORTH

Job#: 231003

Tributary Area Map



Lee & Ogden Drainage Improvement Project
Downers Grove, Illinois

ENGINEERING RESOURCE ASSOCIATES, INC.
Consulting Engineers & Surveyors
214 West Willow Avenue
Wheaton, Illinois 60187
(630) 668-5995

NORTH

Job#: 231003

Lee Ave

Owner

Railroad

Streets

Village Boundary

Downers Grove

Storm Points

No

Yes

Storm Pipes

Topography 2008

INDEX CONTOUR

INDEX DEPRESSION

Wetlands (County)

LPDA

Water Polygons

FloodWay

FP 100year