Village of Northbrook

Master Stormwater Management Plan Appendix

August 2011

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The Appendix presents the background information for the MSMP, details on the 22 watershed and neighborhood projects, and consideration for the Property Owner Programs and Additional Initiatives.

ACRONYMS

AdICPR – Advanced Interconnect Channel-Pond Routing
BCR – Benefit Cost Ratio
BFE – Base Flood Elevations
CCFPD - Cook County Forest Preserve District
CCHD – Cook County Highway Department
CMAP - Chicago Metropolitan Agency for Planning (formerly NIPC)
CRS – Community Rating System
DEC-2 – DuPage Environmental Concerns BCR analysis tool
DWP – Detailed Watershed Plan (Cook County)
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
GBNHS – Glenbrook North High School
HEC-HMS – Hydraulic Engineering Corps- Hydrologic Modeling System
HEC-RAS – Hydraulic Engineering Corps- River Analysis System
IDNR-OWR – Illinois Department of Natural Resources/Office of Water Resources
IDOT - Illinois Department of Transportation
ICPR – Interconnected Channel and Pond Routing
IEPA – Illinois Environmental Protection Agency
MFNBCR – Middle Fork North Branch of Chicago River
MSMP – 2011 Master Stormwater Management Plan
MWRDGC – Metropolitan Water Reclamation District of Greater Chicago
NCSWCD – North Cook Soil and Water Conservation District
NFIP – National Flood Insurance Program
NIPC–Northeastern Illinois Planning Commission
NPDES – National Pollutant Discharge Elimination System
NRCS – Natural Resource Conservation Service
ROW – Right-of-Way
SWMP – 1993, 1996, and 2002 Stormwater Management Plan
TGM – Cook County Watershed Management Ordinance –Draft Technical Guidance Manual – September 24, 2009
USACOE– US Army Corps of Engineers
WMO – Cook County Watershed Management Ordinance – Public Review Draft – September 24, 2009
WFNBCR – West Fork North Branch of the Chicago River
WPC – Watershed Planning Council
WSEL – Water Surface Elevation

Property Owner Programs

BATTERY BACKUP SUMP PUMP
COST PARTICIPATION PROGRAM

Statement of Conditions:

Most residents who responded to the Northbrook Property Owner Flooding Questionnaire indicated that they were interested in a battery backup sump pump cost participation program. Numerous properties experience basement flooding during power failures.

It is estimated that as many as 250 property owners would have interest in the program in the initial year. Interest would likely decrease each year thereafter.

Problem Identification:

Structure flooding during power outages, either related to major storm events or otherwise, may lead to structural damage, personal property damages, lost wages, and related waste disposal costs.

Recommended Plan:

- Develop a cost participation program to assist property owners in the installation of a battery backup sump pump system for short duration power outages
- Reimburse property owners 50% of cost or $150, whichever is less
- Institute a program to educate property owners about factors contributing to basement flooding, such window well elevation, downspout placement, lot grading, etc.

Estimated Cost:

- $25,000 first year
- $10,000 annually after first year

Benefits:

- Reduction of basement flooding risk and associated costs
- Reduction of electrocution hazard due to basement flooding
- Public awareness of basement flooding causes
- Fewer service requests to Public Works Department

OVERHEAD SANITARY SEWER CONVERSION
COST PARTICIPATION PROGRAM

Statement of Conditions:

The program was established in December 2009, and is available to residents or businesses that have experienced or have the potential for flooding due to surcharging (backup) of sanitary sewers into building structures. Eligibility requirements apply for applicants to the program.

The Village's cost-share participation is limited to 50% of the low bid, up to a maximum of $5,000 for conversion of an internal gravity type sanitary sewer system to an overhead system. The Village appropriated $50,000 for the program in fiscal years 2009/2010 and 2010/2011.

Problem Identification:

Residential or business structure flooding due to surcharging of sanitary sewer into a basement or first floor, can result in structural damage, personal property damages, lost wages, and related waste disposal costs.

Recommended Plan:

- Continue program
- Publish details of program to inform property owners of potential benefits
- Assess participation annually and adjust budget as necessary

Estimated Cost: $50,000 annually

Benefits:

- Reduction of sanitary surcharge risk and associated costs
- Fewer service requests to Public Works Department

PRIVATE PROPERTY DRAINAGE AND FLOOD REDUCTION COST PARTICIPATION PROGRAM

Statement of Conditions:

The Private Property Drainage and Flood Reduction Cost Participation Program provides a listing of typical improvements to address concerns from property owners relative to yard drainage. Many of the problems related to ponding waters and overland flow can be addressed by relatively low cost measures. Approximately $35,000 of the Program's budget was utilized during the 2009/2010 fiscal year. The Village appropriated $50,000 for the 2010/2011 fiscal year. The Program maximum reimbursable amount is $3500.

Problem Identification:

Structure damage, front yard, side yard and back yard flooding/standing water

Recommended Plan:

- Continue the program
- Modify the program to encourage projects that utilize Best Management Practices
- Identify potential projects that can be addressed by the property owner and relate to the benefits or impacts that may occur
    - Best Management Practices reduce runoff and increase infiltration
    - Flood-proofing reduces risk of stormwater entering structures and/or dependency on sump pumps.
    - Drainage patterns and runoff characteristics must be maintained so flooding is not transferred to other properties.
- Utilize the program as an educational tool by providing information on requirements and the benefits of a properly designed, implemented and maintained improvement

Estimated Cost: $50,000 annually

Benefits:

- Reduction of flood risk potential to primary property and adjacent properties
- Public awareness of project benefits and possible impacts to nearby properties
- Fewer service requests to Public Works Department

STREAMBANK STABILIZATION PROGRAM

Statement of Conditions

Streambank erosion on private properties can result in loss of usable property and may endanger structures. Property owners often implement streambank stabilization projects on their own property without knowledge of regulations governing such projects, or the potential adverse effects on properties upstream and downstream.

Problem Identification:

Streambank projects undertaken by property owners unaware of regulations or impacts on other sections of the stream

Recommended Plan:

- Develop an educational program relative to acceptable improvements, regulatory permitting requirements, and maintenance guidelines to aid property owners in properly undertaking such streambank projects.

- Village staff provide technical advice

Estimated Cost: Cost of providing articles in the Village newsletter and Village staff involvement.

Benefits:

- Increased public awareness of the importance of timely good husbandry of the channel banks
- Increased public awareness of acceptable streambank stabilization practices
- Avoidance of "after the fact permits" from regulatory agencies and possible fines

Additional Initiatives

CURRENT PARTICIPATION IN COMMUNITY RATING SYSTEM (CRS)

Statement of Conditions:

The National Flood Insurance Program (NFIP) provides federally backed flood insurance that encourages communities to enact and enforce floodplain regulations. The basic objective of the ordinance is to ensure that such development will not aggravate existing flooding conditions and those new buildings will be protected from flood damage. Under the CRS, flood insurance premiums are adjusted to reflect community activities that reduce flood damage to existing buildings, manage development in areas not mapped by the NFIP, protect new buildings beyond the minimum NFIP protection level, help insurance agents obtain flood data, and help people obtain flood insurance.

The objective of the CRS is to support the goals of the NFIP. To do this, the CRS provides insurance premium rate reductions to policy holders in recognition that their communities implement activities that work toward its three goals of reducing flood damage, supporting the insurance part of the NFIP, and pursuing a broad approach to floodplain management. Through the effort of the Village the CRS rating has been improved from an 8 (flood insurance premium reduction of 10%) to its current rating of 7 with a flood insurance premium reduction of 15%.

The reduction in flood insurance premiums can be reduced for all residents based on the following table:

CREDIT POINTS	CLASS	PREMIUM REDUCTION SFHA*	PREMIUM REDUCTION NON-SFHA**
4,500+	1	45%	10%
4,000 – 4,499	2	40%	10%
3,500 – 3,999	3	35%	10%
3,000 – 3,499	4	30%	10%
2,500 – 2,999	5	25%	10%
2,000 – 2,499	6	20%	10%
1,500 – 1,999	**7**	**15%**	**5%**
1,000 – 1,499	8	10%	5%
500 – 999	9	5%	5%
0 – 499	10	0	0

*Special Flood Hazard Area
**Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage. The Preferred Risk Policy does not receive premium rate credits under the CRS because it already has a lower premium than other policies. The CRS credit for AR and A99 Zones are based on non-Special Flood Hazard Areas (non-SFHAs) (B, C, and X Zones). Credits are: classes 1-6, 10% and classes 7-9, 5%. Premium reductions are subject to change.

Considerations:

The program is supported by the Village of Northbrook.

Recommendations:

The Village has the opportunity to obtain points for their CRS rating based on the following programs:

- Elevation Certificates
- Flood Data Maintenance
- Map Information Service
- Stormwater Management
- Outreach Projects
- Repetitive Loss Requirements
- Hazard Disclosure
- Floodplain Management Planning
- Flood Protection Information
- Acquisition and Relocation
- Flood Protection Assistance
- Flood Protection
- Additional Flood Data
- Drainage System Maintenance
- Open Space Preservation
- Flood Warning Program
- Higher Regulatory Standards
- Levee Safety
- Land Development Criteria
- Dam Safety

The Village should continue to pursue a lower CRS rating to reduce insurance for all Village Residents.

FUNDING (GRANTS)

Statement of Conditions:

The Village in the past has pursued and obtained grant funding. There are numerous opportunities for funding available from Federal, State and Local agencies. The funding is limited and normally would require Village matching funds

Considerations:

1. Many of the grants have conditions attached that would alter or increase the amount of work necessary for a project. Project administration, engineering, and construction cost may offset the benefit received from the funding.
2. Funding Programs Available
    a. Illinois Green Infrastructure Grant Program for Stormwater Management (IGIG)
        i. Combined Sewer Overflow (CSO) Rehabilitation Category
        ii. Stormwater Retention and Infiltration Category
        iii. Green Infrastructure Small Projects Category
    b. FEMA Pre-Disaster Mitigation Grant Program
    c. IEMA Pre-Disaster Mitigation Grant Program
    d. EPA Section 319 Grants (Nonpoint Source Pollution Control Grant Program)
    e. IEPA Brownfields (Site Remediation)
    f. USACOE Section 206 Aquatic Ecosystem Restoration Project
    g. EPA Assessment and Watershed Protection Grants
    h. IDNR Open Space Lands Acquisition and Development (OSLAD) Land & Water Conservation Fund program (LWCF
3. Other Sources of Funding
    a. Metropolitan Water Reclamation District of Greater Chicago (Projects developed through the Watershed Planning Council and Detailed Watershed Plan)
    b. Joint participation projects
        i. Illinois Department of Transportation
        ii. Cook County Highway Department

Recommendations (See Table, Possible Funding):

1. Village to evaluate projects that may be a good fit for a grant
2. Village to continue to pursue other funding such as the armoring the east bank of WFNBCR between Dundee Road and Cherry Lane with that is under consideration (2010) for as part of the alternatives evaluated for the North Branch of the Chicago River
3. Village to continue to work with other agencies for possible joint funding projects such as Dundee Road @ Skokie Blvd, Shermer Road Underpass and Lee Street North of Dundee Road Intersection.

Project Number	PROJECT	Illinois Green Infrastructure Grant Program for Stormwater Management (IGIG)	FEMA Pre-Disaster Mitigation Grant Program	IEMA Pre-Disaster Mitigation Grant Program	EPA Section 319 Grants (Nonpoint Source Pollution Control Grant Program)	IEPA Brownfields (Site Remediation)	USACOE Section 206 Aquatic Ecosystem Restoration Project	EPA Assessment and Watershed Protection Grants	IDNR Open Space Lands Acquisition and Development (OSLAD) Land & Water Conservation Fund program (LWCF)	Metropolitan Water Reclamation District of Greater Chicago	Joint participation projects
1	Wescott Park Storage	X					X	X			
2	Shermer Road Overflow Sewer										
3	Techny Drain Phase IV										
4	Cedar Lane (816 to 869)										
5	Cherry Lane Underpass										
6	Church Street (near Chapel Court)										
7	Curb Failure along WFNBCR (Behind 1941 Cherry Lane)				X						
8	Dehne Subdivision (Dehne Road, Brentwood Road)										
9	Dundee Road/Skokie Boulevard										X
10	Keystone Road/Chartres Drive	X						X			
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	X						X			
12	Northbrook Manor (Spruce Street)	X									
13	Ridge Road/Lee Road										
14	Shermer Road Outlet										
15	Shermer Road Underpass										X
16	Sunny Acres (Pamella Lane, Constance Lane)	X						X			
17	Sunset Lane	X									
18	Techny Drain Basin Expansion										X
19	Weller's Subdivision (Weller, Hillcrest, Christina Lanes)	X						X			
20	Western Avenue/Oak Avenue (Wescott Road to Shermer Road)	X						X			
21	Williamsburg Drive/Old Post Road	X									
22	Woodlawn Road (Penfold Place to Shermer Road)										

Table
Possible Funding

IDENTIFY POSSIBLE NEIGHBORHOOD STORAGE AND/OR DRAINAGE EASEMENTS

Statement of Conditions:

Various parcels, developed, undeveloped or redeveloping with proper planning can be modified to improve flooding conditions and/or prevent new flooding. Those parcels generally provide the capability to retain/develop stormwater detention storage necessary to attenuate peak storm runoff flow and provide flood relief improvment The utilization of nearby parcels that are suitable to develop stormwater runoff storage may be instrumental in formulating a cost effective project in problematic neighborhoods and minimizing additional flooding.

Considerations:

1. Parcel Acquisition Priority (for parcel identification and location refer to Exhibit: Prioritized Parcel Acquisition)
    a. Recommended Project (High Priority)
    b. Problematic Areas (Moderate to High Priority)
    c. Development may result in problematic conditions (Low to Moderate Priority)
2. Parcel Drainage Easement Priority (refer to above Exhibit)
    a. Rear yard drainage easements (reduced cost of facility; may function to preserve existing site depressional storage)
    b. Low flow (storm sewers) or improving/maintaining flood flow (swale) routing. This could be independent of utilizing a parcel for storage.
3. Funding (The time frame during which a site is available is limited, therefore a form of general funding needs to be available.)
4. Cost per unit of storage (Cost involves property acquisition, storage facility design, construction and maintenance.)
5. Parcel selection considerations
    a. Size of lot: Developed residential lots ½ acre or less, or of long and narrow configuration, do not appear to be cost effective for acquisition due to the limited open storage that could be developed compared to the cost of the structure and its demolition (Table: Summary of lot size vs. Storage Costs)
    b. Smaller Lot sizes: Underground storage may be a more cost effective consideration with the advantage of utilizing the surface for recreational/open space purposes
    c. Strategic location within a local problem area
    d. Parcel is subject to chronic flooding and/or structure flood damage
    e. Up for sale or re-development
    f. Represents cost effective solution to a local problem affecting several properties
    g. Part of a coordinated effort with an owner of "open space" property
    h. Property vacant or unoccupied
    i. Adjacent to vacant lot

Recommended Plan (See Exhibit E):

1. Set up funding mechanism to purchase parcel
2. Develop and maintain watch list for identified parcels, including a review function for Public Works Department
3. Review other parcels such as tear downs as they become "active" for their potential usage to prevent increases or to reduce flooding, since nearly all properties could be altered accordingly
4. Review redevelopment site plans and provide recommendations for revisions that would reduce or minimize potential for an increase of on-site and off-site flooding
5. Develop checklist for evaluating parcels
6. Evaluate acquisition of drainage easement for storm sewers or flood flow swales when parcels are improved/redeveloped
7. Update parcel identification as problematic areas occur.

Benefits:

1. Flood risk reduction for problematic areas that would otherwise require a flood improvement project to be in place
2. Minimizes the likelihood that an area would become problematic
3. Creates awareness that development may have substantial impacts on neighboring properties
4. Means to preserve parcel storage capabilities that presently serve a significant function in minimizing flood risk in problematic or potentially problematic areas
5. Costs are estimated to be in the range of $400,000 to $600,000 rate per acre feet of storage for a developed lot
6. Benefit Cost Ratio: (need to evaluate on a case by case basis)

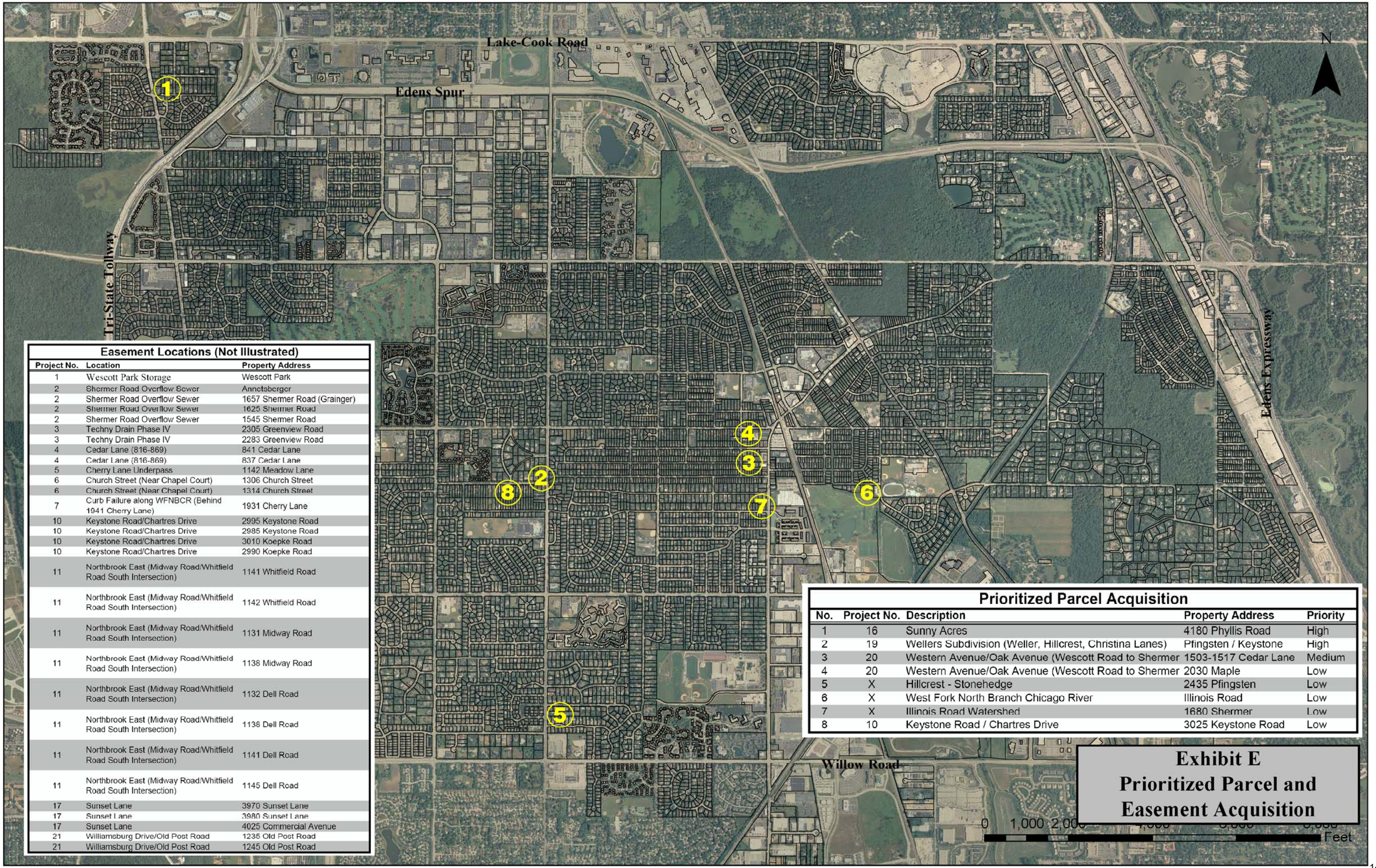
Alternatives Considered:

1. Enact rules and regulations to guide development so as to not increase rate or volume of stormwater runoff
2. Consider underground storage in the form of linear storm sewers when it is more cost effective

TABLE: Summary of parcel size vs. Storage Costs

	Available Site Storage			Estimated Costs	
Lot 100' wide (sq. ft.)	1. Surface Area (acres)	2. Volume (cubic yards)	Volume (acre-feet)	3. Construction and Acquisition	4. Cost per Acre-feet
10,000	0.14	630	0.39	$543,000	$1,400,000
15,000	0.23	1111	0.69	$562,000	$800,000
20.000	0.32	1592	0.99	$581,000	$600,000
25,000	0.41	2074	1.29	$600,000	$450,000
30,000	0.51	2555	1.58	$629,000	$400,000

1. Assumes 10' buffer strip around perimeter of lot
2. 4' depth, 4:1 side slopes
3. Assumes that the lot acquisition cost is constant and the improvement cost approximately 72k/ac-ft (plus engineering)



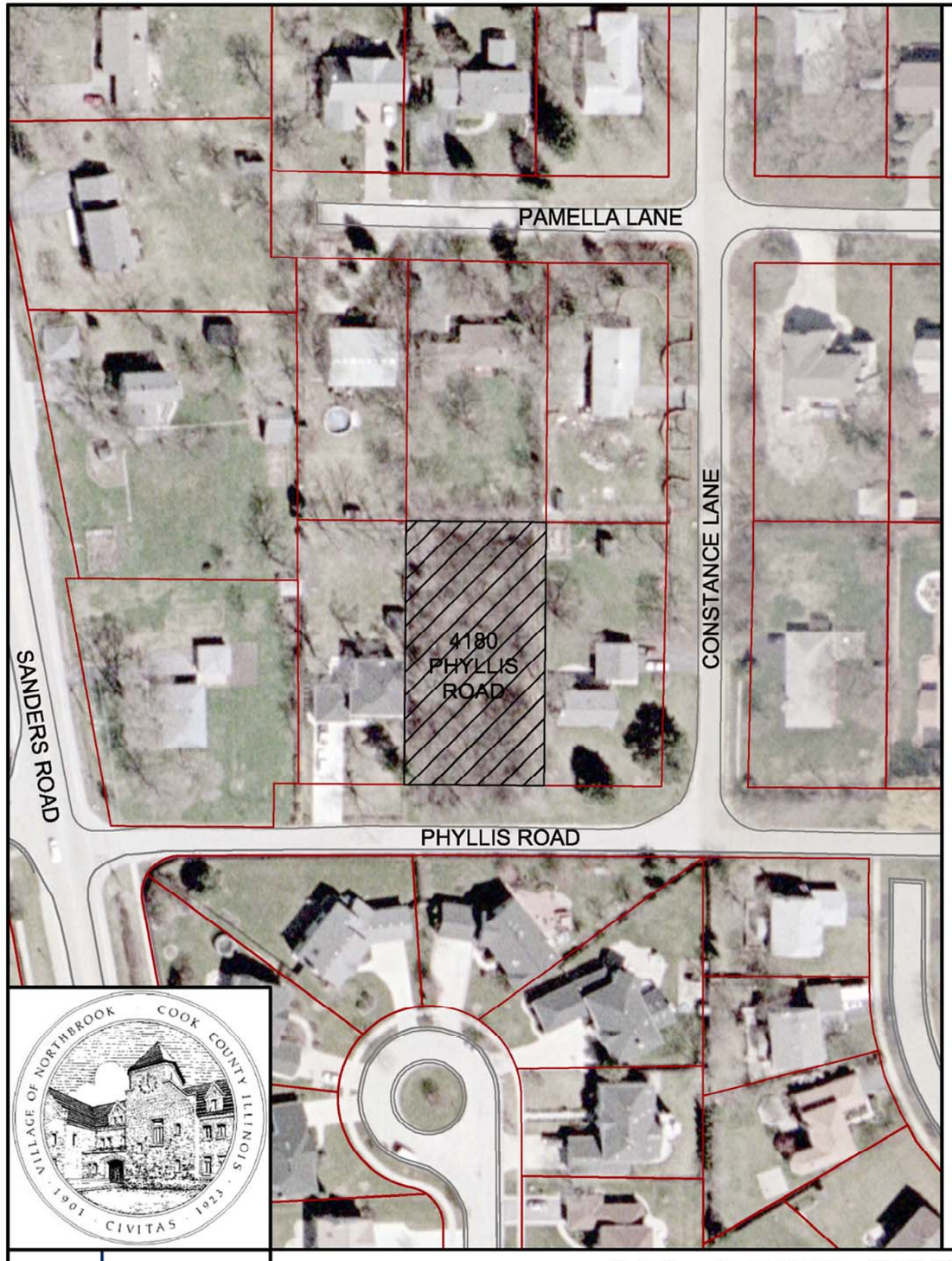
Easement Locations (Not Illustrated)

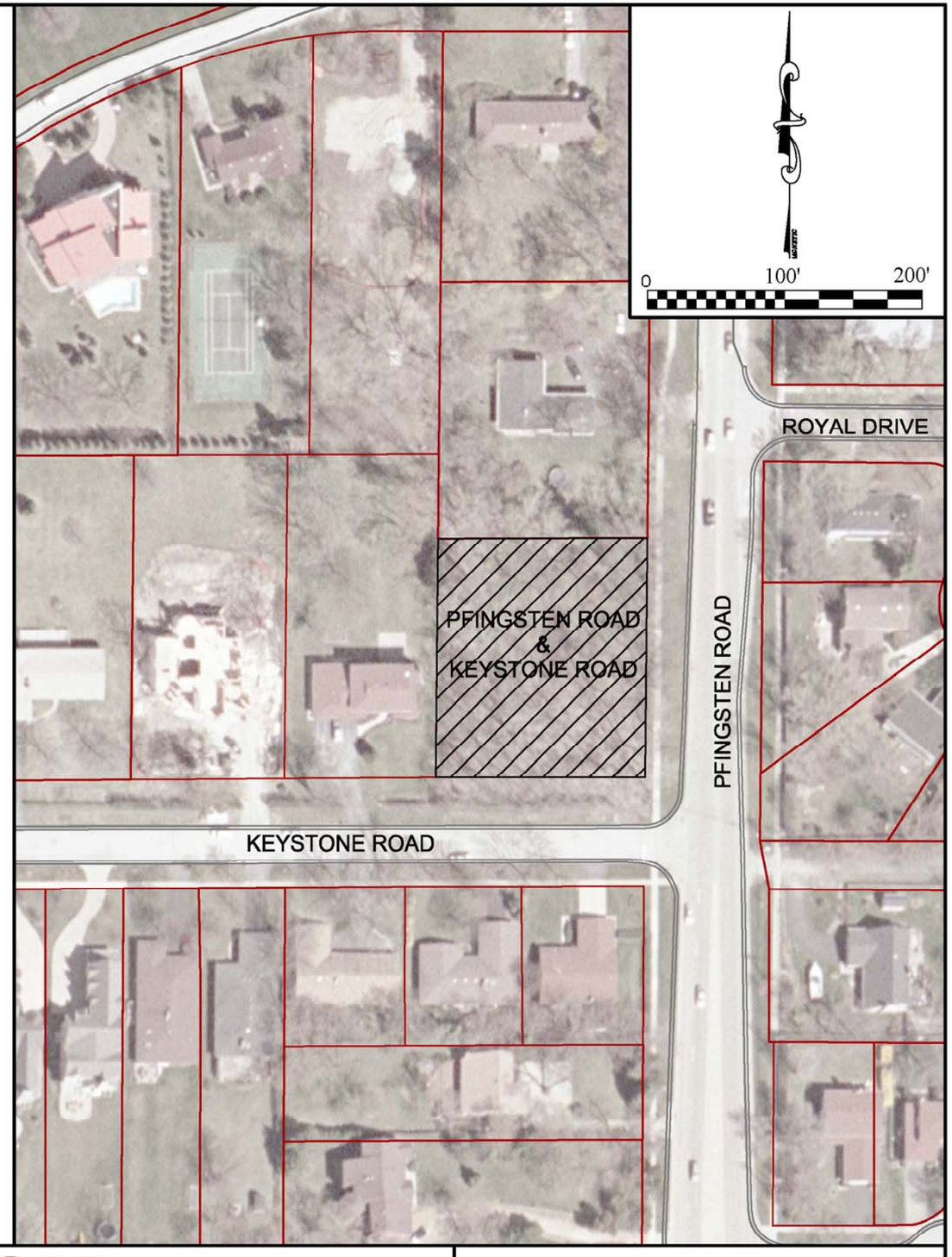
Project No.	Location	Property Address
1	Wescott Park Storage	Wescott Park
2	Shermer Road Overflow Sewer	Annetsberger
2	Shermer Road Overflow Sewer	1657 Shermer Road (Grainger)
2	Shermer Road Overflow Sewer	1625 Shermer Road
2	Shermer Road Overflow Sewer	1545 Shermer Road
3	Techny Drain Phase IV	2305 Greenview Road
3	Techny Drain Phase IV	2283 Greenview Road
4	Cedar Lane (816-869)	841 Cedar Lane
4	Cedar Lane (816-869)	837 Cedar Lane
5	Cherry Lane Underpass	1142 Meadow Lane
6	Church Street (Near Chapel Court)	1306 Church Street
6	Church Street (Near Chapel Court)	1314 Church Street
7	Curb Failure along WFNBCR (Behind 1941 Cherry Lane)	1931 Cherry Lane
10	Keystone Road/Chartres Drive	2995 Keystone Road
10	Keystone Road/Chartres Drive	2985 Keystone Road
10	Keystone Road/Chartres Drive	3010 Koepke Road
10	Keystone Road/Chartres Drive	2990 Koepke Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1141 Whitfield Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1142 Whitfield Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1131 Midway Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1138 Midway Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1132 Dell Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1138 Dell Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1141 Dell Road
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	1145 Dell Road
17	Sunset Lane	3970 Sunset Lane
17	Sunset Lane	3980 Sunset Lane
17	Sunset Lane	4025 Commercial Avenue
21	Williamsburg Drive/Old Post Road	1235 Old Post Road
21	Williamsburg Drive/Old Post Road	1245 Old Post Road

Prioritized Parcel Acquisition

No.	Project No.	Description	Property Address	Priority
1	16	Sunny Acres	4180 Phyllis Road	High
2	19	Wellers Subdivision (Weller, Hillcrest, Christina Lanes)	Pfingsten / Keystone	High
3	20	Western Avenue/Oak Avenue (Wescott Road to Shermer	1503-1517 Cedar Lane	Medium
4	20	Western Avenue/Oak Avenue (Wescott Road to Shermer	2030 Maple	Low
5	X	Hillcrest - Stonehedge	2435 Pfingsten	Low
6	X	West Fork North Branch Chicago River	Illinois Road	Low
7	X	Illinois Road Watershed	1680 Shermer	Low
8	10	Keystone Road / Chartres Drive	3025 Keystone Road	Low

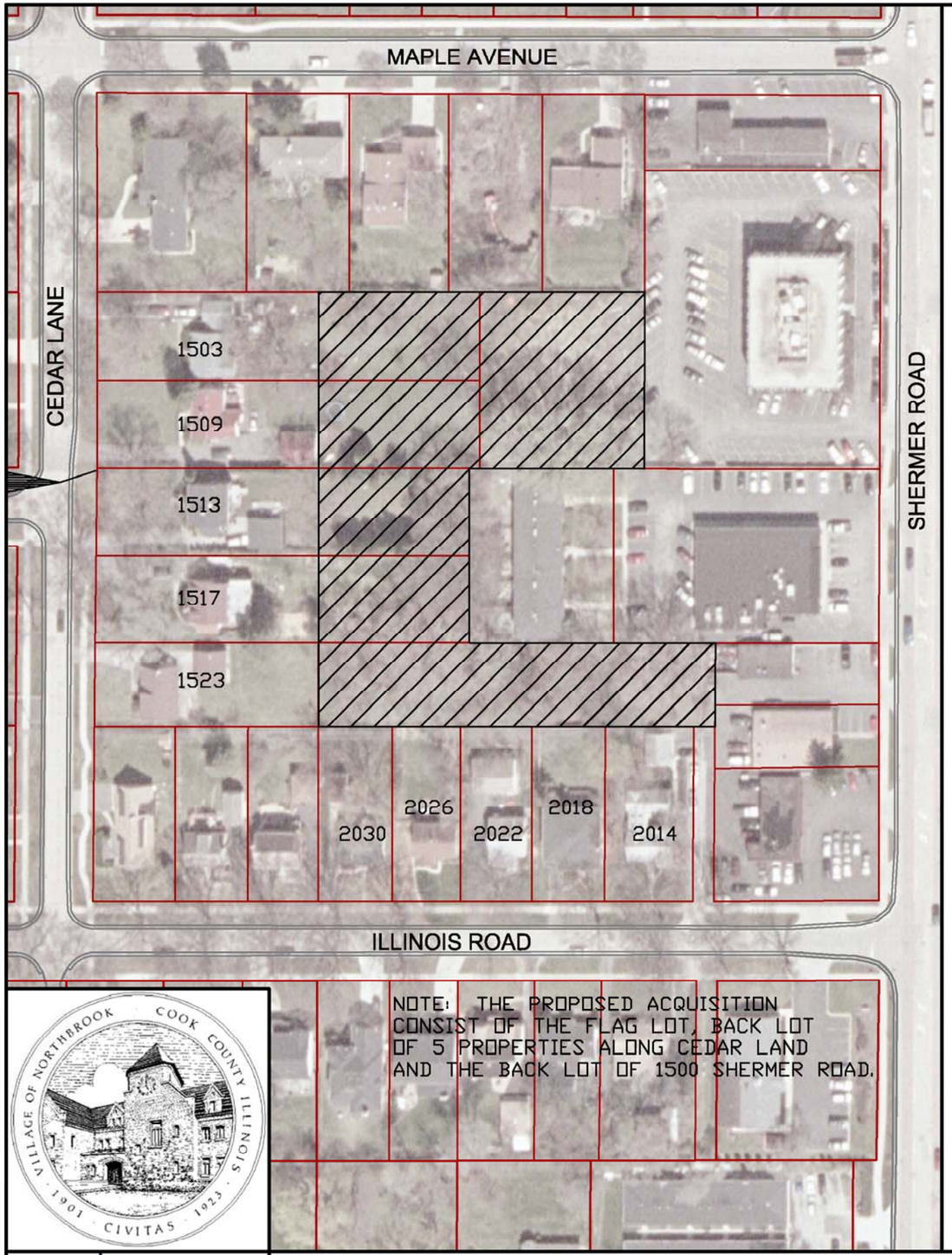
Exhibit E
Prioritized Parcel and Easement Acquisition

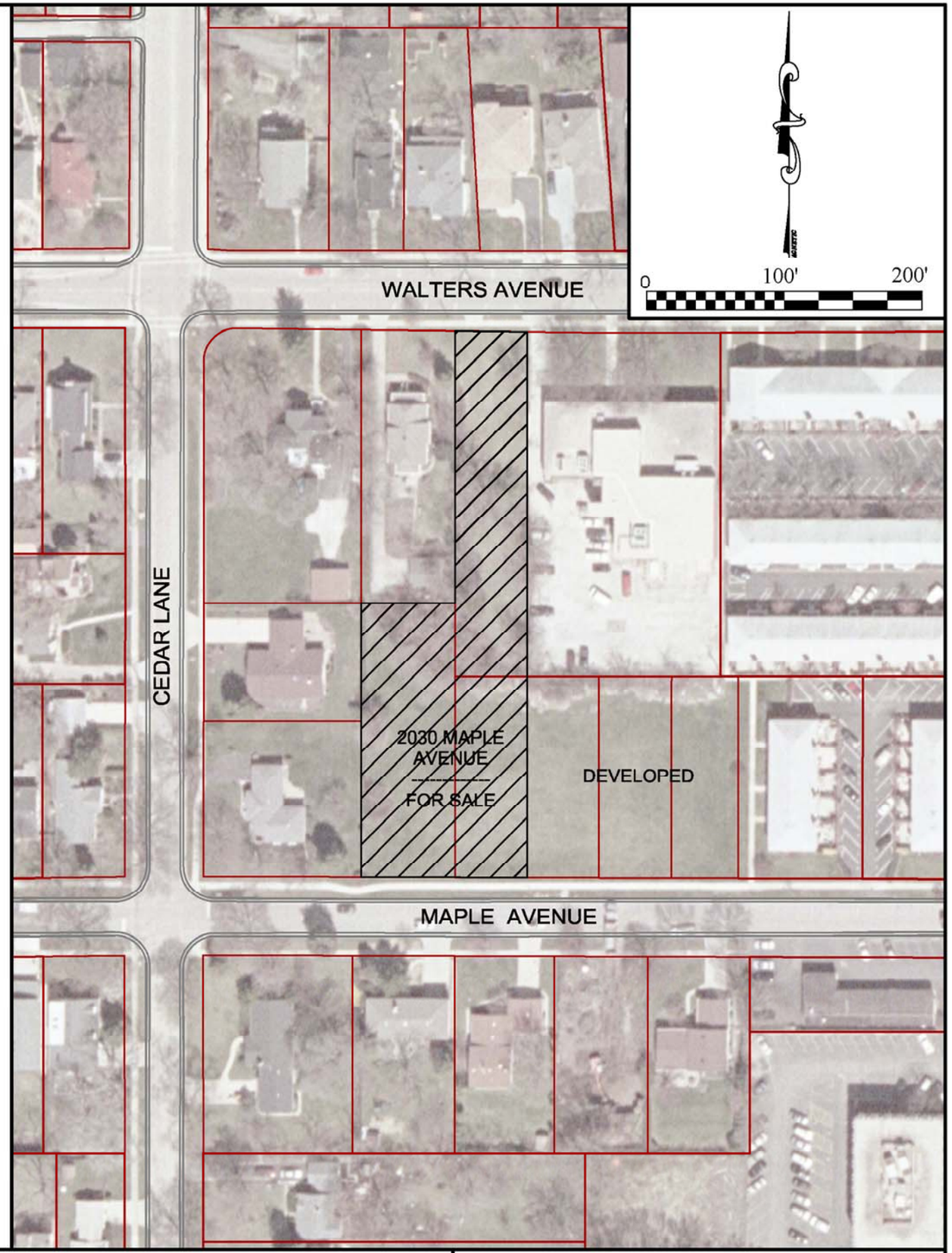




(1) 4180 PHYLLIS ROAD
(2) PFINGSTEN ROAD & KEYSTONE ROAD

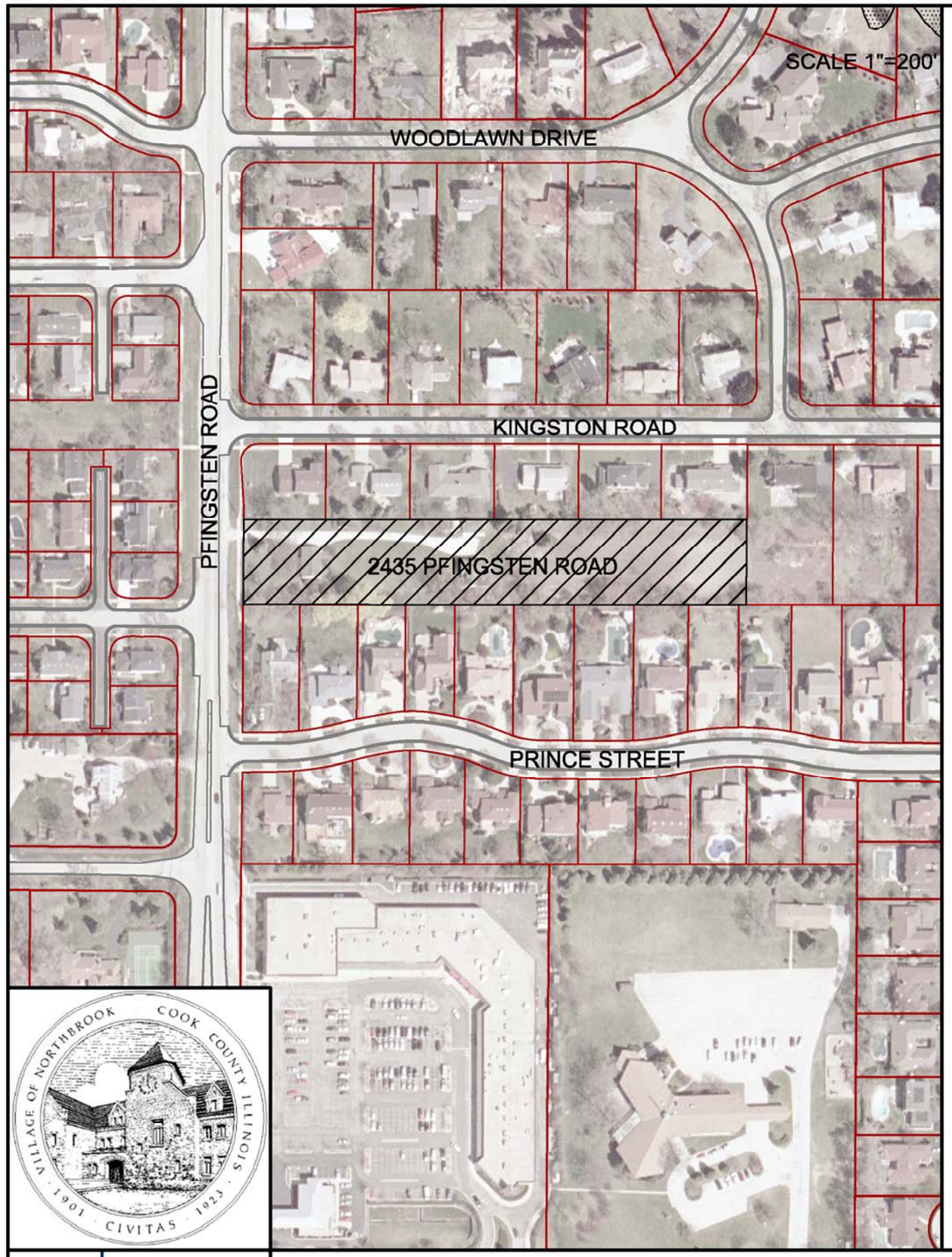
PRIORITIZED PARCEL
PARCELS NO. 1 & 2

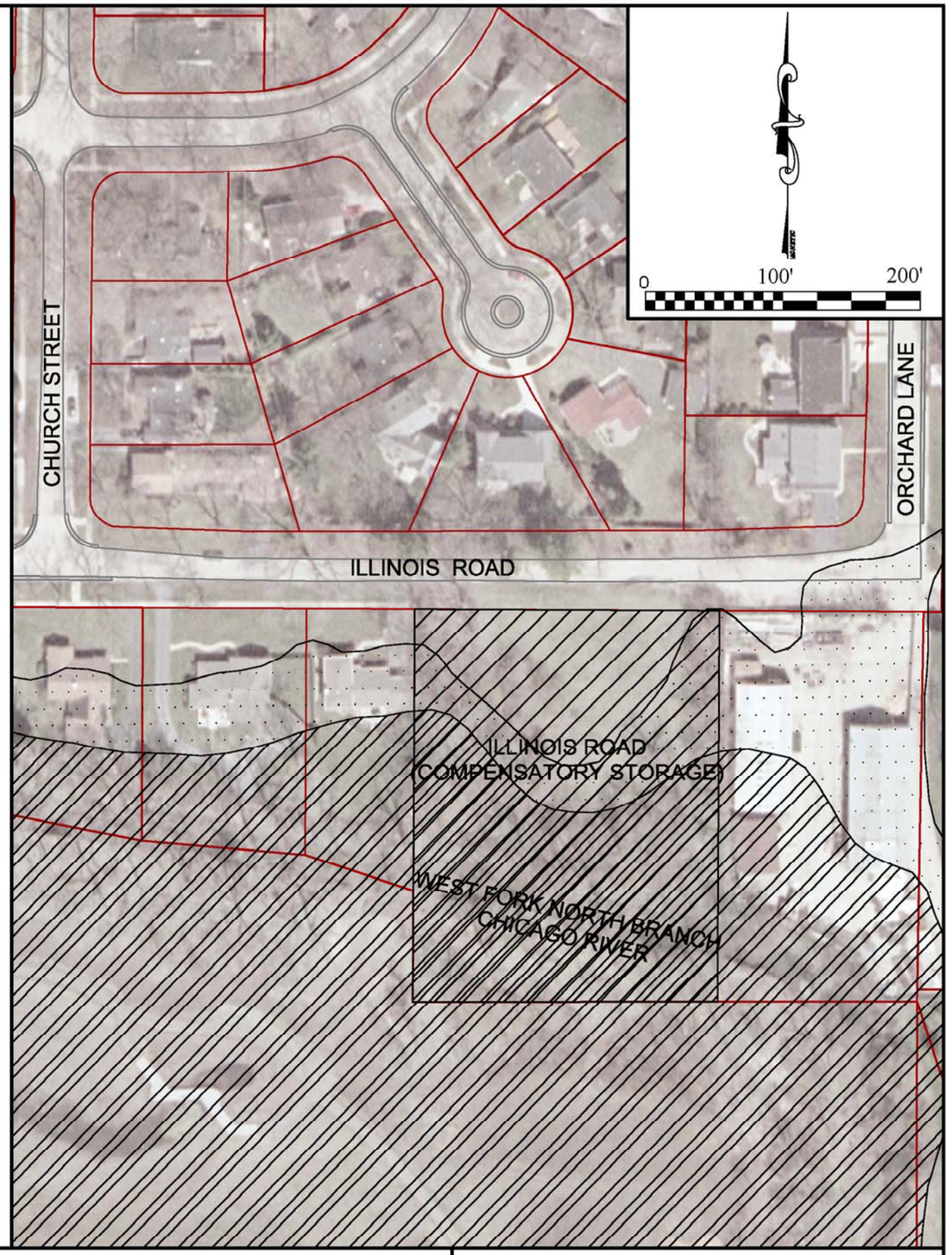




(3) 1503-1517 CEDAR LANE, ILLINOIS AVENUE
(4) 2030 MAPLE AVENUE

PRIORITIZED PARCEL
PARCELS NO. 3 & 4





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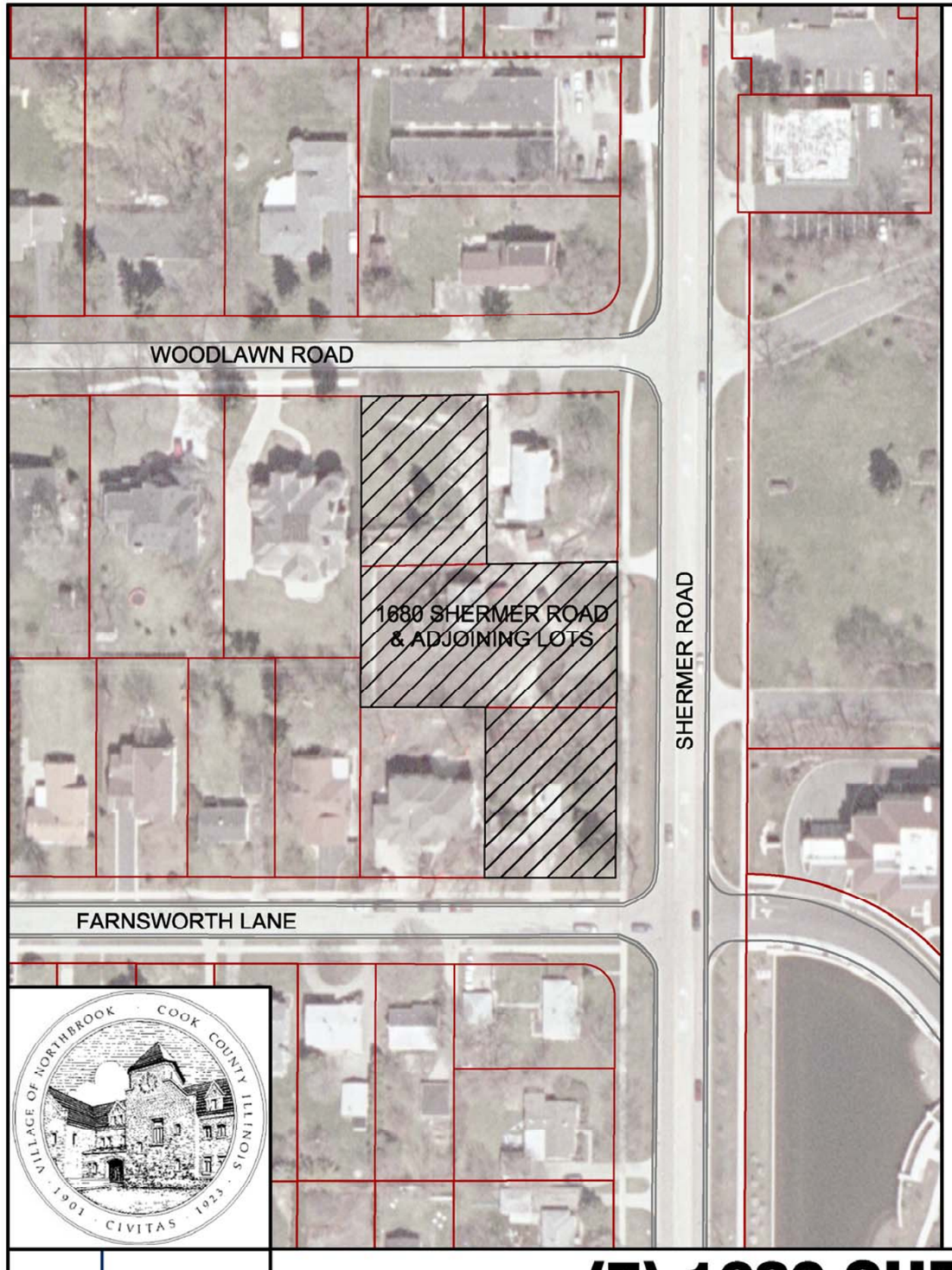
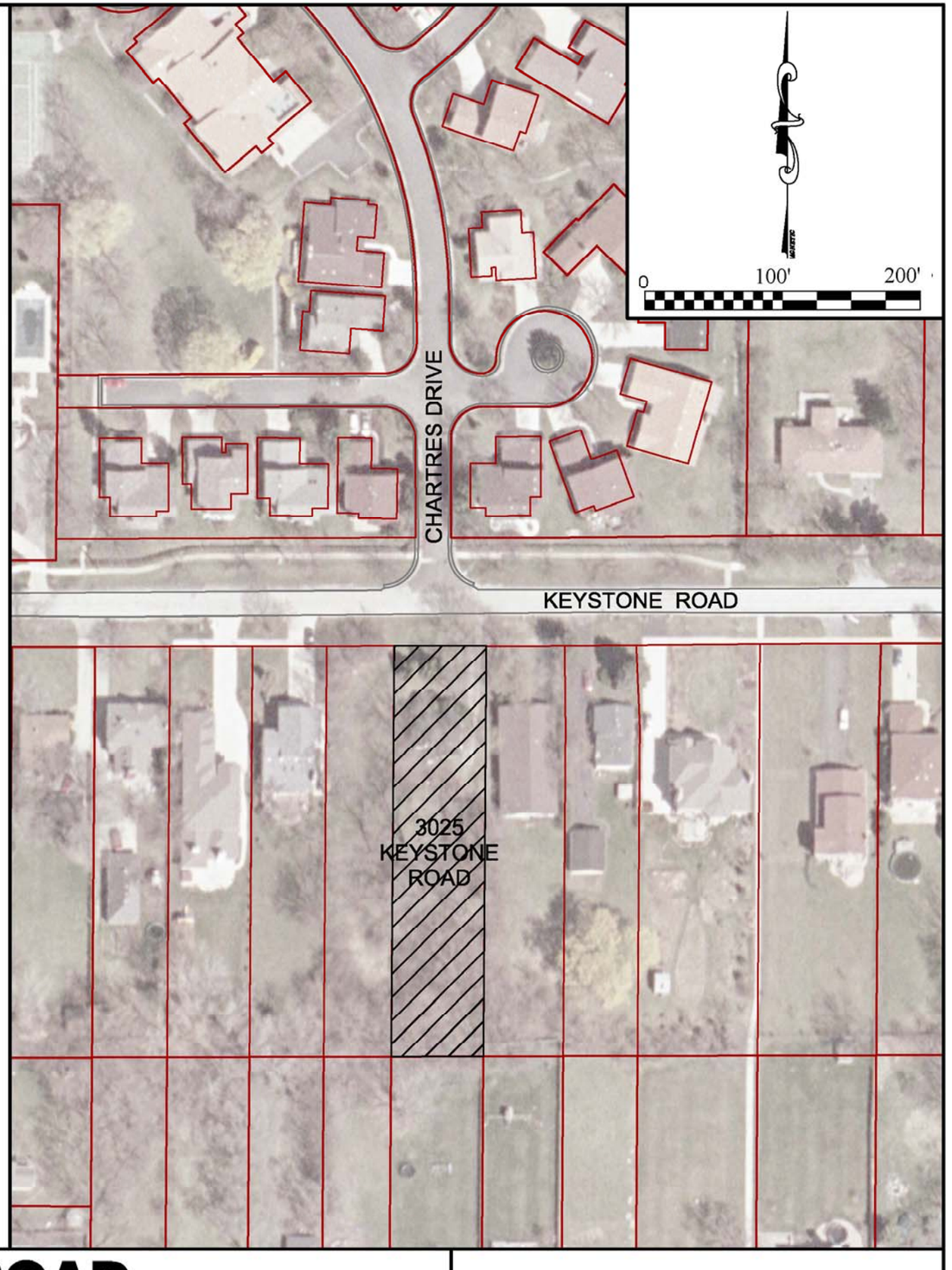
HLR

(5) 2435 PFINGSTEN ROAD
(6) ILLINOIS ROAD (COMPENSATORY STORAGE)

PRIORITIZED PARCEL
PARCELS NO. 5 & 6





(7) 1680 SHERMER ROAD
(8) 3025 KEYSTONE ROAD

PRIORITIZED PARCEL
PARCELS NO. 7 & 8

MORATORIUM ON IMPERVIOUS COVERAGE

Merits of imposing moratorium on impervious coverage increase in problematic drainage area until such time as the improvement projects are completed

Conditions:

Storm Water Management Plan (SWMP) Watershed and Neighborhood projects are based upon existing conditions and do not include the project modifications that would accommodate changes and increases in stormwater runoff under current rules and regulations for development/redevelopment. With a moratorium in place, property redevelopment would be in a sense, restricted, and be dependant upon the scheduling of watershed or neighborhood projects (Techny Drain watershed project being a 20 year project from initial planning to construction). MWRD, draft Watershed Development Ordinance (WDO) in general does not address single lot re-development.

Without mitigation measures being provided for future increases in stormwater runoff (rate and volume) the SWMP projects effective life would be shortened. The choice is to put the burden, initially, on the individual property owners as they develop/modify their site or to spread the cost when the Village budgets a project to remedy the flooding after it persists.

Considerations:

1. Factors that may have led to existing problematic areas:
    a. Developed/subdivided prior to stormwater detention required
    b. Unincorporated, developed areas annexed
    c. Sequence of subdivision development (i.e. Northbrook Park developed and received limited stormwater runoff from the upstream agricultural area soon to be subdivided Sunset Fields)
    d. Rural drainage system capacity exceeded with additional development (i.e. "teardowns" Consequently, drainage systems constructed to older standards do not have the capacity to support new development that are designed under current standards
    e. Outlets became constrained by increased stormwater runoff from outside drainage areas (i.e. flood stages in the West Fork) Channelization of watercourses and the reduction of flood storage.
    f. Accumulative affects of re-development
    g. Increased stormwater runoff volumes due to accumulative loss of depressional storage, stormwater infiltration and increased impervious coverage.
    h. Conveyance system sensitive to increases in discharge
    i. Downstream depressional storage or detention facilities sensitive to increases in storm water runoff volume
    j. Older Drainage system designs based on outdated analytical procedures and rainfall data
    k. Detention storage characteristics evaluated on a site basis rather than a watershed system analysis

2. How a moratorium on impervious coverage may still result in increased rate and volume discharges through a detailed hydrologic analysis:
    a. Alteration of Directly Connected Impervious Area (DCIA). DCIA areas do not allow for infiltration and groundwater re-charge
    b. Reduction/elimination of backyard depression storage due to lot re-grading
    c. Replacing slab type construction with deep basement result in pumping of groundwater and related site grading, perhaps, resulting from spoiling of excavated soils
    d. Disturbance of soils by compaction, re-grading and reduced infiltration capabilities.

Recommendations:

1. Limit the increase in imperviousness (i.e. 10%). This could be considered maintenance of conditions and current Code requirements would apply
    a. Encourage the use of best management practices to offset the increase in imperviousness
    b. Require that depressional storage be maintained or compensatory storage be provided for any loss. If the limit is exceeded then the increase could be considered as new site construction.
2. For increases that exceed 10% consider the re-development to be new construction
    a. Increase in imperviousness allowed provided that mitigation for all increased imperviousness is mitigated by accepted and proven best management practices (i.e., rain gardens, rain barrels, pervious pavers, vegetated swales). The practices utilized must be demonstrated to be functional and made part of property deed covenants
    b. Provide stormwater detention for the entire site based on the premise that the redevelopment is considered to be new development. Supporting analysis would be required to demonstrate that there would be no increase in the outflow from the site for the critical duration storm, based on an accepted hydrograph based method.
    c. Combination of above
3. Increase the cost per square foot of increased imperviousness and/or consider any or all disturbed area of the site to be included in the square footage.
4. Refer to Cook County Watershed Development Ordinance (WDO) and Technical Guidance Manual (TGM) for further guidance.

Benefits:

1. Increases watershed and neighborhood project life
2. Proactive Plan (preventive maintenance of reducing increased demand on existing drainage systems and needing to address newly created flooding conditions)

PUBLIC OUTREACH ACTIVITIES

Objective: Increase the awareness of the Village Residents about stormwater quality and flooding by an outreach program.

Recommendations:

- Publications
  - EPA "Protecting Water Quality from urban Runoff" (http://www.epa.gov/npdes/pubs/nps_urban-facts_final.pdf)
  - EPA "After the Storm" (http://www.epa.gov/npdes/pubs/after_the_storm.pdf)

- Newsletter
  - Remind the Village Residents of steps they can take to reduce flooding. Items found in "Other Improvements that can be Undertaken by Property Owners" section of this plan could be used in the newsletter.

- Youth Education
  - Education of the youth can influence parents and long term habits.
    - http://dnr.state.il.us/education/
    - http://www.epa.state.il.us/education.html

- Promote the Village participation programs. Use those programs for education and increasing the public's awareness (supplement applications for cost participation with examples and advertise it on the Village web site/newsletter)
- Promote the use of Best Management Practices, i.e. Rain Garden Strategies and Green Building ideas.
- Develop a Village of Northbrook, Guidance Manual demonstrating the BMPs and Green Building ideas/concepts and benefits in flooding reduction and improvements to water quality

REVIEW PUBLIC WORKS DEPARTMENT (STORM) SEWER MAINTENANCE PROCEDURES

Statement of Conditions:

General procedures are presented on the Village's website. The procedures are summarized as preventive maintenance, reaction to conditions and public response.

Inspection of all locations in the Village is best done with the aid of public involvement.

Awareness of conditions by properties owners and contact with the PWD could result in preventive maintenance action being taking prior to the rain storm occurring

Recommendations:

1. Expand public outreach
    a. Preventive maintenance (what to look for and when to call the Public Works Department). This includes letting PWD know that an inlet is partially or wholly clogged, before a critical storm event occurs, trimming brush and maintaining stream banks located on private property, etc.)
    b. Avoid creating problems (disposal of grass and brush clipping)
    c. Explain importance of debris clogging and inlet and if notice, to contact PWD before the next storm event occurs
2. Stream bank and ditch maintenance
    a. Establish annual monitoring procedures for potential problems (i.e. once invasive species such as buckthorn is established, it is difficult to remove when vegetative ground cover is gone, hence the channel is subject to erosion).
3. Cleaning of Catch Basins, Culverts and Sewer Lines
    a. Continue to perform preventative inspection /maintenance. This is extremely important function as the clean inlets are the first line of defense against flooding. Performing the cleaning during or after flooding has its obvious added cost and consequences

Benefits:

1. Reduction in flood risk

REVIEW OF SITE PLAN & INSPECTION ACTIVITIES

Statement of Conditions:

From a Stormwater Management perspective each site improvement has the potential for stabilizing or aggravating an existing drainage concern to not only that site but also to adjacent properties, including the Villages Streets. Sites located either within problematic areas or are potentially problematic sites should be reviewed and attested to by an Illinois licensed Civil Engineer with a "reasonable" amount of background in stormwater management.

Considerations:

1. Site is located within a drainage areas that is subject to flooding and/or is located within the influence of a Watershed or Neighborhood Project placed on the watch list
2. Site that is itself a likely candidate to increase/create increases in downstream flood risk should also be placed on the watch list (loss of depressional storage, increased imperviousness, loss of overland flood relief paths)
3. Site is considered to be a candidate for stormwater detention either by rear yard drainage easement or acquisition by the Village

Recommendations:

1. Site Plan Review
    a. To assure that the development/redevelopment of a site does not aggravate existing drainage problems or create new ones the following must be addressed
        i. Is the site on the "watch list" for properties that are suitable for detention or other drainage improvements
        ii. Are there any low areas on site? If so then the degree as to how much they are disturbed, filled or drained needs to be included in a detailed drainage analysis
        iii. Is the site one of the last remaining sites to be developed? Is it the lowest site on the block? Does it have groundwater problems?. (those sites need to be paid special attention to)
        iv. Is the site located within an area with flooding experience? This may be a factor in the elevation determination of the first floor/window well
        v. All site designs should be carefully scrutinized a Illinois licensed engineer to assure that:
            1. Flood overflow paths are reinstated
            2. "Backyard" depressional storage is not lost without appropriate mitigation measure being taken

vi. Information on groundwater table should be thoroughly examined. Slab constructed tear downs or nearby homes with significant pumping may identify problematic area. Groundwater information should be required and pumping requirements determined. Redevelopment that results in groundwater pumping should be discourage or the resultant additional flow that occurs offsite shall be mitigated
vii. The signoff for the site development, relevant to the reasonableness of the drainage alterations must be by an Illinois licensed civil engineer
viii. The definition of backfill needs to be clarified. Is it allowed to use to fill low areas on the site
ix. Evaluation of the outlet drainage system should be made, especially for the fragmented drainage systems.

2. Inspection Activities (all sites)

REVIEW OF VARIOUS CODES THAT GOVERN BUILDING IN THE VILLAGE OF NORTHBROOK

1. NORTHBROOK MUNICIPAL CODE
    a. Chapter 19 – Planning and Development, Article VI – Expansion of Impervious Surface, Division 1
        i. Recommendation: Include a preamble to the effect that increases in imperviousness is generally related to increasing adjacent and downstream property flooding'
    b. Chapter 19 – Planning and Development, Article VI – Expansion of Impervious Surface, Division 2
        i. Recommendation: Include requirement to determine per-cent of impervious for both existing and proposed conditions
        ii. Refer to other related codes (i.e., Article XI – Site Grading, Drainage and Soil Erosion/Sedimentation Control)
    c. Chapter 6 – Building and Constructions Regulations, Article XI – Site Grading, Drainage and Soil Erosion/Sedimentation Control, Recommendations
        i. Sec. 6-182 Permits required
            1. (c) Alteration of grade, contour or drainage pattern. The decision on permit approval is based upon reasonableness. Reasonableness is probably defined in the courts when damages are sustained. This part of the code seemingly promotes actions that may be in violation of the Illinois Drainage Law by providing an avenue to construct diversions, blockages or to convert sheet flow to concentrated flow
        ii. Sec. 6-183 General engineering site plan content
            1. (d) determine and show all low areas located on and adjacent to the site
            2. (d)(5) Add, including loss of storage from filling of low areas on land, changes that result in the draining of the low areas and adjacent low areas
            3. (e)(21) Add preference of best management practices, such as rain barrel, vegetated swale, etc. in lieu of a direct connection to storm sewer
            4. (f)(3) Stormwater detention. Add; the highwater elevation of the proposed facility shall be no higher than the down stream highwater.

2. ENGINEERING STANDARDS AND SPECIFICATIONS

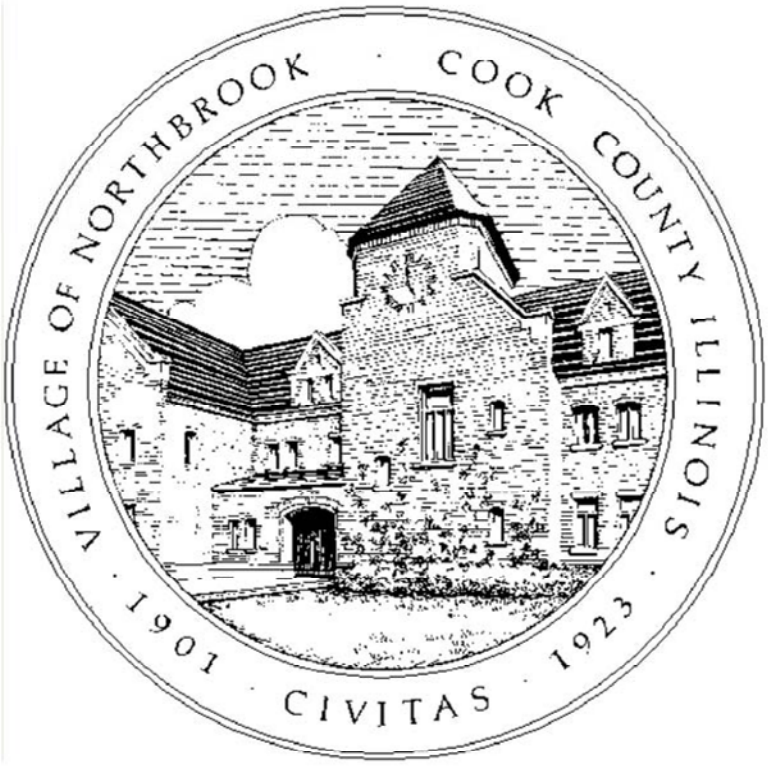
    a. Chapter F- Design, Recommendations
        i. 7 – Drainage Computations, (c) Building drainage : Favor BMP in lieu of direct connections to storm sewer
    b. Chapter J – Stormwater Detention Requirements
        i. 2 – Release Rate – Consider reducing release rates for problematic drainage areas, throughout the Village on a sub-watershed basis
        ii. 5.- Design Standards – Hydrological and Hydraulic computation procedures for sites (say over 5 acres) shall be base upon an interconnected pond routing procedure that includes the evaluation of the downstream low flow and flood flow capacity and provides downstream highwater elevations for both with and without project conditions for all critical duration storm events up to and including the 100-year reoccurrence interval
        iii. 5 – Design Standards – Need to modify when the MWRDGC draft WMO is adopted
        iv. 6 – Compensatory Storage – Consider expanding to include storage requirements for fill in depressional storage.
        v. 7 – Small Developments – Need to define. The determination should include extent of mass grading/soil disturbance, loss or alteration of depressional storage, the condition of the existing drainage in addition to the increased imperviousness
        vi. 12 – High Water Level – Shall be no higher than the corresponding storm frequency level in the receiving drainage system

3. ZONING CODE (No Comments)

4. SUBDIVISION & DEVELOPMENT CODE (No Comments)

5. COOK COUNTY WATERSHED MANAGEMENT ORDINANCE & TECHNICAL GUIDANCE MANUAL (draft, September 24, 2009, currently being assessed by economic impact analysis by MWRDGC)
    a. In the adoption of the ordinance make sure that parts of the ordinance do not override the Northbrook ordinance
        i. Review both ordinances in detail and publicize differences
    b. General comments:
        i. Table 1. Summary of Site Stormwater Management Requirements (reduce size of exempt properties)
        ii. 506- (page 5-13)
        iii. Critical duration storm analysis (5-14)
        iv. Overland flood route
        v. HWEL in pond is 1' lower than adjacent property that serves as an outlet.

Watershed and Neighborhood Project Information



Project Summary Tables
Recommended Project Data
Benefit Cost Ratio (BCR) Determination
Estimated Total Cost

SUMMARY TABLES

Recommended Plan Information for Watershed and Neighborhood Projects

The following tables are summary of findings and recommendations:

Table #1 – Completed Projects This table is a list of the projects that have been completed from previous SWMP. The list contains the projects names, the construction cost and the year it was completed on.

Table #2 – Project Status This table is a list of projects recommended from the previous SWMP (2002). The list contains the project names, whether they were prioritized or non-prioritized, and a comment on the status. Many of the projects have been modified for the SWMP and the comment section directs the reader to the section based on the current project number and name.

Table #3 – Projects Recommended to be Addressed by Others This table is a list of projects in the MSMP that HLR recommends be addressed by others. The projects are on this list since they are under their jurisdiction (IDOT), should be addressed by watershed planning (MWRDGC), or were improvements initiated by others (GBNHS).

Table #4 – Project Benefit Cost Ratio This table is a list of all of the projects within the MSMP ordered by their estimated number of damaged structures removed by the recommended construction project. The table also includes the projects estimate of cost and benefit – cost ratio.

Table #5 – Project Cost per Property Benefited This table is a list of all of the projects within the MSMP ordered by cost per property benefited. The table ranges from $300 to $332,000/per property benefited. The table also includes the projects estimate of cost and the number of properties benefited.

Table #6 – Project Cost Range This table is a list of all of the projects within the MSMP ordered by their estimate of cost. The table ranges from $13,000 to $8,200,000. This table should be used to identify a project that could be implemented with the funds available.

COMPLETED PROJECTS (1993, 1996, and 2002 SWMP)		
Previously Completed Stormwater Management Projects	**Construction Cost ($)**	**Year Complete**
Dell Road Stormwater Management Improvements (Longacre Lane Detention Basin)	$485,000	1994
Flap Gates	$270,000	1996
Greenacre Drive Relief Sewer/Wildebrook Pond Overflow	$535,000	1997
Shag Bark Lane Storm Sewer	$10,000	1997
Ancient Tree Outflow Swale	$37,500	1999
Underwriter Laboratory Tributary Relief Sewer	$580,000	2000
Cedar Lane Sewer Outfall	$65,000	2000
Cattle Pass Relief Swale	$235,000	2001
Techny Drain Relief Sewer and Stormwater Storage Facility (Phases 1 & 2)	$3,000,000	2003-2007
TOTAL	**$5,217,500**	

Techny Drain Relief Sewer Phase 3	-	Design in Progress
Techny Drain Relief Sewer Phase 4	-	Design in Progress

Table 1
Completed Projects

8/3/2011

2002 SWMP Project Status

	Project or Programs	Comment
Prioritized Projects*	1635-1645 Landwehr	Completed
	Cedar Lane	Modified - See Cedar Lane (816-869)
	Dacoma Day Camp	Completed
	Jeffrey Court South	Completed
	Northbrook Park	Modified - See Project 1 - Wescott Park Storage
	Shermer Road Trunk Sewer	Modified - See Project 2 - Shermer Road Overflow Sewer
	Sunset Fields	Modified - See Project 1 - Wescott Park Storage
	West Fork of the North Branch of the Chicago River	Remains - See West Fork Berm
	Western Avenue - Oak Avenue	Modified - See Project 20 - Western Avenue/Oak Avenue (Wescott Road to Shermer Road)
Non-Prioritized Projects or Programs*	Cedar Lane Ditch	Modified - See Cedar Lane Ditch (East of Walnut Lane) in Appendix 2
	Cherry Lane Underpass	Modified - See Project 5 - Cherry Lane Underpass
	Floodproofing Program	Modified - See Private Property Drainage and Flood Reduction Cost Participation
	Local Storage Program	Modified - See Identify Possible Neighborhood Storage
	Overhead Sewer Program	Modified - Overhead Sanitary Sewer Conversion Cost Reimbursement
	Rear Yard Drainage Program	Modified - See Private Property Drainage and Flood Reduction Cost Participation
	Reserve Power Program	Modified - See Battery Backup Sump Pump Cost Reimbursement
	Salceda North - Villas North	Deleted - Project Solution beyond Village Limits
	Shermer Road Underpass	Modified - See Project 15 - Shermer Road Underpass
	Sump Pump Upgrade Program	Modified - See Battery Backup Sump Pump Cost Reimbursement

Note: Prioritized and Non-Prioritized Projects are from the 2002 MSMP.

Table 2
Project Status

Projects Recommended to be Addressed by Others		
Project No.	**Project**	**Agency**
X	Cost Effective Modifications to Existing Regional Flood Control Reservoirs	MWRDGC
X	West Fork Berm	MWRDGC
X	Cherry Lane Underpass (Flooding from WFNBCR)	MWRDGC
9	Dundee Road / Skokie Boulevard	IDOT
X	Lee Road, North of Dundee Road Intersection	IDOT
15	Shermer Road Underpass Flooding	IDOT
18	Techny Drain Basin Expansion (at Glenbrook North High School)	GBNHS

Table 3
Projects Recommended to be Addressed by Others

PROJECT BENEFIT COST RATIO				
Project No.	Project	Estimate of Cost	Estimated Number of Damaged Structures Benefited	Benefit Cost Ratio
3	Techny Drain Phase IV	$798,000	10	10.57
16	Sunny Acres (Pamella Lane, Constance Lane)	$614,000	3	4.16
5	Cherry Lane Underpass	$246,000	1	3.51
10	Keystone Road/Chartres Drive	$635,000	5	3.05
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	$718,000	11	2.18
2	Shermer Road Overflow Sewer	$1,327,000	17	1.92
14	Shermer Road Outlet	$13,000	0	0.85
9	Dundee Road/Skokie Boulevard	$51,000	0	0.84
4	Cedar Lane (816 to 869)	$42,000	0	0.76
6	Church Street (near Chapel Court)	$80,000	0	0.54
13	Ridge Road/Lee Road	$60,000	0	0.35
1	Wescott Park Storage	$8,200,000	12	0.33
7	Curb Failure along WFNBCR (Behind 1941 Cherry Lane)	$41,000	0	0.27
22	Woodlawn Road (Penfold Place to Shermer Road)	$140,000	0	0.23
21	Williamsburg Drive/Old Post Road	$270,000	2	0.16
18	Techny Drain Basin Expansion	$268,000	0	0.16
8	Dehne Subdivision (Dehne Road, Brentwood Road)	$109,000	0	0.10
20	Western Avenue/Oak Avenue (Wescott Road to Shermer Road)	$631,000	0	0.07
12	Northbrook Manor (Spruce Street)	$446,000	0	0.07
17	Sunset Lane	$432,000	0	0.05
19	Weller's Subdivision (Weller, Hillcrest, Christina Lanes)	$784,000	0	0.04
15	Shermer Road Underpass	$332,000	0	0.04

Table 4
Project Benefit Cost Ratio

PROJECT COST PER PROPERTY BENEFITED				
Project No.	Project	Estimate of Cost	Estimated Number of Properties Benefited*	Cost per Property Benefited
14	Shermer Road Outlet	$13,000	42	$300
18	Techny Drain Basin Expansion	$268,000	60	$4,500
20	Western Avenue/Oak Avenue (Wescott Road to Shermer Road)	$631,000	106	$6,000
12	Northbrook Manor (Spruce Street)	$446,000	60	$7,400
22	Woodlawn Road (Penfold Place to Shermer Road)	$140,000	15	$9,300
3	Techny Drain Phase IV	$798,000	82	$9,700
9	Dundee Road/Skokie Boulevard	$51,000	4	$12,800
8	Dehne Subdivision (Dehne Road, Brentwood Road)	$109,000	8	$13,600
4	Cedar Lane (816 to 869)	$42,000	3	$14,000
21	Williamsburg Drive/Old Post Road	$270,000	18	$15,000
6	Church Street (near Chapel Court)	$80,000	5	$16,000
13	Ridge Road/Lee Road	$60,000	3	$20,000
5	Cherry Lane Underpass	$246,000	10	$24,600
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	$718,000	29	$24,800
17	Sunset Lane	$432,000	13	$33,200
10	Keystone Road/Chartres Drive	$635,000	17	$37,400
7	Curb Failure along WFNBCR (Behind 1941 Cherry Lane)	$41,000	1	$41,000
16	Sunny Acres (Pamella Lane, Constance Lane)	$614,000	14	$43,900
2	Shermer Road Overflow Sewer	$1,327,000	22	$60,300
1	Wescott Park Storage	$8,200,000	91	$90,100
19	Weller's Subdivision (Weller, Hillcrest, Christina Lanes)	$784,000	7	$112,000
15	Shermer Road Underpass	$332,000	1	$332,000

*Public Right-of-Way is considered one property

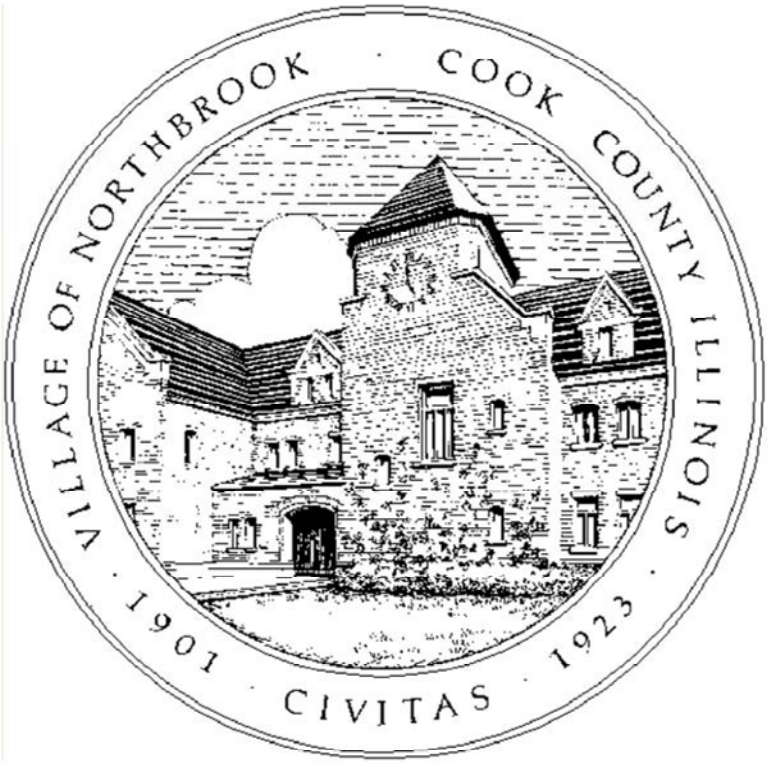
Table 5
Project Cost Per Property Benefited

2011

PROJECT COST RANGE			
Project No.	Project	Estimate of Cost	Project Cost Range
14	Shermer Road Outlet	$13,000	> $250,000
7	Curb Failure along WFNBCR (Behind 1941 Cherry Lane)	$41,000	
4	Cedar Lane (816 to 869)	$42,000	
9	Dundee Road/Skokie Boulevard	$51,000	
13	Ridge Road/Lee Road	$60,000	
6	Church Street (near Chapel Court)	$80,000	
8	Dehne Subdivision (Dehne Road, Brentwood Road)	$109,000	
22	Woodlawn Road (Penfold Place to Shermer Road)	$140,000	
5	Cherry Lane Underpass	$246,000	
18	Techny Drain Basin Expansion	$268,000	$250,000 < $500,000
21	Williamsburg Drive/Old Post Road	$270,000	
15	Shermer Road Underpass	$332,000	
17	Sunset Lane	$432,000	
12	Northbrook Manor (Spruce Street)	$446,000	
16	Sunny Acres (Pamella Lane, Constance Lane)	$614,000	$500k < $1M
20	Western Avenue/Oak Avenue (Wescott Road to Shermer Road)	$631,000	
10	Keystone Road/Chartres Drive	$635,000	
11	Northbrook East (Midway Road/Whitfield Road South Intersection)	$718,000	
19	Weller's Subdivision (Weller, Hillcrest, Christina Lanes)	$784,000	
3	Techny Drain Phase IV	$798,000	
2	Shermer Road Overflow Sewer	$1,327,000	> 1M
1	Wescott Park Storage	$8,200,000	

Table 6
Project Cost Range

Watershed Projects
(Recommended Plan Information)



Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Wescott Park Storage - 10-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Cost over Project Life (50-years)	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	6	$2,010,000	$1,038,000	$71,000	$13,500	$6,000	$8,400	$12,100	$146,300	$3,305,300	$16,526,500	$331,000	-
Wescott Park Underground Storage	2	$757,000	$391,000	$50,000	$4,500	$2,000	$2,800	$4,000	$48,800	$1,260,100	$6,300,500	$126,000	$205,000

Wescott Park Storage - 25-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Cost over Project Life (50-years)	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	21	$4,956,000	$2,649,000	$270,000	$47,250	$21,000	$29,400	$42,400	$512,200	$8,527,250	$17,054,500	$341,000	-
Wescott Park Underground Storage	9	$2,613,000	$1,357,000	$316,000	$20,250	$9,000	$12,600	$18,200	$219,500	$4,565,550	$9,131,100	$183,000	$127,000

Wescott Park Storage - 50-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Cost over Project Life (50-years)	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	36	$9,077,000	$4,795,000	$508,000	$81,000	$36,000	$50,400	$72,700	$878,000	$15,498,100	$15,498,100	$310,000	-
Wescott Park Underground Storage	13	$3,853,000	$2,008,000	$365,000	$29,250	$13,000	$18,200	$26,300	$317,100	$6,629,850	$6,629,850	$133,000	$177,000

Wescott Park Storage - 100-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Cost over Project Life (50-years)	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	41	$11,141,000	$5,897,000	$1,025,000	$92,250	$41,000	$57,400	$82,800	$1,000,000	$19,336,450	$9,668,225	$193,000	-
Wescott Park Underground Storage	28	$7,626,000	$4,053,000	$598,000	$63,000	$28,000	$39,200	$56,500	$682,900	$13,146,600	$6,573,300	$131,000	$62,000

Wescott Park Storage - 10-Year Storm Event

	Total Flood Damage per Year	Present Worth Damages	Benefit per Year	Present Worth Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$331,000	$7,110,542				
Wescott Park Underground Storage	$126,000	$2,706,732	$205,000	$4,404,000	$8,200,000	0.54

Note: Assume the interest rate is 4%and a project life of 50 years

Wescott Park Storage - 25-Year Storm Event

	Total Flood Damage per Year	Present Worth Damages	Benefit per Year	Present Worth Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$341,000	$7,325,362				
Wescott Park Underground Storage	$183,000	$3,931,206	$127,000	$2,728,000	$8,200,000	0.33

Note: Assume the interest rate is 4%and a project life of 50 years

Wescott Park Storage - 50-Year Storm Event

	Total Flood Damage per Year	Present Worth Damages	Benefit per Year	Present Worth Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$310,000	$6,659,420				
Wescott Park Underground Storage	$133,000	$2,857,106	$177,000	$3,802,000	$8,200,000	0.46

Note: Assume the interest rate is 4%and a project life of 50 years

Wescott Park Storage - 100-Year Storm Event

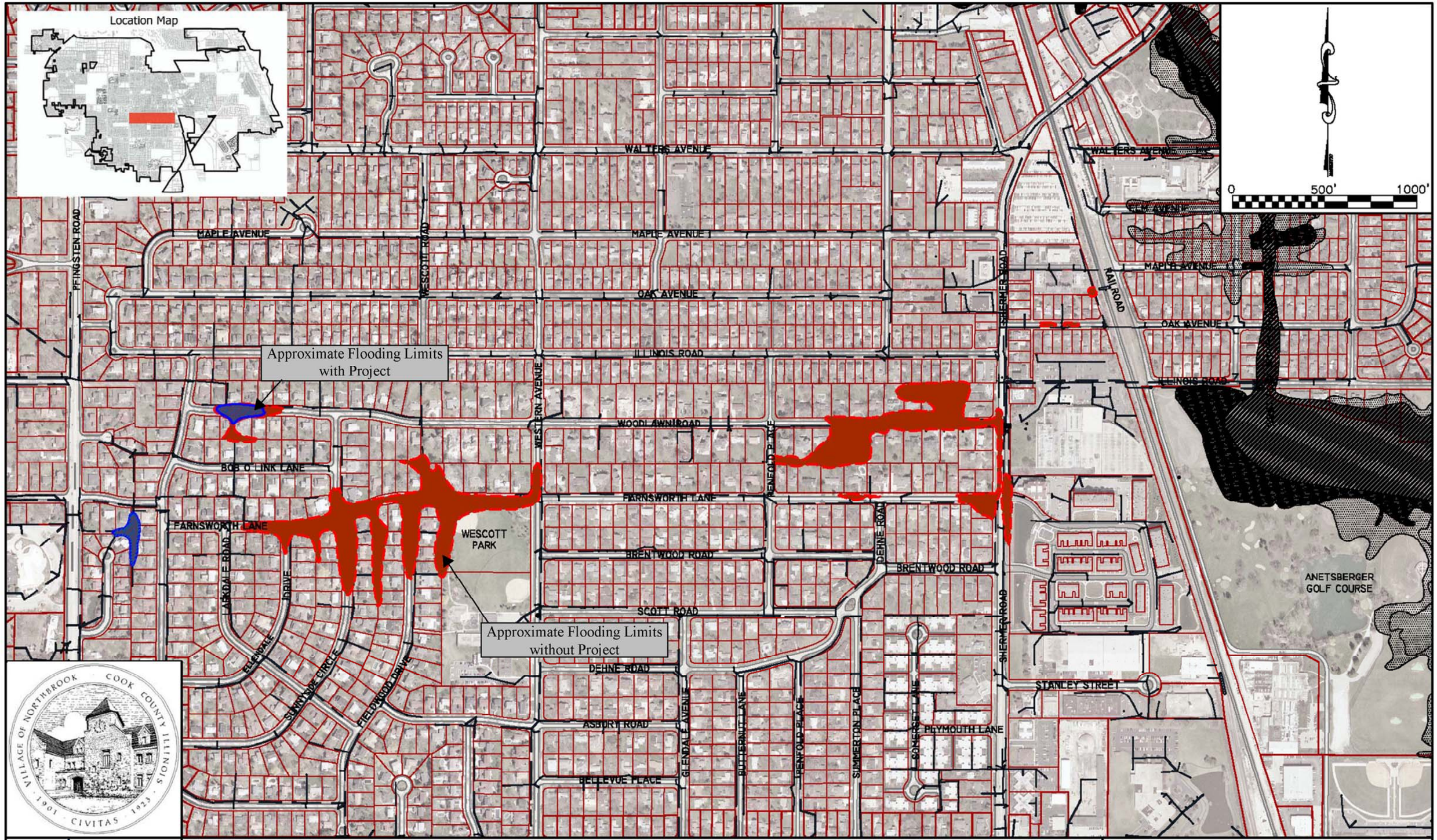
	Total Flood Damage per Year	Present Worth Damages	Benefit per Year	Present Worth Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$193,000	$4,146,026				
Wescott Park Underground Storage	$131,000	$2,814,142	$62,000	$1,332,000	$8,200,000	0.16

Note: Assume the interest rate is 4%and a project life of 50 years

Wescott Park Storage

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCAVATION	CU YD	48000	$25.00	$1,200,000.00
	TRENCH BACKFILL	CU YD	1530	$45.00	$68,850.00
	SEEDING, CLASS 2	ACRE	6.5	$10,000.00	$65,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	890	$10.00	$8,900.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	320	$80.00	$25,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	210	$100.00	$21,000.00
	STORM SEWER, CLASS A, TYPE 2, 48"	FOOT	70	$125.00	$8,750.00
	STORM SEWER, CLASS A, TYPE 2, 72"	FOOT	600	$250.00	$150,000.00
	MANHOLES, TYPE A, 9' DIAMETER, TYPE 1 FRAME AND LID	EACH	2	$12,000.00	$24,000.00
	JUNCTION CHAMBER	EACH	2	$20,000.00	$40,000.00
	HIGH FLOW INLET	EACH	4	$10,000.00	$40,000.00
	UNDERGROUND STORAGE - 20 ACRE-FEET	L SUM	1	$4,800,000.00	$4,800,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$14,000.00	$14,000.00
				SUBTOTAL	$6,466,000.00
				CONTINGENCY 10%	$647,000.00
				TOTAL	**$7,113,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$1,067,000.00	$1,067,000.00
				TOTAL	**$1,067,000.00**

ESTIMATED TOTAL COST	**$8,180,000.00**



WESCOTT PARK UNDERGROUND DETENTION
25-YEAR FLOOD LIMIT - ILLINOIS ROAD WATERSHED

Shermer Road Overflow Sewer

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	17	$3,666,000	$1,983,000	$121,000	$38,250	$17,000	$23,800	$34,300	$50,000	$5,933,350	$118,700	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$118,700

Shermer Road Overflow Sewer

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$118,700	$2,549,913			
Proposed Conditions	$0	$0	$2,550,000	$1,327,000	1.92

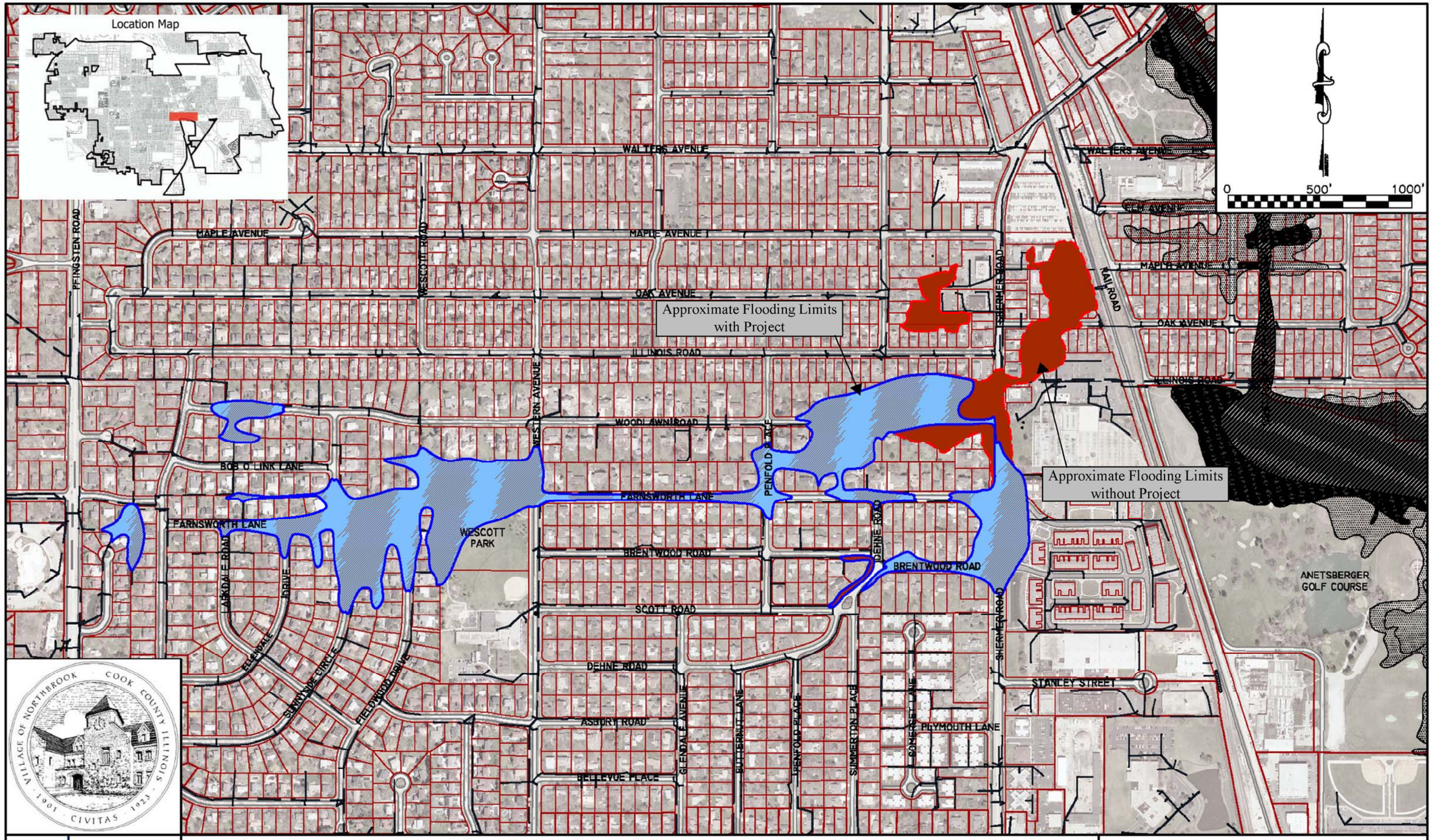
Note: Assume the interest rate is 4%and a project life of 50 years

The following houses are calculated to have damage for the **50**-year storm event: Oak Street (1901, 1903, 1904, 1906, 1909, 1912, 1913, 1916, 1919, 1920, 1923, 1924, 1927, 1928, & 1931) Shermer Road (1600 & 1499)

Shermer Road Overflow Sewer

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	4150	$45.00	$186,750.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	1560	$10.00	$15,600.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	560	$80.00	$44,800.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	370	$100.00	$37,000.00
	STORM SEWER, CLASS A, TYPE 2, 72"	FOOT	1750	$225.00	$393,750.00
	STORM SEWER, CLASS A, TYPE 2, 72" (JACKING)	FOOT	80	$2,250.00	$180,000.00
	STORM SEWER, CLASS A, TYPE 3, 90"	FOOT	80	$400.00	$32,000.00
	MANHOLES, TYPE A, 8' DIAMETER, TYPE 1 FRAME AND LID	EACH	2	$10,000.00	$20,000.00
	MANHOLES, TYPE A, 9' DIAMETER, TYPE 1 FRAME AND LID	EACH	4	$12,000.00	$48,000.00
	JUNCTION CHAMBER	EACH	1	$32,000.00	$32,000.00
	HIGH FLOW INLET	EACH	2	$10,000.00	$20,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$31,000.00	$31,000.00
				SUBTOTAL	$1,041,000.00
				CONTINGENCY 10%	$104,000.00
				TOTAL	**$1,145,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$172,000.00	$172,000.00
	EASEMENT ACQUISITION	LSUM	2	$5,000.00	$10,000.00
				TOTAL	**$182,000**

ESTIMATED TOTAL COST	**$1,327,000.00**



SHERMER ROAD OVERFLOW SEWER
50 -YEAR FLOOD LIMITS, ILLINOIS ROAD WATERSHED

Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Techny Drain Phase IV

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	10	$2,500,000	$1,250,000	$100,000	$22,500	$10,000	$14,000	$20,200	$40,000	$3,956,700	$395,700	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$25,000	$25,000	$3,000	$392,700

Techny Drain Phase IV

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$395,700	$8,500,427			
Proposed Conditions	$3,000	$64,446	$8,436,000	$798,000	10.57

Note: Assume the interest rate is 4%and a project life of 50 years

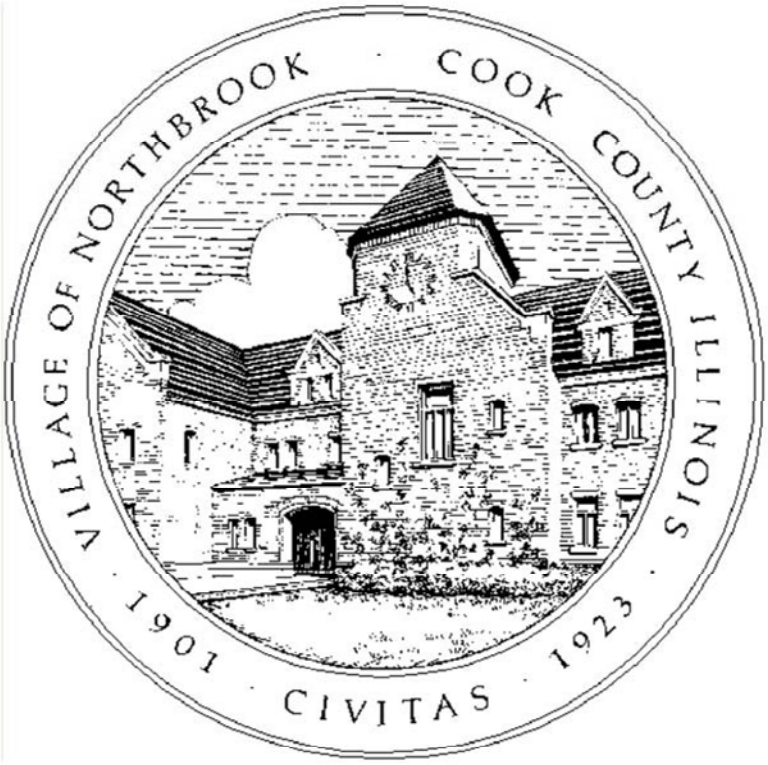
Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Techny Drain Phase IV

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	3900	$45.00	$175,500.00
	PAVEMENT PATCHING (FULL DEPTH)	SQ YD	510	$50.00	$25,500.00
	ADJUSTING WATER MAIN 10"	FOOT	100	$40.00	$4,000.00
	ADJUSTING SANITARY SEWERS, 8-INCH DIAMETER OR LESS	FOOT	100	$50.00	$5,000.00
	CATCH BASINS, TYPE A, 5'-DIAMETER	EACH	7	$1,750.00	$12,250.00
	MANHOLES TO BE ADJUSTED	EACH	15	$500.00	$7,500.00
	STORM SEWERS, CLASS A, TYPE 1 12"	FOOT	590	$50.00	$29,500.00
	STORM SEWERS, CLASS A, TYPE 2 48"	FOOT	2640	$85.00	$224,400.00
	REMOVAL AND REPLACEMENT OF BITUMINOUS DRIVEWAY	SQ YD	610	$30.00	$18,300.00
	MANHOLES, TYPE A, 8'-DIAMETER, TYPE 1 FRAME, CLOSED LID	EACH	7	$7,500.00	$52,500.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$17,000.00	$17,000.00
	MODIFICATIONS TO TECHNY DRAIN PHASE III	L SUM	1	$60,000.00	$60,000.00
				SUBTOTAL	$631,000.00
				CONTINGENCY 10%	$63,000.00
				TOTAL	**$694,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$104,000.00	$104,000.00
				TOTAL	**$104,000**

ESTIMATED TOTAL COST	**$798,000.00**

Neighborhood Projects
(Recommended Plan Information)



Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Cedar Lane (816 to 869)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$15,000	$15,000	$1,500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,500

Cedar Lane (816 to 869)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$1,500	$32,223			
Proposed Conditions	$0	$0	$32,000	$42,000	0.76

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 4 - 816 to 869 Cedar Lane

816 to 869 Cedar Lane

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONST	SEEDING, CLASS 2A	ACRE	0.07	$10,000.00	$700.00
	STORM SEWER, CLASS A, TYPE 2, 12"	FOOT	120	$60.00	$7,200.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	75	$75.00	$5,625.00
	MANHOLES, TYPE A, 5' DIAMETER, TYPE 1 FRAME AND LID	EACH	3	$2,500.00	$7,500.00
	CATCH BASIN	EACH	2	$1,500.00	$3,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$1,000.00	$1,000.00
				SUBTOTAL	$25,000.00
				CONTINGENCY 10%	$3,000.00
				TOTAL	**$28,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$4,000.00	$4,000.00
	EASEMENT ACQUISITION	LSUM	1	$10,000.00	$10,000.00
				TOTAL	**$14,000.00**
				ESTIMATED TOTAL COST	**$42,000.00**

Cherry Lane Underpass

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	1	$250,000	$125,000	$10,000	$2,250	$1,000	$1,400	$2,000	$30,000	$421,651	$42,200	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$20,000	$20,000	$2,000	$40,200

Cherry Lane Underpass

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$42,200	$906,540			
Proposed Conditions	$2,000	$42,964	$864,000	$246,000	3.51

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Cherry Lane Underpass

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	1070	$45.00	$48,150.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	80	$10.00	$800.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	30	$80.00	$2,400.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	20	$100.00	$2,000.00
	LONGITUDENAL GRATE	L SUM	1	$25,000.00	$25,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	170	$75.00	$12,750.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	620	$90.00	$55,800.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	4	$3,500.00	$14,000.00
	HIGH FLOW INLET	EACH	2	$10,000.00	$20,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$5,000.00	$5,000.00
				SUBTOTAL	$186,000.00
				CONTINGENCY 10%	$19,000.00
				TOTAL	**$205,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$31,000.00	$31,000.00
	EASEMENT ACQUISITION	LSUM	1	$10,000.00	$10,000.00
				TOTAL	**$41,000.00**

ESTIMATED TOTAL COST	**$246,000.00**

Church Street (Near Chapel Court)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$20,000	$20,000	$2,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,000

Church Street (Near Chapel Court)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$2,000	$42,964			
Proposed Conditions	$0	$0	$43,000	$80,000	0.54

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Church Street (Near Chapel Court)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
	SEEDING, CLASS 2	ACRE	0.11	$10,000.00	$1,100.00
	TRENCH BACKFILL	CU YD	30	$45.00	$1,350.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	40	$10.00	$400.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	10	$80.00	$800.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	10	$100.00	$1,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	360	$75.00	$27,000.00
	HIGH FLOW INLET	EACH	2	$10,000.00	$20,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$2,000.00	$2,000.00
				SUBTOTAL	$55,000.00
				CONTINGENCY 10%	$6,000.00
				TOTAL	**$61,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$9,000.00	$9,000.00
	EASEMENT ACQUISITION	LSUM	1	$10,000.00	$10,000.00
				TOTAL	**$19,000.00**

ESTIMATED TOTAL COST	**$80,000.00**

Curb Failure along WFNBCR (Behind 1941 Cherry Lane)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$5,000	$5,000	$500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$500

Curb Failure along WFNBCR (Behind 1941 Cherry Lane)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$500	$10,741			
Proposed Conditions	$0	$0	$11,000	$41,000	0.27

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 7 - Curb Failure along WFNBCR (Behind 1941 Cherry Lane)

Curb Failure along WFNBCR (Behind 1941 Cherry Lane)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	CURB AND GUTTER REMOVAL	FOOT	200	$15.00	$3,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	130	$10.00	$1,300.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	50	$80.00	$4,000.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	30	$100.00	$3,000.00
	SLOTTED DRAIN 12"	FOOT	220	$60.00	$13,200.00
	MANHOLES, TYPE A, 4' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$1,850.00	$1,850.00
	GUARDRAIL	FOOT	200	$30.00	$6,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$1,000.00	$1,000.00
				SUBTOTAL	$33,000.00
				CONTINGENCY 10%	$3,000.00
				TOTAL	**$36,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$5,000.00	$5,000.00
				TOTAL	**$5,000.00**

ESTIMATED TOTAL COST	**$41,000.00**

Dehne's Subdivision (Dehne Road, Brentwood Road)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$15,000	$15,000	$1,500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$7,500	$7,500	$1,000	$500

Dehne's Subdivision (Dehne Road, Brentwood Road)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$1,500	$32,223			
Proposed Conditions	$1,000	$21,482	$11,000	$109,000	0.10

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 8 - Dehne's Subdivision (Dehne Road, Brentwood Road)

Dehne's Subdivision (Dehne Road, Brentwood Road)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	GRADING	L SUM	1	$25,000.00	$25,000.00
	SEEDING, CLASS 2	ACRE	0.4	$10,000.00	$4,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	190	$10.00	$1,900.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	70	$80.00	$5,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	50	$100.00	$5,000.00
	STORM SEWER, CLASS A, TYPE 2, 18"	FOOT	140	$85.00	$11,900.00
	HIGH FLOW INLET	EACH	3	$10,000.00	$30,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$3,000.00	$3,000.00
				SUBTOTAL	$86,000.00
				CONTINGENCY 10%	$9,000.00
				TOTAL	**$95,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$14,000.00	$14,000.00
				TOTAL	**$14,000.00**

ESTIMATED TOTAL COST	**$109,000.00**

Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Dundee Road/Skokie Boulevard

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$20,000	$20,000	$2,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,000

Dundee Road/Skokie Boulevard

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$2,000	$42,964			
Proposed Conditions	$0	$0	$43,000	$51,000	0.84

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 9 - Dundee Road/Skokie Boulevard

Dundee Road/Skokie Boulevard

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONST	DREDGING	CU YD	500	$45.00	$22,500.00
	SEEDING, CLASS 4	ACRE	0.2	$30,000.00	$6,000.00
	STORM SEWER AND INLET CLEANING	L SUM	1	$10,000.00	$10,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$1,000.00	$1,000.00
				SUBTOTAL	$40,000.00
				CONTINGENCY 10%	$4,000.00
				TOTAL	**$44,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$7,000.00	$7,000.00
				TOTAL	**$7,000.00**

ESTIMATED TOTAL COST	**$51,000.00**

Keystone Road/Chartres Drive

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	5	$1,365,000	$712,000	$163,000	$11,250	$5,000	$7,000	$10,100	$30,000	$2,303,350	$92,100	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$50,000	$50,000	$2,000	$90,100

Keystone Road/Chartres Drive

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$92,100	$1,978,492			
Proposed Conditions	$2,000	$42,964	$1,936,000	$635,000	3.05

Note: Assume the interest rate is 4%and a project life of 50 years

The following houses are calculated to have damage for the **25**-year storm event: 3035 Keystone, 3045 Keystone, 3055 Keystone, 3025 Rennes, 3028 Rennes
Assume project to benefit for roadway flooding during a 25-year storm event

Keystone Road/Chartres Drive

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	GRADING	L SUM	1	$10,000.00	$10,000.00
	EARTH EXCAVATION	CU YD	10200	$25.00	$255,000.00
	SEEDING, CLASS 2A	ACRE	0.3	$10,000.00	$3,000.00
	SEEDING, CLASS 4	ACRE	1.4	$30,000.00	$42,000.00
	TRENCH BACKFILL	CU YD	1240	$45.00	$55,800.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	100	$10.00	$1,000.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	40	$80.00	$3,200.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	20	$100.00	$2,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	1100	$75.00	$82,500.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	5	$3,500.00	$17,500.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$14,000.00	$14,000.00
				SUBTOTAL	$486,000.00
				CONTINGENCY 10%	$49,000.00
				TOTAL	**$535,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$80,000.00	$80,000.00
	EASEMENT ACQUISITION	LSUM	2	$10,000.00	$20,000.00
				TOTAL	**$100,000.00**

ESTIMATED TOTAL COST	**$635,000.00**

Northbrook East (Midway Road/Whitfield Road South Intersection) - 10-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	4	$753,000	$390,000	$12,000	$9,000	$4,000	$5,600	$8,100	$100,000	$1,281,700	$128,000	-
Proposed Conditions	0	$0	$0	$2,000	$0	$0	$0	$0	$0	$2,000	$0	$128,000

Northbrook East (Midway Road/Whitfield Road South Intersection) - 25-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	9	$1,778,000	$921,000	$27,000	$20,250	$9,000	$12,600	$18,200	$225,000	$3,011,050	$120,000	-
Proposed Conditions	2	$329,000	$170,000	$4,000	$4,500	$2,000	$2,800	$4,000	$50,000	$566,300	$23,000	$97,000

Northbrook East (Midway Road/Whitfield Road South Intersection) - 50-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	13	$2,449,000	$1,270,000	$51,000	$29,250	$13,000	$18,200	$26,300	$325,000	$4,181,750	$84,000	-
Proposed Conditions	2	$331,000	$171,000	$4,000	$4,500	$2,000	$2,800	$4,000	$50,000	$569,300	$11,000	$73,000

Northbrook East (Midway Road/Whitfield Road South Intersection) - 100-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	20	$3,917,000	$2,032,000	$80,000	$45,000	$20,000	$28,000	$40,400	$500,000	$6,662,400	$67,000	-
Proposed Conditions	3	$529,000	$273,000	$6,000	$6,750	$3,000	$4,200	$6,100	$75,000	$903,050	$9,000	$58,000

Northbrook East (Midway Road/Whitfield Road South Intersection) - 10-Year

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$128,000	$2,749,696			
Proposed Conditions	$0	$0	$2,750,000	$718,000	3.83

Note: Assume the interest rate is 4%and a project life of 50 years

Northbrook East (Midway Road/Whitfield Road South Intersection) - 25-Year

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$120,000	$2,577,840			
Proposed Conditions	$23,000	$494,086	$2,084,000	$718,000	2.90

Note: Assume the interest rate is 4%and a project life of 50 years

Northbrook East (Midway Road/Whitfield Road South Intersection) - 50-Year

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$84,000	$1,804,488			
Proposed Conditions	$11,000	$236,302	$1,568,000	$718,000	2.18

Note: Assume the interest rate is 4%and a project life of 50 years

Northbrook East (Midway Road/Whitfield Road South Intersection) - 100-Year

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$67,000	$1,439,294			
Proposed Conditions	$9,000	$193,338	$1,246,000	$718,000	1.74

Note: Assume the interest rate is 4%and a project life of 50 years

Northbrook East (Midway Road/Whitfield Road South Intersection)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCAVATION	CU YD	6900	$25.00	$172,500.00
	TRENCH BACKFILL	CU YD	1100	$45.00	$49,500.00
	SEEDING, CLASS 4	ACRE	1.8	$30,000.00	$54,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	260	$10.00	$2,600.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	90	$80.00	$7,200.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	60	$100.00	$6,000.00
	PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH	SQ FT	12750	$4.50	$57,375.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	350	$75.00	$26,250.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	450	$90.00	$40,500.00
	STORM SEWER, CLASS A, TYPE 2, 42"	FOOT	735	$115.00	$84,525.00
	MANHOLES, TYPE A, 5' DIAMETER, TYPE 1 FRAME AND LID	EACH	2	$2,500.00	$5,000.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$3,500.00	$3,500.00
	MANHOLES, TYPE A, 7' DIAMETER, TYPE 1 FRAME AND LID	EACH	2	$7,500.00	$15,000.00
	HIGH FLOW INLET	EACH	4	$10,000.00	$40,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$3,000.00	$3,000.00
				SUBTOTAL	$567,000.00
				CONTINGENCY 10%	$57,000.00
				TOTAL	**$624,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$94,000.00	$94,000.00
				TOTAL	**$94,000**

ESTIMATED TOTAL COST	**$718,000.00**

Northbrook Manor (Spruce Street)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$75,000	$75,000	$1,500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,500

Northbrook Manor (Spruce Street)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$1,500	$32,223			
Proposed Conditions	$0	$0	$32,000	$446,000	0.07

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 50-year storm event

Project 12 - Northbrook Manor (Spruce Street)

Northbrook Manor (Spruce Street)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	1560	$45.00	$70,200.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	1710	$10.00	$17,100.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	620	$80.00	$49,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	360	$100.00	$36,000.00
	STORM SEWER, CLASS A, TYPE 2, 12"	FOOT	125	$65.00	$8,125.00
	STORM SEWER, CLASS A, TYPE 2, 18"	FOOT	435	$75.00	$32,625.00
	STORM SEWER, CLASS A, TYPE 2, 48"	FOOT	860	$110.00	$94,600.00
	MANHOLES, TYPE A, 4' DIAMETER, TYPE 1 FRAME AND LID	EACH	2	$1,850.00	$3,700.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	4	$3,500.00	$14,000.00
	CATCH BASIN	EACH	6	$1,500.00	$9,000.00
	COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.24	FOOT	480	$25.00	$12,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$6,000.00	$6,000.00
				SUBTOTAL	$353,000.00
				CONTINGENCY 10%	$35,000.00
				TOTAL	**$388,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$58,000.00	$58,000.00
				TOTAL	**$58,000.00**

ESTIMATED TOTAL COST	**$446,000.00**

Ridge Road/Lee Road

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$10,000	$10,000	$1,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,000

Ridge Road/Lee Road

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$1,000	$21,482			
Proposed Conditions	$0	$0	$21,000	$60,000	0.35

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 13 - Ridge Road/Lee Road

Ridge Road/Lee Road

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	30	$45.00	$1,350.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	46	$10.00	$460.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	20	$80.00	$1,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	10	$100.00	$1,000.00
	STORM SEWER, CLASS A, TYPE 2, 12"	FOOT	40	$65.00	$2,600.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	300	$75.00	$22,500.00
	DITCH REGRADING	L SUM	1	$5,000.00	$5,000.00
	MANHOLES, TYPE A, 4' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$2,500.00	$2,500.00
	INLET	EACH	2	$3,000.00	$6,000.00
	CATCH BASIN	EACH	2	$1,500.00	$3,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$1,000.00	$1,000.00
				SUBTOTAL	$47,000.00
				CONTINGENCY 10%	$5,000.00
				TOTAL	**$52,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$8,000.00	$8,000.00
				TOTAL	**$8,000.00**

ESTIMATED TOTAL COST	**$60,000.00**

Project 13 - Ridge Road/Lee Road

6/15/2011

Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Shermer Road Outlet

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$25,000	$25,000	$500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$500

Shermer Road Outlet

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$500	$10,741			
Proposed Conditions	$0	$0	$11,000	$13,000	0.85

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 50-year storm event

Project 14 - Shermer Road Outlet

Shermer Road Outlet

SUMMARY OF QUANTITIES			ESTIMATE OF COST	
ITEM	UNIT	QUANTITY	UNIT PRICE	COST
REMOVE FLAP GATE	LSUM	1	$5,000.00	$5,000.00
MODIFY HIGH FLOW INLET	EACH	1	$5,000.00	$5,000.00
			SUBTOTAL	$10,000.00
			CONTINGENCY 10%	$1,000.00
			TOTAL	**$11,000.00**
ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$2,000.00	$2,000.00
			TOTAL	**$2,000.00**

ESTIMATED TOTAL COST	**$13,000.00**

Project 14 - Shermer Road Outlet

Shermer Road Underpass

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$30,000	$30,000	$600	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$600

Shermer Road Underpass

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$600	$12,889			
Proposed Conditions	$0	$0	$13,000	$332,000	0.04

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 50-year storm event

Project 15 - Shermer Road Underpass

Shermer Road Underpass

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	1670	$45.00	$75,150.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	270	$10.00	$2,700.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	100	$80.00	$8,000.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	60	$100.00	$6,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	40	$75.00	$3,000.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	1150	$90.00	$103,500.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	4	$3,500.00	$14,000.00
	HIGH FLOW INLET	EACH	4	$10,000.00	$40,000.00
	CATCH BASIN	EACH	2	$1,500.00	$3,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$8,000.00	$8,000.00
				SUBTOTAL	$263,000.00
				CONTINGENCY 10%	$26,000.00
				TOTAL	**$289,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$43,000.00	$43,000.00
				TOTAL	**$43,000.00**

ESTIMATED TOTAL COST	**$332,000.00**

Sunny Acres (Pamella Lane, Constance Lane)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	3	$750,000	$375,000	$30,000	$6,750	$3,000	$4,200	$6,100	$10,000	$1,185,050	$119,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$119,000

Sunny Acres (Pamella Lane, Constance Lane)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$119,000	$2,556,358			
Proposed Conditions	$0	$0	$2,556,000	$614,000	4.16

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 16 - Sunny Acres

Sunny Acres (Pamella Lane, Constance Lane)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TREE REMOVAL	ACRE	0.5	$15,000.00	$7,500.00
	EARTH EXCAVATION	CU YD	1592	$25.00	$39,800.00
	SEEDING, CLASS 2A	ACRE	0.32	$10,000.00	$3,200.00
	TRENCH BACKFILL	CU YD	750	$45.00	$33,750.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	100	$10.00	$1,000.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	40	$80.00	$3,200.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	20	$100.00	$2,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	660	$75.00	$49,500.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	7	$3,500.00	$24,500.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$5,000.00	$5,000.00
				SUBTOTAL	$169,000.00
				CONTINGENCY 10%	$17,000.00
				TOTAL	**$186,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$28,000.00	$28,000.00
	PROPERTY ACQUISITION	LSUM	1	$400,000.00	$400,000.00
				TOTAL	**$428,000.00**

ESTIMATED TOTAL COST	**$614,000.00**

Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Sunset Lane												
	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$20,000	$20,000	$2,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$7,500	$7,500	$1,000	$1,000

Sunset Lane					
	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$2,000	$42,964			
Proposed Conditions	$1,000	$21,482	$21,000	$432,000	0.05

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 17 - Sunset Lane

Sunset Lane

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCAVATION	CU YD	4000	$25.00	$100,000.00
	SEEDING, CLASS 2	ACRE	2.4	$10,000.00	$24,000.00
	TRENCH BACKFILL	CU YD	890	$45.00	$40,050.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	80	$10.00	$800.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	30	$80.00	$2,400.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	20	$100.00	$2,000.00
	STORM SEWER, CLASS A, TYPE 2, 12"	FOOT	460	$65.00	$29,900.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	960	$90.00	$86,400.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	5	$3,000.00	$15,000.00
	HIGH FLOW INLET	EACH	2	$9,000.00	$18,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$6,000.00	$6,000.00
				SUBTOTAL	$325,000.00
				CONTINGENCY 10%	$33,000.00
				TOTAL	**$358,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$54,000.00	$54,000.00
	EASEMENT ACQUISITION	LSUM	2	$10,000.00	$20,000.00
				TOTAL	**$74,000.00**

ESTIMATED TOTAL COST	**$432,000.00**

Techny Drain Basin Expansion

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$60,000	$60,000	$6,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$40,000	$40,000	$4,000	$2,000

Techny Drain Basin Expansion

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$6,000	$128,892			
Proposed Conditions	$4,000	$85,928	$43,000	$268,000	0.16

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 18 - Techny Drain Basin Expansion (at Glenbrook North High School)

Techny Drain Basin Expansion

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCATION	CU YD	5833	$30.00	$174,990.00
	SEEDING, CLASS 4	ACRE	0.75	$30,000.00	$22,500.00
	SOIL EROSION PROTECTION AND SEDIMENT CONTROL	L SUM	1	$15,000.00	$15,000.00
				SUBTOTAL	$212,000.00
				CONTINGENCY 10%	$21,000.00
				TOTAL	**$233,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$35,000.00	$35,000.00
				TOTAL	**$35,000**

ESTIMATED TOTAL COST	**$268,000.00**

Project 18 - Techny Drain Basin Expansion
(at Glenbrook North High School)

8/2/2011

Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Weller's Subdivison (Weller, Hillcrest, Christina Lanes)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$15,000	$15,000	$1,500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,500

Weller's Subdivison (Weller, Hillcrest, Christina Lanes)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$1,500	$32,223			
Proposed Conditions	$0	$0	$32,000	$784,000	0.04

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 19 - Wellers Subdivision (Weller, Hillcrest, Christina Lanes)

Weller's Subdivison (Weller, Hillcrest, Christina Lanes)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TREE REMOVAL	ACRE	1	$15,000.00	$15,000.00
	EARTH EXCAVATION	CU YD	6500	$25.00	$162,500.00
	SEEDING, CLASS 2A	ACRE	1.6	$10,000.00	$16,000.00
	STORM SEWER, CLASS A, TYPE 2, 12"	FOOT	70	$60.00	$4,200.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	1100	$75.00	$82,500.00
	MANHOLES, TYPE A, 5' DIAMETER, TYPE 1 FRAME AND LID	EACH	6	$2,500.00	$15,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$9,000.00	$9,000.00
				SUBTOTAL	$304,000.00
				CONTINGENCY 10%	$30,000.00
				TOTAL	**$334,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$50,000.00	$50,000.00
	PROPERTY ACQUISITION	LSUM	1	$400,000.00	$400,000.00
				TOTAL	**$450,000.00**

ESTIMATED TOTAL COST	**$784,000.00**

Project 19 - Wellers Subdivision (Weller, Hillcrest, Christina Lanes)

8/11/2011

Western Avenue/Oak Avenue (Wescott Road to Shermer Road)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$75,000	$75,000	$3,000	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$30,000	$30,000	$1,000	$2,000

Western Avenue/Oak Avenue (Wescott Road to Shermer Road)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$3,000	$64,446			
Proposed Conditions	$1,000	$21,482	$43,000	$651,000	0.07

Note: Assume the interest rate is 4%and a project life of 50 years

Project 20 - Western Avenue/Oak Avenue (Wescott Road to Shermer Road)

Western Avenue/Oak Avenue (Wescott Road to Shermer Road)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	TRENCH BACKFILL	CU YD	1720	$45.00	$77,400.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	2670	$10.00	$26,700.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	960	$80.00	$76,800.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	470	$100.00	$47,000.00
	STORM SEWER, CLASS A, TYPE 2, 12"	FOOT	60	$65.00	$3,900.00
	STORM SEWER, CLASS A, TYPE 2, 48"	FOOT	2000	$110.00	$220,000.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	6	$3,500.00	$21,000.00
	CATCH BASIN	EACH	12	$1,500.00	$18,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$8,000.00	$8,000.00
				SUBTOTAL	$499,000.00
				CONTINGENCY 10%	$50,000.00
				TOTAL	**$549,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$82,000.00	$82,000.00
				TOTAL	**$82,000.00**

ESTIMATED TOTAL COST	**$631,000.00**

Village of Northbrook
Master Stormwater Management Plan
Benefit-Cost Ratio Determination

Williamsburg Drive/Old Post Road - 10-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	2	$500,000	$250,000	$4,500	$2,000	$2,800	$4,000	$35,000	$798,300	$80,000	-
Proposed Conditions	2	$500,000	$250,000	$4,500	$2,000	$2,800	$4,000	$12,000	$775,300	$78,000	$2,000

Williamsburg Drive/Old Post Road - 50-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	3	$694,000	$360,000	$6,750	$3,000	$4,200	$6,100	$25,000	$1,099,050	$22,000	-
Proposed Conditions	2	$500,000	$250,000	$4,500	$2,000	$2,800	$4,000	$12,000	$775,300	$16,000	$6,000

Williamsburg Drive/Old Post Road - 100-Year Storm Event

	Number of Structures Damaged	Structural Damage	Contents Damage	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	5	$1,222,000	$631,000	$11,250	$5,000	$7,000	$10,100	$30,000	$1,916,350	$19,000	-
Proposed Conditions	3	$750,000	$375,000	$6,750	$3,000	$4,200	$6,100	$18,000	$1,163,050	$12,000	$7,000

Williamsburg Drive/Old Post Road - 10-Year Storm Event

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$80,000	$1,718,560			
Proposed Conditions	$78,000	$1,675,596	$43,000	$270,000	0.16

Note: Assume the interest rate is 4%and a project life of 50 years

Williamsburg Drive/Old Post Road - 50-Year Storm Event

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$22,000	$472,604			
Proposed Conditions	$16,000	$343,712	$129,000	$832,000	0.16

Note: Assume the interest rate is 4%and a project life of 50 years

Williamsburg Drive/Old Post Road - 100-Year Storm Event

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$19,000	$408,158			
Proposed Conditions	$12,000	$257,784	$150,000	$1,230,000	0.12

Note: Assume the interest rate is 4%and a project life of 50 years

Williamsburg Drive/Old Post Road (10-Year Design)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCAVATION	CU YD	3410	$25.00	$85,250.00
	TRENCH BACKFILL	CU YD	460	$45.00	$20,700.00
	SEEDING, CLASS 4	ACRE	0.3	$30,000.00	$9,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	50	$10.00	$500.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	20	$80.00	$1,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	10	$100.00	$1,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	215	$75.00	$16,125.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	155	$90.00	$13,950.00
	MANHOLES, TYPE A, 5' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$2,500.00	$2,500.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$3,500.00	$3,500.00
	HIGH FLOW INLET	EACH	4	$10,000.00	$40,000.00
	COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.24	FOOT	40	$25.00	$1,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$2,000.00	$2,000.00
				SUBTOTAL	$197,000.00
				CONTINGENCY10%	$20,000.00
				TOTAL	**$217,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$33,000.00	$33,000.00
	EASEMENT ACQUISITION	LSUM	2	$10,000.00	$20,000.00
				TOTAL	**$53,000.00**

ESTIMATED TOTAL COST	**$270,000.00**

Williamsburg Drive/Old Post Road (50-year Design)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCAVATION	CU YD	3410	$25.00	$85,250.00
	TRENCH BACKFILL	CU YD	460	$45.00	$20,700.00
	SEEDING, CLASS 4	ACRE	0.3	$30,000.00	$9,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	1990	$10.00	$19,900.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	720	$80.00	$57,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	480	$100.00	$48,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	215	$75.00	$16,125.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	155	$90.00	$13,950.00
	STORM SEWER, CLASS A, TYPE 2, 48"	FOOT	2500	$115.00	$287,500.00
	MANHOLES, TYPE A, 5' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$2,500.00	$2,500.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	6	$3,500.00	$21,000.00
	HIGH FLOW INLET	EACH	4	$10,000.00	$40,000.00
	COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.24	FOOT	40	$25.00	$1,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$19,000.00	$19,000.00
				SUBTOTAL	$642,000.00
				CONTINGENCY10%	$64,000.00
				TOTAL	**$706,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$106,000.00	$106,000.00
	EASEMENT ACQUISITION	LSUM	2	$10,000.00	$20,000.00
				TOTAL	**$126,000.00**

ESTIMATED TOTAL COST	**$832,000.00**

Williamsburg Drive/Old Post Road (100-year Design)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	EARTH EXCAVATION	CU YD	3410	$25.00	$85,250.00
	TRENCH BACKFILL	CU YD	460	$45.00	$20,700.00
	SEEDING, CLASS 4	ACRE	0.3	$30,000.00	$9,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	1990	$10.00	$19,900.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	720	$80.00	$57,600.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	480	$100.00	$48,000.00
	STORM SEWER, CLASS A, TYPE 2, 24"	FOOT	215	$75.00	$16,125.00
	STORM SEWER, CLASS A, TYPE 2, 36"	FOOT	155	$90.00	$13,950.00
	STORM SEWER, CLASS A, TYPE 2, 48"	FOOT	5000	$115.00	$575,000.00
	MANHOLES, TYPE A, 5' DIAMETER, TYPE 1 FRAME AND LID	EACH	1	$2,500.00	$2,500.00
	MANHOLES, TYPE A, 6' DIAMETER, TYPE 1 FRAME AND LID	EACH	11	$3,500.00	$38,500.00
	HIGH FLOW INLET	EACH	4	$10,000.00	$40,000.00
	COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.24	FOOT	40	$25.00	$1,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$28,000.00	$28,000.00
				SUBTOTAL	$956,000.00
				CONTINGENCY10%	$96,000.00
				TOTAL	**$1,052,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$158,000.00	$158,000.00
	EASEMENT ACQUISITION	LSUM	2	$10,000.00	$20,000.00
				TOTAL	**$178,000.00**

ESTIMATED TOTAL COST	**$1,230,000.00**

Woodlawn Road (Penfold Place to Shermer Road)

	Number of Structures Damaged	Structural Damage	Contents Damage	Associated Damages	Automobile Damage	Exterior Damage	Displacement Cost	Lost Wages and Income	Public Works Costs	Total Costs	Total Flood Damage Per Year	Benefits per Year
Existing Conditions	0	$0	$0	$0	$0	$0	$0	$0	$15,000	$15,000	$1,500	-
Proposed Conditions	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,500

Woodlawn Road (Penfold Place to Shermer Road)

	Total Flood Damage per Year	Present Worth Damages	Net Benefit	Project Costs	Benefit / Cost Ratio
Existing Conditions	$1,500	$32,223			
Proposed Conditions	$0	$0	$32,000	$140,000	0.23

Note: Assume the interest rate is 4%and a project life of 50 years

Assume structural damage cost $250,000, content damage $125,000, and $10,000 per structure.
Assume project to benefit for roadway flooding during a 10-year storm event

Project 22 - Woodlawn Road (Penfold Place to Shermer Road)

Woodlawn Road (Penfold Place to Shermer Road)

	SUMMARY OF QUANTITIES			ESTIMATE OF COST	
	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION	GRADING	L SUM	1	$20,000.00	$20,000.00
	SEEDING, CLASS 2	ACRE	0.2	$10,000.00	$2,000.00
	AGGREGATE BASE COURSE, TYPE A 6"	SQ YD	500	$10.00	$5,000.00
	HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N70	TON	180	$80.00	$14,400.00
	HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70	TON	120	$100.00	$12,000.00
	STORM SEWER, CLASS A, TYPE 2, 18"	FOOT	410	$85.00	$34,850.00
	HIGH FLOW INLET	EACH	2	$10,000.00	$20,000.00
	TRAFFIC CONTROL AND PROTECTION	L SUM	1	$3,000.00	$3,000.00
				SUBTOTAL	$111,000.00
				CONTINGENCY 10%	$11,000.00
				TOTAL	**$122,000.00**
	ENGINEERING (15% CONSTRUCTION COST)	LSUM	1	$18,000.00	$18,000.00
				TOTAL	**$18,000.00**

ESTIMATED TOTAL COST	**$140,000.00**

STORMWATER MANAGEMENT PLAN HISTORY

As a result of three major flood events, two in 1982 and another in 1987, and floodplain regulation changes, Village residents and the Village Board became sensitized to the need to improve floodplain stormwater management in the Village. Village records showed that water-damaged personal items were picked up at 818 locations (1 out of 12 homes) after the 1987 flood. Village Staff prepared a report after the 1987 flood which identified flooding or stormwater problems at a number of broadly defined areas throughout the Village. Most areas were not in identified floodplains.

After reviewing Village drainage and flooding problems, it was apparent to Village Staff that the need for stormwater management planning extended beyond floodplain areas to encompass all areas and aspects of Village drainage. As the Village continued a pattern of development of infill areas and redevelopment of existing properties, increased impervious surfaces would continue to add runoff to flood-prone areas. With a long history of stormwater management problems, new rainfall data (which indicated the existing detention basins were designed for less severe storms than previously thought), and the need to have a comprehensive means of addressing stormwater management, Village Staff recommended to the Board that the Village prepare and adopt a Comprehensive MSMP.

In February of 1992 the Board of Trustees of the Village of Northbrook contracted with BASCOR Inc., to prepare a SWMP for the Village of Northbrook. This action was in response to a long history of stormwater management complaints, floodplain issues and flooding problems throughout the Village. One significant issue of concern to the Board and Village residents was the impact of flooding and floodplain issues on property values. In recognition of these Village-wide concerns, the Board determined that the Village should establish a process and plan to address stormwater management within the Village. This led to the preparation and issue of the Original SWMP which was adopted in October 1993.

Prior to the Original 1993 SWMP, stormwater management efforts by the Village had included the enactment of a floodplain ordinance and numerous detailed studies and proposals to address flooding within specific areas of the Village. The SWMP was intended to serve as a guidance document for future stormwater management activities of the Village. To provide for representative citizen input during the development of the SWMP, the Board established an Ad Hoc Stormwater Management Committee (the Committee). The Committee's charge was to review the SWMP in progress, coordinate with BASCOR on behalf of the Village, and make recommendations concerning the SWMP to the Board. At the request of the Board, in June 1993, the Committee became a permanently established Stormwater Management Commission under Village Code.

The Original 1993 SWMP outlined specific improvement projects prioritized through a standardized method recommended by the Committee and approved by the Board. Also included were in the SWMP were proposed programs which could include cost sharing by individual property owners as well as recommendations for modifications to the Village's existing ordinances and regulations. These improvements were specifically selected and evaluated to ensure that the improvements proposed would neither accelerate the rate nor increase the volume of water delivered to downstream properties

subject to flood damage.
The Original SWMP was updated twice, in 1996 and 2002. The basic purposes of the updates can be summarized as follows:

- Guide residents and property owners regarding how to pursue their stormwater problems within the Village
- Guide the Village Board, Staff and Stormwater Management Commission regarding how to address ongoing Village stormwater management concerns
- Coordinate Village-wide stormwater management activities
- Prioritize necessary improvements
- Establish continuity in Village ordinances and regulations regarding stormwater management.
- Suggest funding sources available to the Village for stormwater management
- Create programs, as appropriate, to assist residents or property owners in addressing their individual stormwater problems
- Establish a process for continual maintenance of the SWMP

In September of 1995, the Board contracted with TY Lin International BASCOR, Inc. (TYLIN BASCOR) to update the Original SWMP to account for the revised floodplain boundaries of Techny Drain, Underwriters Tributary, and the West Fork of the North Branch of the Chicago River. TYLIN BASCOR performed a re-study of these three floodplains under contracts with the Federal Emergency Management Agency (FEMA) and the Village of Northbrook. The new data was utilized to re-evaluate the proposed project improvements, costs and benefits of the Original SWMP. The cost/benefit data were refined and construction projects were identified.

Subsequent to the 1996 issue of the Second Edition of the SWMP, the Underwriters Tributary project was completed, and further engineering analysis of project alternatives resulted in the modification of the nature of the proposed Northbrook Park, Sunset Fields and Techny Drain (phase III and IV currently under design) projects. The evolution of these projects, the addition of other potential projects, and the need to update the cost/benefit dollars presented in the Second Edition resulted in the Village contracting with Kimley-Horn Inc. and Associates, (KHA) in June of 2001 to provide a third update of the SWMP. That update included the re-evaluation and prioritization of projects.

In October of 2001, the Village experienced a storm event which, due to an already high antecedent moisture condition within the Village, resulted in floodwater levels in some areas equivalent to those expected from a 100-year event. The Stormwater Management Commission sent out a survey to residents and businesses which included stormwater conveyance and flood related questions to be used in further evaluation as well as for the targeting of currently unidentified flood prone and project/program worthy areas. The Commission then requested that this information be incorporated into the planning revision process to ensure a more accurate outline of problem areas, proposed solutions and project costs. This resulted in the August 16, 2002 (Third Edition) of the SWMP by KHA.

Subsequent to the 2002 issue of the Third Edition, the Village began the initial steps of the Techny Drain Stormwater Management Improvements. Two of the four stages of the project have been constructed, and the remaining two stages are in the design phase. The full implementation of this initiative will reduce or eliminate much of the recent

flooding in the Techny Watershed.

In June 2010, the Village contracted with Hampton, Lenzini and Renwick, Inc. for a revised and re-thought version of the SWMP. The MSMP would have a similar structure but all prioritized and non-prioritized project not completed would be re-evaluated for benefits to the community. The additions of numerous new projects to address areas affected by recent flooding were included in the expanded list of projects considered. The projects were researched and evaluated, and have been assigned estimated cost and benefit values associated with their recommended improvements.

The MSMP, August, 2011, considers the following refinement:

- It was recognized that many of the previously identified projects were too large and costly and the need to modify them into smaller, more affordable projects was apparent.
- It is the intent that the MSMP will be relevant for 20 years with updates required at approximate 5 year intervals.
- Additional projects have been identified as a result of more recent rainfall events, including the September 13-14, 2008 event.
- Project cost estimates are updated to 2011 costs and include engineering and permitting costs.
- The draft 2009 MWRDGC Watershed Development Ordinance and Technical Guidance Manual and anticipated adoption in 2011 has been considered.
- The advent of MWRDGC as a funding source for Regional Projects is recognized.
- The advent of Watershed Planning Councils and Detailed Watershed Plans are recognized.
- The need for mitigation for projects involving increased conveyance is recognized.
- The ranking of projects includes the number of structures and properties benefitted.
- Guidance and recommendations to preserve project life and minimize potential for creating new problematic flooding areas is addressed.
- Increased impervious cover and loss of depressional storage is addressed.
- Addresses Watershed and Neighborhood flooding associated with older drainage systems.

ROLE OF THE STORMWATER MANAGEMENT COMMISSION

Since it was established in 1992 to work with residents, Staff, consultants, the Stormwater Management Commission has made valuable recommendations to the Board of Trustees. These recommendations addressed the level of funding requested from Village property owners for improvements, which improvements to construct and in what order, and how to address new stormwater management issues as they have occurred within the Village. The Commission's efforts, combined with the knowledge and foresight of Village Staff and the technical information included in the MSMP, should serve to continue to improve stormwater management within the Village of Northbrook.

PRIORITIZATION STANDARD AND LIMITATION CONSIDERATIONS

At the recommendation of BASCOR and the Commission, the Village Board established a method of prioritizing stormwater management improvements within the Village for the Original SWMP. This method, developed after extensive consideration of the issues, combined benefit-cost analysis with the effect a proposed improvement would have on Village residents, property owners, or businesses. Independent rankings of proposed improvements by benefit-cost and net number of structures benefited were calculated. These rankings were then equally weighted and combined into an overall ranking. Projects were then placed in the proper order based on the combined ranking.

The method used in the MSMP has been modified to include the estimated number of structures and properties benefitted due the critical nature of the flooding impacts. The overall ranking, based on low score, has been revised to combine the rankings of the benefit-cost ratio, properties benefited, and structures benefitted.

Limitations of these prioritization standards are dependent on the accuracy and level of detail utilized to determine

- Property values
- Projected costs
- Flood modeling
- Proposed design solution
- Flood level relative to buildings
- Low entry elevations to structures
- Property owners' recognition of the cause of basement flooding
- Information obtained from the Public Survey and other public and private sources
- Date of sources

The accuracy and level of detail which was reasonable to use in the preparation of the MSMP was constrained by available funding. Uniform assumptions were utilized throughout the Village so as not to favor one project, program or area as compared to another. Through the use of uniform assumptions, the relative ranking of individual projects does not change when a uniform assumption is changed.

EVALUATION STANDARDS AND LIMITATIONS

LEVEL OF FLOOD PROTECTION

In order to equitably compare all portions of the Village in the evaluation of stormwater management problems and their possible solutions, BASCOR recommended the selection of an intended "Level of Protection" for all properties within the Village. Level of protection would be stated in terms of years. To help understand level of protection, the following four statements all describe the same condition:

- "My property would be protected from damage from a storm of intensity and duration expected to occur on the average of once in every one-hundred years."
- "My property has protection from damage from a storm that has a one percent change of occurring in any given year."
- "My property is protected from the 100-year storm."
- "My property has an average storm reoccurrence interval of 100 years"

In 1987 the Illinois State Water Survey (ISWS) published new rainfall data referred to as Bulletin 70, which contains 80 years of historical data regarding storms occurring within the State of Illinois. Through statistical analysis, ISWS attempted to describe the intensity and duration of storms expected to occur at different intervals (on the average). With only 80 years of data, the ISWS may not have been able to include storms which occur at intervals greater than 80 years. Thus their evaluation of the 100-year storm is based on statistics alone, not on being sure that a 100-year storm is part of their records. (The 1987 storm which flooded Northbrook occurred after the ISWS work was complete).

As stated earlier, the most common means of describing level of protection (or duration and intensity of storm) is XX-year protection or an "XX-year storm." This has led to some confusion, as it implies that once the Village has seen a 10-year storm, another of the same duration and intensity will not occur for another ten years. Unfortunately, ISWS was only able to evaluate 80 years of data. In those 80 years, they may have found eight storms of intensity and duration that they would call "10-year storms" (8 x 10 = 80). These may have all occurred in the first forty years of record or the last forty years. Two of these storms may have occurred in consecutive years.

Excellent examples of this are the 1982 and 1987 storms occurring in the Village. These two events have been typified in the press as both being "100-year storms." However, it is possible that the 1982 storm occurred in the 98" year of a 100-year period and the 1987 storm occurred in the 3rd year of the next 100-year period. It is also possible that in the period from 1000 A.D. to 2000 A.D. no "100-year storm occurred in the 1600s or 1700s and that two or three or more 100-year storms could occur in the 1900s. For these reasons, the statement presented above referring to a "…one percent chance of occurring in any given year" provides the most accurate description of the level of protection that could be expected.

During preparation of the Original SWMP, it was recommended to the Commission that Village drainage facilities be evaluated for the 5-year level of protection. After some

evaluation, which demonstrated very little damage from the 5-year storm, this level was raised to and remains at a 10-year level of protection along major watercourses (draining greater than one square mile in area). It was then recommended, and the Commission agreed to evaluation of a 100-year level of protection, in line with federal flood insurance requirements (i.e. protection from a storm with a one percent chance of occurring in any given year).

Representative rainfall values for the Village of Northbrook from ISWS Bulletin 70 are:

- For the 10-year, 24-hour duration storm: 4.47 inches
- For the 100-year, 24-hour duration storm: 7.58 inches

A listing of historical recorded rainfall data is presented in this Appendix. The information in historical recorded rainfall has been updated to include rainfall data accumulated since the second report update was authored. The historical recorded rainfall now reflects rainfall data from January 1999 through the end of 2010.

FLOOD FREQUENCIES EVALUATED

Through coordination with the Commission, it was agreed to evaluate Village drainage facilities (as necessary) for the 10 (10%), 50 (2%), and 100 (1%) year events.

ANALYTICAL METHODS

HLR utilized several drainage software modeling programs to perform hydraulic and hydrologic evaluations and compute stormwater volumes, depths and velocities. These programs included HEC-HMS, HEC-RAS, and AdICPR Version 2.0. HEC-HMS and HEC-RAS are floodplain hydrologic and hydraulic models authored by the U.S. Army Corps of Engineers and utilized by state and federal agencies to determine flood elevations in streams and rivers. AdICPR (Advanced Interconnected Channel & Pond Routing) is a program which models the hydraulics and hydrology of a drainage and conveyance system. In addition, inteliSOLVE Hydraflow Storm Sewers and Hydraflow Hydrographs were used to evaluate local drainage systems. All of these programs are generally accepted for these types of analysis.

BENEFIT-COST FACTORS

For the purpose of evaluating the cost of proposed improvements, it was assumed that each project would have a typical life span of 50 years. Costs were based on 2011 prices. The cost estimates are for planning purposes and will require refinement during the detailed design of projects. The elements considered in development of the benefit-cost evaluations.

Benefit / Cost Analysis

The methodology involves the determination of annual benefits, annual costs over the project life for the storm event frequency being evaluated: It is calculated by the simple formula:

BCR = Project Estimated Total Cost/ Flood Reduction Costs

The engineer's opinion of probable costs (Project Estimated Total Cost) are utilized as the present worth costs of the proposed flood reduction project. The benefits for each project are given on an annual basis, and these benefits must be converted to a present worth benefit using the following formula:

$$PW = A\left\{\frac{\left[(1+I)^n - 1\right]}{\left[I \times (1+I)^n\right]}\right\}$$

In this formula, PW is the present worth of the annual benefits (A). I is the interest rate, which was assumed to be 4% (decimal equivalent in formula would be 0.04). "n" is the project life (in years), which was assumed to be 50 years based on the U.S. Army Corps of Engineers methodology.

The Flood Damage Cost Analysis is determined by the following:

A. Structure and Content Analysis

a. Structure Damage - Structure damage was calculated using the DEC-2 flood damage cost analysis computer program developed by the DuPage County Department of Development and Environmental Concerns (DEC). This program is similar to the URB1 model of the National Resource Conservation Service (NRCS) and is based on residential structure data, flood elevations and damage curves. Zillow.com and the Cook County Assessor's Office data was refered to for estimating the fair market value of each residence. The Water Surface Elevation (WSEL) estimated flood stage included the 10, 25, 50, and 100-year storm events and were used as the stage data in the DEC-2 model for existing and proposed conditions.

Structures first floor and low entry data is based upon the interpretation of the Village topographic maps and generally not upon surveyed information. The program assigns damage reduction values that correspond to difference between the existing and the proposed flood reduction elevation resulting from the Project

The damage curves used were formulated by the USACOE in 2003 to reflect recent damages. The 2003 USACOE damage curves replace the 1980's FEMA and IDNR-OWR curves that have been used in the past

b. Contents Damage - The DEC-2 model also calculated contents damage. The total value of contents for each structure is based on the 2003 USACOE damage curve.

B. Other Items added to the flood Damage Cost Analysis

a. Automobile Damage - Automobile damage was calculated by the following formula:

Auto Damage ($) = 0.075 x (1.5 cars/residence) x ($20,000/car) x (No. of flooded structures)

The garage was considered to be flooded if the predicted flood WSEL was greater than the top of foundation of the associated structure. This is consistent with the U.S. Army Corps of Engineers methodology.

b. Exterior Damage - Exterior property damage was calculated using the following formula:

Exterior Damage ($) = $1000 x (No. of Yards Flooded)

A yard was considered flooded if the predicted flood WSEL if the structure also experienced flooding.

c. Displacement Costs - The displacement cost for flooded structures reflects the displacement costs to residents for the time period where the floodwaters recede and their houses are repaired. It was calculated using the following formula:

Displacement Costs ($) = ($100/day) x (14 days) x (No. of flooded structures)

This reflects the FEMA methodology. A structure was considered to be flooded if the predicted flood Water Surface Elevation (WSEL) was greater than the low entry elevation of the structure.

d. Lost Wages and Income - The cost of lost wages represents the cost to residents of missed work during flood events. It was calculated using the following formula:

Lost Wages ($) = ($50000/yr) x (1yr/260 working days) x (7 days) x (1.5 residents / structure) x (No. of flooded structure)

A residential structure was considered to be flooded if the predicted flood WSEL was greater than the low entry elevation of the structure.

e. Public Works Costs - This is the cost borne by the Village for emergency activities during the storm event and follow-up activities after the storm event. The Public Works Cost for the existing conditions 100-year design storm event was verified by Village Staff.

C. Cost Items Not Considered

a. Displacement Costs for Structures in the Floodplain - The displacement costs for structures reflects the displacement of residents because floodwaters make their residence inaccessible. The projects were not evaluated for the displacement costs for structures in the floodplain since the project were evaluated on a smaller watershed based projects.

b. Road Detour Costs - The road detour cost reflects the income cost and mileage cost for residents having to change routes due to road closures. These costs were not considered relevant due to a relatively short duration of floodwater

c. Land Enhancement Benefits - This benefit reflects the change in property values due to the implementation of a flood control project.

d. Flood Insurance Costs - This benefit reflects the avoidance of homeowners from having to pay flood insurance if the proposed project lowers the floodplain enough to remove one or more structures from the floodplain. There is no mapped floodplain within the study project areas, and it was assumed that none of the residents currently pay flood insurance. An exception is the Techny Drain Phae IV (Project 3), however the data was not incorporated since the benefit for the project were perceived to not significantly affect the BCR and the Project Ranking

e. Recreational Facilities - This benefit reflects the increase in utility from recreational facilities that will result from a flood control alternative.

Determination of Total Flood Damages Per Year These costs were developed for the existing and proposed conditions. The flood damage costs for each flood event evaluated were converted to a yearly cost by multiplying the cost of each condition by their percentage chance of the storm happening within a 100 year period (i.e., 25 year storm event is 1/25 = 0.04 or 4%) The benefit from each alternative was calculated by multiplying the Benefits per year over the project life span, assumed to be 50 years (Refer to Project Benefit-Cost Ratio Determination Tables)

Determination of Project Estimated Total Cost The Project construction and property acquisition costs are based on upon limited available data used in the development of the project concept plan. The costs will need to be revised during the detailed construction plans preparation stage. The cost of each project includes a 10% contingency and a 15% engineering fee. The engineer's opinion of probable cost calculations are provided within this appendix (Refer to Project Estimated Total Cost).

PROCEDURE FOR DETERMINATION OF IMPROVEMENTS

DATA COLLECTION

In order to accurately assess the state of stormwater management, Hampton, Lenzini and Renwick, Inc. needed to gather as much information as reasonable within the funding limits established for preparation of the MSMP. An index of reviewed documents is included in this Appendix. Several sources of information were investigated, including:

VILLAGE RECORDS

An extensive review of Village files and records was conducted to gather and analyze information held by Village departments relative to stormwater management issues. This included a detailed review of

- Prior studies and plans for stormwater management improvements
- Various reports and photographs of major flooding events prepared by the Village of Northbrook
- Records of flooding complaints within the Village since 1982
- Documentation of flood control structure failure and other emergency maintenance issues
- Cost data (bid tabulations and unit prices) for completed stormwater projects and major stormwater components of other completed projects
- Stormwater and roadway related sections of the Village Capital Improvement Plan
- Stormwater related sections of the Village of Northbrook Ordinances and Regulations

VILLAGE MAPS

HLR reviewed several maps provided by the Village in order to gain a comprehensive understanding of the nature and location of reported/documented flooding problems in order to provide a thorough evaluation of currently proposed and potential stormwater solutions. These maps included

- Digital mapping of the current corporate limits of the Village of Northbrook
- Digital contour mapping covering the Village of Northbrook
- Digital aerial photography of the Village of Northbrook

FIELD INSPECTION OF PROBLEM AREAS

In preparation of the MSMP, HLR reviewed existing file data and coordinated with Village Staff and residents to determine the nature and cause of the stormwater problems in identified areas. For the net number of structures damaged, HLR reviewed previous work as well as information received from the Village Public Works Department. HLR performed field inspection of all projects sites to confirm the evaluations and recommended alternative(s) derived

OTHER RECORDS/INFORMATION

HLR also collected and reviewed available stormwater management information from the following local, state and federal agencies:

- Federal Emergency Management Agency
- Illinois Department of Transportation (District One Pavement Flooding Prioritization, 2009 Annual Report)
- Cook County Highway Department
- Illinois Department of Natural Resources, Division of Water Resources
- U.S. Army Corps of Engineers

PUBLIC SURVEYS

To further quantify the nature and extent of Village stormwater management problems, surveys of Village residents and property owners were conducted in May of 1992 and November 2001. In 2010, an online survey was conducted through the Village's website (See Village of Northbrook Property Owner Flooding Questionnaire).

In 1992, 13,000 surveys were mailed Village-wide to residents, property owners and businesses. Of the 3,148 surveys returned, 1,462 reported stormwater problems. Results of the 1992 survey are tabulated below.

REPORTS	PROBLEM (1992)
327	Sewer Backup
208	Sump Pump Failure
126	Basement Flooding Due to Power Outage
160	Street Flooding
149	Think they are in the Regulatory Floodplain
1,073	Think that they are not in the Regulatory Floodplain
1,733	Do not know if they are in the Regulatory Floodplain

In 2001, 17,000 surveys were mailed Village-wide to residents, property owners and businesses. Of the 1,349 surveys returned, 629 reported stormwater problems. Results of the 2001 survey are tabulated below.

REPORTS	PROBLEM (2001)
128	Sewer Backup
109	Sump Pump Failure
67	Basement Flooding Due to Power Outage
not included	Street Flooding
42	Think they are in the Regulatory Floodplain
604	Think that they are not in the Regulatory Floodplain
703	Do not know if they are in the Regulatory Floodplain

The 2010 web poll was linked to the Village's website from August through November. The survey was completed by 17 property owners reporting the problems tabulated below.

8	Street flooding in front of your residence
12	Street flooding in your neighborhood
9	Front yard flooding or ponding
10	Backyard flooding or ponding
3	Backyard flooding caused by stream/river/creek
0	Basement flooding due to seepage
5	Basement flooding due to window wells
5	Basement flooding due to sump pump failure/inadequacies
0	Basement flooding caused by stream/river/creek
1	Sewer backflow into basement
1	First floor flooding/damages

Interest in the overhead sanitary, drainage improvement, and battery backup programs was mixed. Not every respondent answered every question. The low response rate may have been due to the lack of a major rainfall event during the time the poll was available online.

Village of Northbrook Property Owner Flooding Questionnaire

The Village of Northbrook has started the process of completing a new Master Stormwater Management Plan (MSMP). The MSMP will be used by the Village as a guide to identify possible future stormwater projects to reduce flooding risks. This questionnaire will be used to understand problems that persist for the residences, properties or businesses and aid in the implementation of the MSMP. Any details that you provide could be used to prioritize project implementation.

1.Name

Address

2.Have you experienced any of the following at your property? (check all that apply):

- ☐ Street Flooding in front of your residence
- ☐ Street Flooding in your neighborhood
- ☐ Front yard flooding or ponding
- ☐ Backyard flooding or ponding
- ☐ Backyard flooding caused by stream/river/creek
- ☐ Basement flooding due to sewage
- ☐ Basement flooding due to window wells
- ☐ Basement flooding due to sump pump failure/inadequacies
- ☐ Basement flooding caused by stream/river/creek
- ☐ First floor flooding/damages

3.What area of the Village or intersection do you think urgently needs a stormwater management project to reduce flooding?

4.The Village of Northbrook is currently offering or considering the following programs for the residents:

Overhead Sanitary Sewer Conversion Cost Reimbursement - more info.

- ○ Already used the program
- ○ Interested in the program in the future
- ○ Not interested in the program
- ○ Don't know enough about
- ○ Not Applicable

Private Property Drainage/Flood Protection Cost Reimbursement - more info.

- ○ Already used the program
- ○ Interested in the program in the future
- ○ Not interested in the program
- ○ Don't know enough about
- ○ Not Applicable

Battery Backup Sump Pump Cost Reimbursement - more info.

- ○ Interested in the program in the future
- ○ Not interested in the program
- ○ Don't know enough about
- ○ Not Applicable

5.Please fill in the your opinion of the following statements:

Flooding is a major problem within the Village

- ○ Strongly Agree
- ○ Agree
- ○ Indifferent
- ○ Disagree
- ○ Strongly Disagree

The Village is making appropriate actions to reduce flooding

○ Strongly Agree ○ Agree ○ Indifferent ○ Disagree ○ Strongly Disagree

The Village is maintaining the stormwater infrastructure adequately

○ Strongly Agree ○ Agree ○ Indifferent ○ Disagree ○ Strongly Disagree

The Village should allocate additional resources to reduce flooding

○ Strongly Agree ○ Agree ○ Indifferent ○ Disagree ○ Strongly Disagree

6. Please list any additional comments:

7. Photographs of severe flooding may aid in the development of the Master Stormwater Management Plan. May we contact you about flooding you have witnessed?

○ No
○ Yes

Phone Number or email where you can be contacted at:

Best time to contact you:

Submit Reset

DATA AND INFORMATION REVIEWED SUMMARY

The following list is representative of the information that was obtained from the Village, on file at HLR or obtained from other sources.

Village of Northbrook GIS data

- 1991 Mapping, 1' contour intervals
- 2005 Aerial photography
- Storm sewer and utility atlases

Village of Northbrook SWMP

- Original-October 1993
- 2nd Edition, June, 1996
- 3rd Edition, August, 2002

Rainfall Data

- Power Point presentation, May 13th (2010) Storm
- Memorandum, Week of August 19, 2002 (8/21-8/22 heavy rains), August 23, 2002
- Memorandum, Week of April 28, 2003 (4/29 & 5/1-8/22 rains), May 2, 2003
- 2001-2010 digital rainfall data records
- Other Rainfall data (1987 August 14, 1987 storm event and 1995 through 2001 rainfall data
- Illinois State Water Survey
- Memorandum, September 13-14 (2008) Rainfall Event and Pictures, , November, 2008

Village of Northbrook Reports, Studies, Technical Memorandums and other information

- Hydraulic Analysis of the Cedar Lane/Ash Storm Sewer Network in the Village of Northbrook, CBBEL, January 2002
- Miscellaneous Stormwater Projects (Landwehr/Keystone Site and Cedar Lane Site), Technical Memorandums and Supporting Calculations for 60% Plan Submittal, Burns & McDonnell Engineering Co. Inc June 2007
- Grainger Property Detention Facility, Village of Northbrook, February 2010
- Northbrook Park/Sunset Field Relief Storm Sewer Study and Appendices, CBBEL (February 2003)
- Midway/Whitfield Intersection Stormwater Management Improvement Study and Appendices, CBBEL (April 2003)
- Property owner letter, Street Flooding by 3214 River Falls Drive and Village of Northbrook produced exhibits
- Sunset Lane Stormwater Management Study, Burns & McDonnell (March 2003)
- Williamsburg Square Subdivision Flooding, Memorandum, CBBEL (October 2008)
- Beneficial Modifications to Flood Control Reservoirs, Bonestroo, April 2010
- Draft report to the Village Board regarding the September 13-14, 2008 storm event and other supplemental exhibits/attachments
- Follow-up discussion of September 13-14, 2008 storm event
- May 13, 2010 storm event presentation slides.

- IDOT, District One Pavement Flooding Prioritization, 2009 Annual Report (Prepared by HLR)

Detailed Plans:

- IDOT Roadway Plans, Shermer Road, Techny Road to Meadow Road (March 1995)
- Village of Northbrook, Cattle Pass Stormwater Relief Swale (August 1999)
- Village of Northbrook, Dell Road Stormwater Management Improvements, (September, 1994)
- Village of Northbrook, Flapgate Improvements, Maple avenue, Oak Avenue, Illinois Road, Cedar Lane (1996)
- Cook County Department of Highways, Lee Road Walters to Dundee Road (2008)

MWRDGC

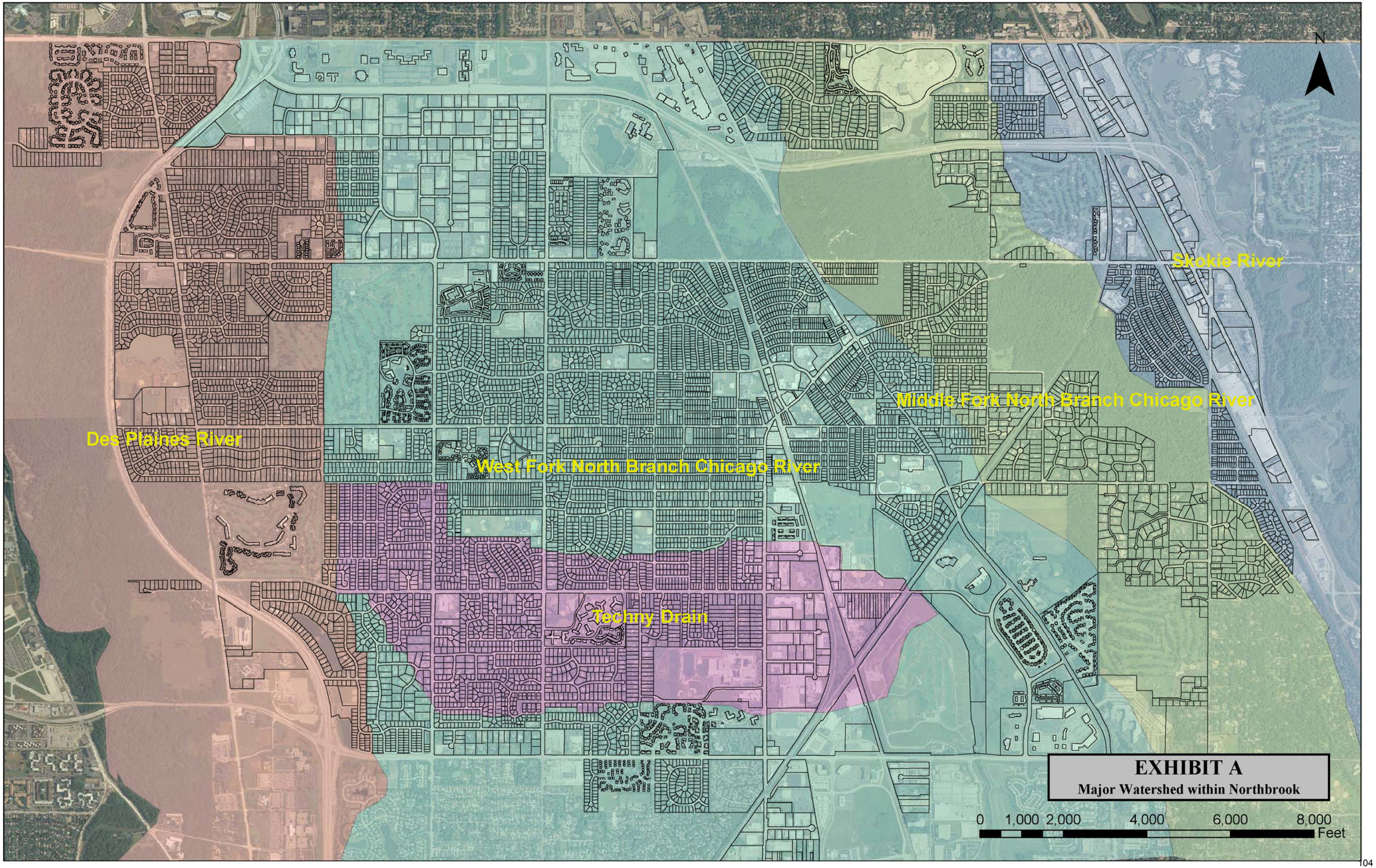
- Cook county Watershed Management Ordinance, Public Review Draft, September 24, 2009
- Cook county Watershed Management Ordinance, Draft Technical Guidance Manual, September 24, 2009
- North Branch of the Chicago River, Detailed Watershed Plan, November, 2010

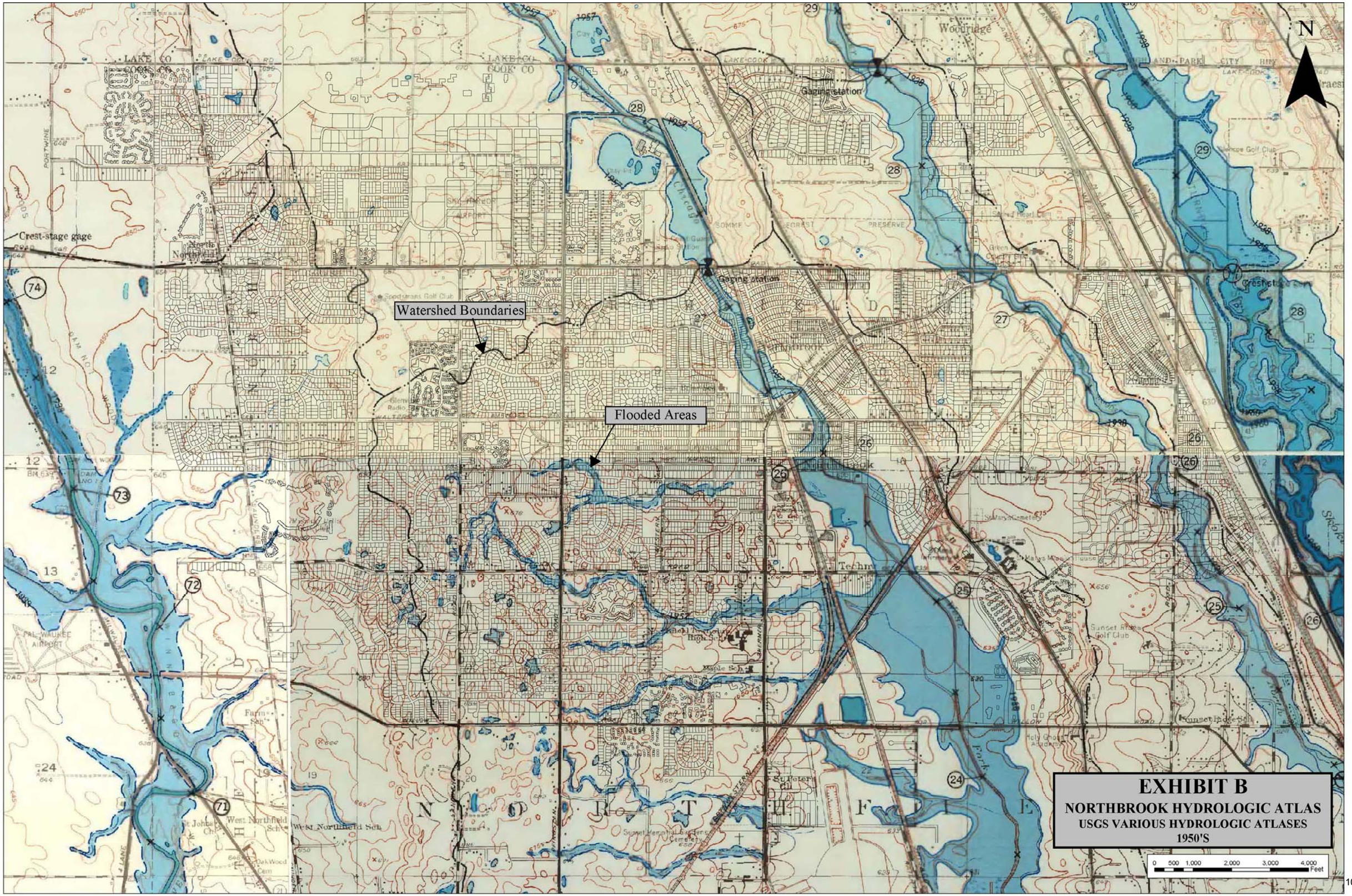
DuPage County, Department of Development and Stormwater, DEC-2, Flood Damage Cost Analysis Computer Program, Users Guide, May 1999 (Damage Curves Updated)

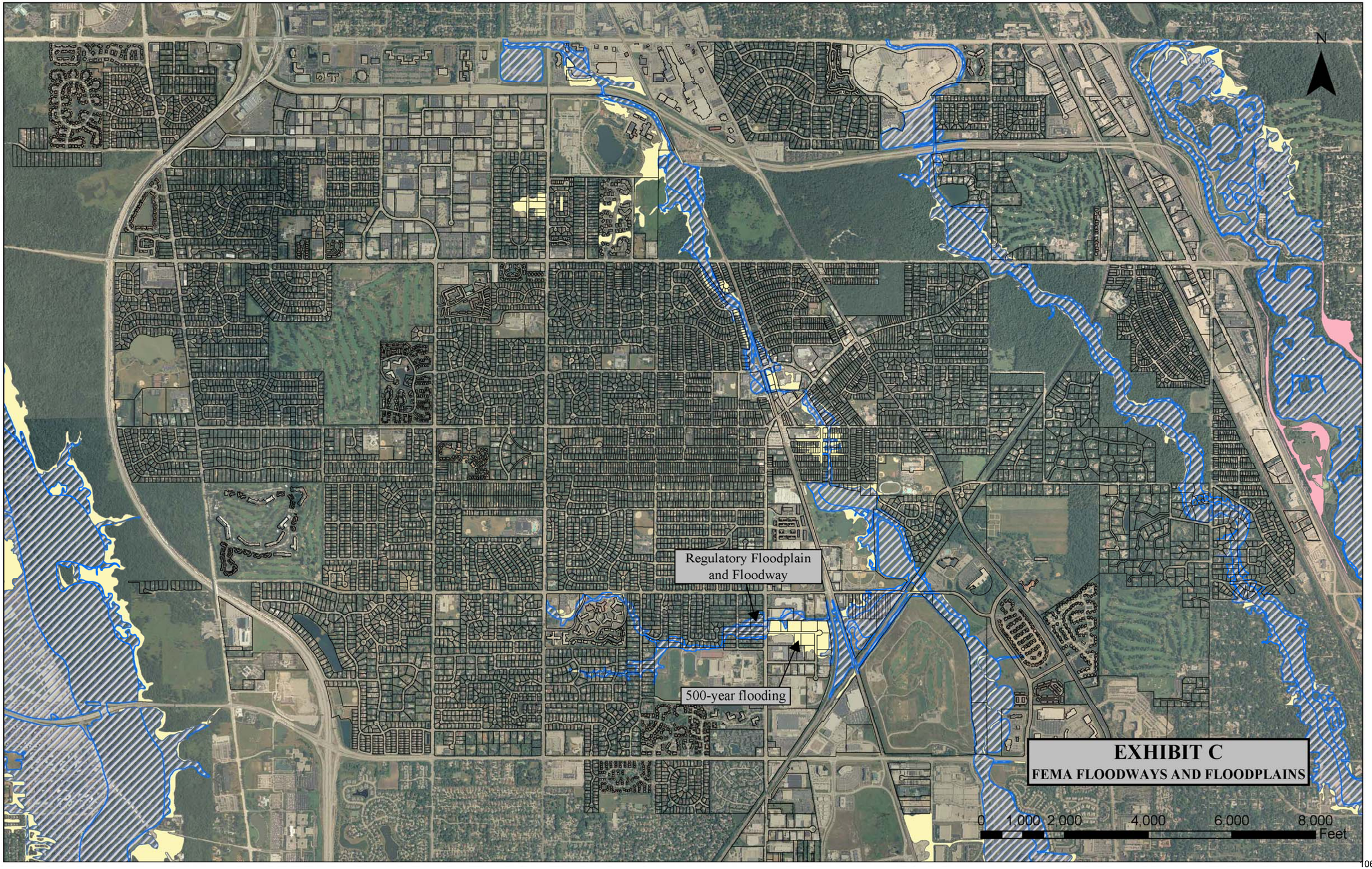
Flood Plain Information Maps and Profiles, North Branch of the Chicago River, North Branch of the Chicago River Steering Committee, October, 1974

General Watershed Information:

- Major Watershed within Northbrook (Exhibit A)
- Northbrook Hydrologic Atlas (Exhibit B)
- FEMA Floodways and Floodplains (Exhibit C)
- Northbrook Drainage Basin Boundaries (Exhibit D)
- Rainfall Gauge Data 1999-2010 (Exhibit E)


N
Skokie River
Middle Fork North Branch Chicago River
Des Plaines River
West Fork North Branch Chicago River
Techny Drain
EXHIBIT A
Major Watershed within Northbrook
0 1,000 2,000 4,000 6,000 8,000
Feet


N
Crest-stage gage
Watershed Boundaries
Flooded Areas
Gaging station
Gaging station
Crest-stage gage
Woodridge
LAKE CO
COOK CO
LAKE CO
COOK CO
Northfield
Techny
West Northfield Sch
Sunset Memorial Gardens Cemetery
Sunset Ridge Golf Club
Glenview Naval Air Station
Glenview Radio Station
Skokie Golf Club
Green Garden Country Club
Chicago Botanic Garden
Maple Sch
Farms Sch
Pal-Waukee Airport
Holy Ghost Academy
St Mary's Cemetery
St Mary's Mission House
Sunset Ridge
Sunset Woods
Northbrook
Glenview
Northfield
Wheeling
EXHIBIT B
NORTHBROOK HYDROLOGIC ATLAS
USGS VARIOUS HYDROLOGIC ATLASES
1950'S
0 500 1,000 2,000 3,000 4,000 Feet


N
Regulatory Floodplain and Floodway
500-year flooding
EXHIBIT C
FEMA FLOODWAYS AND FLOODPLAINS
0 1,000 2,000 4,000 6,000 8,000
Feet

VILLAGE OF NORTHBROOK, ILLINOIS

LOCATION LEGEND

PRIORITIZED PROJECTS

- A ABANDONED CATTLE PASS
- B CEDAR LANE
- C JEFFREY COURT SOUTH
- D SUNSET FIELDS/NORTHBROOK PARK
- E TECHNY DRAIN
- F UNDERWRITERS TRIBUTARY
- G WESTERN AVE./OAK AVE.
- H WEST FORK OF THE NORTH BRANCH OF THE CHICAGO RIVER

NON-PRIORITIZED PROJECTS

- I CEDAR LANE DITCH
- J CHERRY LANE UNDERPASS
- K SALCEDA NORTH/VILLAS NORTH
- L SHERMER ROAD UNDERPASS

OTHER AREAS

- M ACADEMY DETENTION BASIN
- N CLOVER DITCH
- O MIDDLE FORK OF THE NORTH BRANCH OF THE CHICAGO RIVER
- P RUSSETT LANE
- Q SHERATON DITCH

LEGEND

- VILLAGE LIMIT
- ADJACENT VILLAGE LIMIT
- PRIVATE ROAD
- PUBLIC, QUASI-PUBLIC LAND USE
- POND OR LAKE
- RAILROAD
- CENTER OF SECTION
- DRAINAGE BASIN BOUNDARIES

EXHIBIT D
Northbrook Drainage Basin Boundaries

VILLAGE OF NORTHBROOK
RAINFALL GAUGE DATA
1999 TO 2011

DATE	RAIN GAUGE #1	RAIN GAUGE #2
9/13/2008	6.4	6.4
10/13/2001	3.77	4.35
8/22/2002	4.38	4.31
9/19/2001	3.15	3.98
6/19/2009	3.37	3.35
10/2/2006	3.22	3.3
9/4/2008	3.53	2.57
9/11/2000	N/A	2.52
6/13/1999	N/A	2.41
8/19/2007	2.86	2.38
8/23/2007	2.52	2.25
5/13/2010	2.2	2.2
5/1/2003	2.35	2.12
9/28/1999	N/A	2.01
8/13/2002	2.38	2
6/8/2008	1.02	1.93
3/8/2009	1.86	1.86
8/27/2009	1.83	1.85
8/7/2007	2.44	1.82

Note: Gauge #1 is located at the Water Filtration Center

Note: Gauge #2 is located at the Public Works Facility

Note: From 8/22/2011 to 8/23/2011 Northbrook recorded 5.25" of precipitation.

Exhibit E
Rainfall Gauge Data
1999-2010

ORGANIZATION OF POTENTIAL PROJECTS

All of the possible solutions are not appropriate for each problem category. After categorization of problems and evaluation of potential solutions, HLR examined each problem category to determine which solutions were appropriate for that problem.

DEFINITION OF IMPROVEMENT TYPES

Improvements are grouped in the following categories:

- PROJECTS (Watershed and Neighborhood)
- PROPERTY OWNER PROGRAMS
- ADDITIONAL INITIATIVES

PROJECTS (Watershed and Neighborhood)
This type solution includes capital improvements for a specific problem area requiring work for the Village by an independent contractor. Watershed projects generally are related to major waterways or floodplains and generally affect a large area. Neighborhood projects impact smaller areas, are local in nature and may be interconnected or dependant upon a watershed project. This category also includes activities or improvements (other than maintenance) already being performed by the Village

PROPERTY OWNER PROGRAMS
The Programs category includes improvements for one type of repetitive problem which occurs throughout the Village. Work could be performed by a contractor or a resident, property owner, business, or groups of them working together.

ADDITIONAL INITIATIVES
Additional initiatives generally involve non-structural means of preventing or minimizing the proliferation of flood prone areas in the future. These solutions range from establishing public outreach programs to implementing good stormwater management practices as part of new development, street reconstruction or individual residential development. Implementation of Village ordinances and regulations will also ensure that new construction utilizes the best stormwater management practices available. This category also includes work performed by or under contract with the Village Department of Public Works. The Village appears to have an excellent sewer maintenance plan in place.

CATEGORIZATION OF PROBLEMS

In order to evaluate Village stormwater management projects, it was necessary to establish categories of stormwater management problems which occur within the Village. The intent was to establish an all-inclusive list of possible problems so that a resident, property owner or business could describe his or her individual problems (or concerns) within a category and review the MSMP for possible solutions. During the preparation of the Third (2002) Edition, consultation with the Stormwater Management Commission resulted in the following proposed categories:

- Overland flooding from streams, rivers, drains, or tributaries
- Basement flooding
- Rear yard flooding

- Street/front yard flooding
- Flood insurance costs

Please note that an individual problem or problem area could fall into more than one of the above categories. Descriptions of the problem categories follow.

FLOODING FROM STREAM, RIVERS, DRAINS, OR TRIBUTARIES
This category consists of flooding caused by major watercourses within the Village and includes flooding of buildings, basements, garages, yards, and streets caused by waters within the floodplain of the major watercourse. With the advent of MWRDGC as the funding agency for regional projects, project development was relegated to coordination through the Watershed Planning Councils and the development of beneficial Detailed Watershed Plans.

The following categories do not include flooding due to a major watercourse:

STRUCTURE FLOODING
This category consists of basement flooding caused by sanitary sewer backup, sump pump failure, power outage, and overland flow of water into basement windows.

REAR YARD FLOODING
Rear yard flooding includes ponded water or water moving through a rear or side yard.

STREET/FRONT YARD FLOODING
This category includes flooding in front of properties caused by water moving or ponding along the yard or street.

FLOOD INSURANCE COSTS
Flood insurance cost problems are normally associated with a property being within or close to the federal regulatory floodplain of a major watercourse. Problems could include the mandatory nature of the insurance required by mortgage lenders and/or the actual cost of the insurance as compared to the potential for flood related damage. This aspect of the plan primarily relates to the floodplain re-mapping of Techny Drain that will occur when that project is completed, and the continued efforts by the Village to improve the Community Rating System (CRS) which if successful, would reduce flood insurance premium rates

POSSIBLE IMPROVEMENT CATEGORIES

The Original SWMP determined the categories of problems occurring within the Village and presented a comprehensive list of possible solutions. This list included structural solutions (construction of improvements) and non-structural solutions (regulatory, informational and other measures not requiring construction). The list was established to ensure that all reasonable solutions were evaluated or examined for each problem area. The list also serves as a tool for the Village to use in the evaluation of stormwater management problems which have come to light after publication of the MSMP. Following are brief descriptions of the possible categories as modified by HLR.

STRUCTURAL IMPROVEMENTS

MAJOR REGIONAL PROJECT

- Flood control basins
- Major watercourse conveyance improvements

CONVEYANCE PROJECT

- Enlarge storm sewers, culverts, ditches or channels
- Clean storm sewers, culverts, ditches or channels
- Rear yard drainage

FLOOD OVERFLOW RELIEF PROJECT

- Flood overflow relief storm sewer or ditch
- Reinstate overland relief routes

STORAGE PROJECTS

- Detention or retention basins (watershed, neighborhood, rear yard)
- Enlarge sewers
- Yard ponding
- Modification of existing basin outflow conditions

FLOODPROOFING (PROGRAM)

- Waterproofing basements
- Berming around structures to be protected
- Window well protection
- Gutter drains away from window wells

LEVEES (PROJECT)

- Berms or walls separating structures from floodplains (applicability is low)
- Infrastructure project behind levee conditions

FLAP GATES (PROJECT)

- Addition of backflow protection to sewers or detention or retention basins (considered to be a last resort)
- Infrastructure projects behind flap gate to improve drainage system performance

BACKUP POWER SUPPLY (PROGRAM)

- Provision of an independent power supply for power outages

SUMP PUMP UPGRADE (PROGRAM)

- Enlarge sump pump
- Provision for backflow protection

OVERHEAD SANITARY SEWERS (PROGRAM)

- Elimination of gravity drainage from basements

UNDERDRAINS (PROGRAM)

- Addition of below-ground perforated pipe to reduce ponding time (in lieu of directly discharging via ditch or sewer)

INLET CAPACITY PROJECTS

- Increase inlet grate capacity

REGRADING (PROGRAM)

- Changes to ground surface to improve drainage that does not increase downstream flooding risk

DEPRESSED DRIVEWAY PROTECTION

- Berm around depressed driveways or alter sidewalk grades to reduce inflow of runoff

DEPRESSED PARKWAYS

- Provide ponding areas in parkways (with underdrain connection to storm sewer)

SEWER LINING

- Creation of a smoother inside surface of existing sewer to improve drainage (and correct structural deficiencies)

MAINTENANCE

- Improve condition of existing sewers and ditches (root and sediment removal)

BEST MANAGEMENT PRACTICES

- Rain barrels
- Rain gardens
- Pervious pavement
- Vegetated swales
- Bio filters
- Etc.

NON-STRUCTURAL IMPROVEMENTS

FLOOD INSURANCE REMAPPING

- More accurately defined floodplain boundaries (All flood boundaries remapped since the last SWMP)

COMMUNITY RATING SYSTEM

- Improved stormwater management in the Village (resulting in lower mandatory flood insurance premium costs)

EARLY WARNING SYSTEMS

- Warn property owners and businesses so that people and goods can be relocated above flood elevations

PUBLIC AWARENESS

- Education of the public in good stormwater management practices

ACQUISITION OF PROPERTY

- Public acquisition of property which cannot be protected from floodwaters
- Drainage easement acquisition as part of development

RULES AND REGULATIONS (relative to development)

- Limitations on increase in site runoff rate and volume
- Preservation of bowl/depressional storage

FUNDING OPTIONS

GENERAL REVENUE FUND

These are funds available to the Village for all Village services raised through property, sales, and other taxing sources. They are budgeted by the Village Board to pay for different aspects of Village services (police, fire, etc.). In the pursuit of stormwater management improvements, the Board can budget these funds to pay for any type of improvement it decides is appropriate. Competition for these funds includes all governmental services provided by the Village (excluding existing Enterprise funds).

FUNDING FROM OTHER AGENCIES

These funds would be available from other local, regional, or federal agencies. These funds could include grants to the Village for Village projects. They also could represent cost savings to the Village by combining work proposed by other agencies with Village projects. Often, by combining Village funds with funds from other agencies, a combined improvement can be constructed which costs the Village less than if the Village were to construct the improvement by itself. The Village is currently pursuing two of these projects with the Illinois Department of Transportation, Division of Highways, on Shermer Road and Waukegan Road.

STORMWATER UTILITY SERVICE CHARGE

Through the Village's power as a home rule community, the Village examined its ability to institute a utility service charge for stormwater management improvements. This charge, similar to a sanitary sewer fee which appears on water bills, would apply to all property owners, could appear on Village water bills, and could be based on the property's relative contribution to stormwater runoff. This funding would only be utilized for stormwater management improvements and maintenance.

BONDING

To fund large projects, the Village could elect to sell municipal bonds. These would require repayment through one of the funding sources previously discussed. The funds obtained through this process would only be utilized for the improvement for which the bonds were sold.

SALES TAX

The Village of Northbrook has the power to impose an increase to the current state sales tax. A $0.0025 increase to the sales tax would generate an estimated 1 million dollars in additional revenue annually.

Subsequent to the approval of the Original SWMP, the Village board passed bond issues to pay for the construction of improvements, and is utilizing an impervious coverage fee to retire those bonds.

MSMP IMPLEMENTATION RECOMMENDATIONS

Implementation of the MSMP includes five aspects: Construction of Improvements; Pursuit of Regional Improvements; Improvement to the Flood Insurance System; Maintenance and Updating of the MSMP; and the Role of the Stormwater Management Commission.

CONSTRUCTION OF IMPROVEMENTS

The MSMP has presented the prioritization procedure, proposed stormwater management projects, and potential funding sources. The decision of which funding source to utilize for a given project or program is not an engineering decision and will be made by the Village Board based on recommendations from Staff and the Commission. The period over which the known projects or programs are constructed is a function of the level and type of funding the Village chooses to pursue.

PURSUIT OF REGIONAL IMPROVEMENTS

The Village should continue to pursue the construction of regional improvements which would benefit the West Fork and Middle Fork of the North Branch of the Chicago River and the Skokie Ditch. Cleaning of the outlet channel which parallels the Skokie Ditch between the ditch and the Edens Expressway is an example of one possible regional improvement. This improvement should include a coordinated effort between the Village, the Lake County Stormwater Management Commission, the North Cook County Soil & Water Conservation District, the Illinois Department of Natural Resources -Office of Water Resources, the U.S. Army Corps of Engineers, the Metropolitan Water Reclamation District of Greater Chicago, and the Cook County Forest Preserve District.

IMPROVEMENT TO THE FLOOD INSURANCE SYSTEM

Through its pursuit of accurate floodplain mapping and improvements to the Village's flood insurance Community Rating, the Village was able to improve the flood insurance system within the Village. Through implementation of the Underwriter's Tributary project and the partially completed projects for Techny Drain, the Village has been and will continue to be able to remove properties from the federal regulatory floodplain. With the cooperation and support of other local and regional agencies, especially those upstream, the Village should encourage the construction of major regional flood control facilities to benefit the West Fork and Middle Fork watersheds through its continued coordination efforts with MWRDGC.

MAINTENANCE AND UPDATING OF THE MSMP

The MSMP has been prepared as a dynamic or "living" document. It has been written so that it can be implemented by the Village and understood by its residents, property owners, and businesses. In order to retain the relevance of the MSMP to current conditions and preserve its usefulness as a guidance document, technical information and cost estimates have been updated. In the future, updates should only require revisions for changed or new conditions and cost data, not the reevaluation of problem areas.