Village of

WINNETKA

Flood Risk Reduction Assessment - Additional Study Areas

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Village of Winnetka, Illinois
Flood Risk Reduction Assessment – Additional Study Areas

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EXECUTIVE SUMMARY

This Flood Risk Reduction Assessment, prepared by Baxter & Woodman Consulting Engineers, presents recommendations to mitigate flood damage in six areas of the Village which were not included in the previous Assessments completed by Christopher B. Burke Engineering, Ltd. Flooding in these "Additional Study Areas" consists primarily of standing water and overland flow in streets and yards. This nuisance flooding most commonly results in sewer back-ups, basement seepage, and sump pump failures, although several cases of overland flow into structures have also been reported. Recommendations for each study area are summarized below, along with the Engineer's Opinion of Probable Cost.

Study Area A

The recommended improvements for this area consist of constructing new storm sewers ranging from 24 to 36 inches in place of the existing 12- to 18-inch sewers, along with inlet capacity improvements (Exhibit 2). The Engineer's Opinion of Probable Cost for these improvements is $0.5 million.

Study Area C

Potential improvements for this area consist of consist of replacing existing 12- to 36-inch storm sewers with 18- to 48-inch sewers, along with inlet capacity improvements. Two alternatives were presented: disconnection of the Village storm sewer from the MWRD interceptor sewer; and maintaining the connection without increasing the rate of discharge to the interceptor sewer (Exhibits 3A and 3B). The

Engineer's Opinion of Probable Cost for Alternates 1 and 2 are $1.9 million and $1.7 million, respectively.

Study Area E

The recommended improvements for this area consist of constructing new storm sewers ranging from 18 to 30 inches in place of the existing 8- to 24-inch sewers, along with inlet capacity improvements (Exhibit 4). The Engineer's Opinion of Probable Cost for these improvements is $0.9 million.

Study Area G

The recommended improvements for this area consist of constructing new storm sewers ranging from 24 to 48 inches in place of the existing 8- to 30-inch sewers, along with inlet capacity improvements (Exhibit 5). The Engineer's Opinion of Probable Cost for these improvements is $2.0 million.

Study Area N

Baxter & Woodman developed potential storm sewer improvements for this area; however, the modeled storm sewer improvements in Area N are not recommended, since the modeling demonstrates that the downstream high water surface elevation limits the effectiveness of the potential storm sewer improvements. Instead, the Village should perform a detailed topographic survey of Area N to determine how residences can be protected against overland flooding by making improvements to the overland flow paths.

Study Area O

Potential improvements for this area consist of consist of replacing existing 22- and 24-inch storm sewers with 42- and 48-inch sewers, along with inlet capacity

improvements. Two alternatives were presented: disconnection of the Village storm sewer from the MWRD interceptor sewers; and maintaining the connections without increasing the rate of discharge to the interceptor sewers (Exhibits 7A and 7B). The Engineer's Opinion of Probable Cost for Alternates 1 and 2 are $2.3 million and $1.8 million, respectively.

1. INTRODUCTION

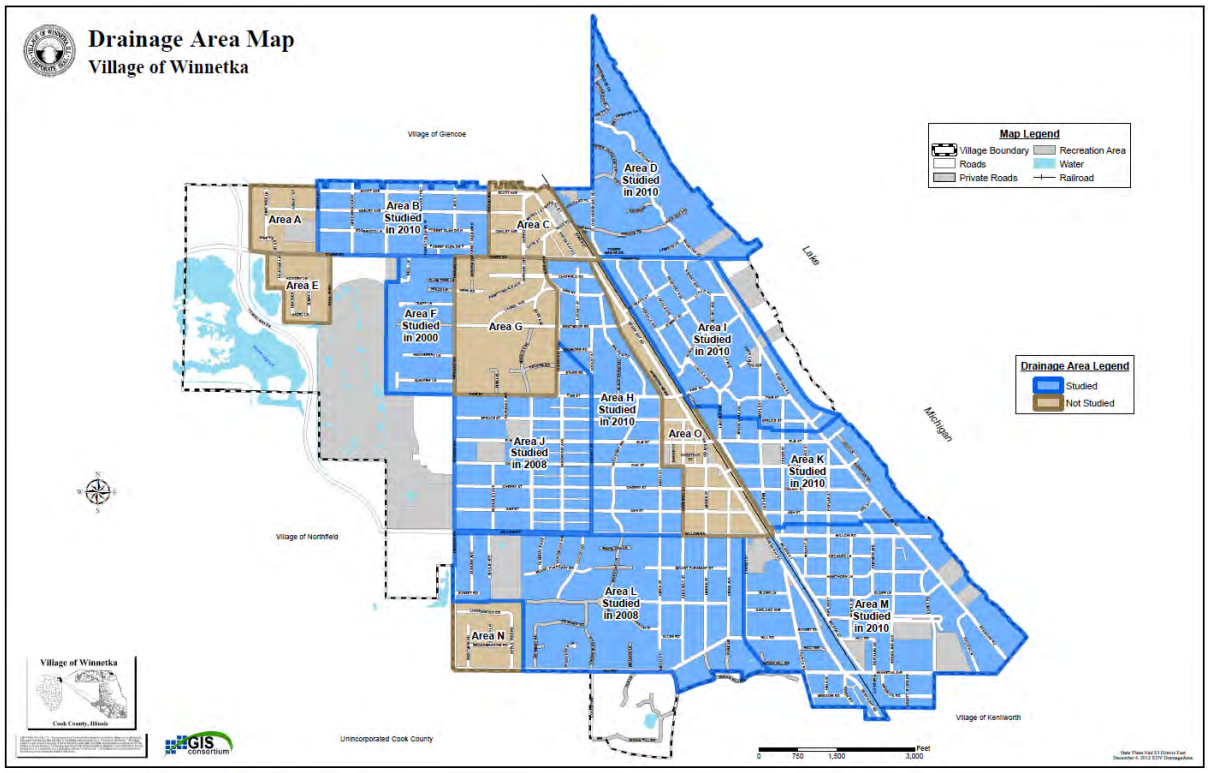
1.1 Purpose and Scope

The flood damage resulting from severe storm events in September 2008 and July 2011 devastated the citizens of Winnetka. The Village responded by initiating Flood Risk Reduction Assessments to determine what improvements could be made to mitigate flood damage from future storm events in the areas which have proven to be the most susceptible to flooding. With $41.1 million of recommended improvements, the Village is now developing a Stormwater Master Plan, which includes prioritization of the planned improvements and development of an implementation strategy for funding the improvements. As a first step in the development of the Stormwater Master Plan, the Village is conducting this Flood Risk Reduction Assessment of the areas within the Village that have yet to be assessed (the "Additional Study Areas").

The purpose of this Assessment is to recommend improvements that will mitigate flood damage in the Additional Study Areas, which are shown below on Figure 1 and also on Exhibit 1.

FIGURE 1

Drainage Areas Map



This Assessment supplements those previously completed by Christopher B. Burke Engineering, Ltd. (CBBEL). For consistency with the planned improvements (CBBEL, October 2011), this Assessment recommends improvements that would provide relief from storms up to and including the 100-year design event.

Flooding in the Additional Study Areas primarily consists of standing water and overland flow in streets and yards. This nuisance flooding most commonly results in sewer back-ups, basement seepage, and sump pump failures. A few cases of overland flow into structures have also been reported. The Village conducted a flooding survey following the July 2011 storm event in which residents reported the incidences and types of flooding they experienced. Figures 2-7 in this report show stormwater flooding results categorized as either "overland flooding" or "other stormwater flooding".

2. METHODOLOGY

The methodology used in this Assessment is consistent with the methodology used in Flood Risk Reduction Assessments completed by CBBEL in September 2009, June 2011, and October 2011. The following description of hydrologic and hydraulic model development has been included to provide a clear understanding of what data was used to determine the recommended improvements.

Each study area has been delineated with drainage area boundaries defined by the topographic data (1-foot contours) and storm sewer mapping provided by the Village. The Village's detailed storm sewer mapping includes: pipe invert elevations, pipe diameters, pipe lengths, and structure rim elevations. Where necessary data was missing from the storm sewer mapping, the data was field surveyed by Village staff.

Each study area was further divided into sub-areas to which hydrologic parameters, such as the Runoff Curve Number (RCN) and Time of Concentration (Tc), were assigned. The RCN value is based on the ratio of impervious to pervious area within a sub-area. It is a function of the current land use, as determined using aerial photography provided by the Village, and the soil type, as determined using soil data published by the Natural Resources Conservation Service (NRCS). The Tc is the length of time it takes for runoff to travel from the furthest point in the sub-area to the outlet.

After the sub-areas were delineated for each study area, hydrologic and hydraulic data were input into an XP-Software Stormwater and Wastewater Management Model (XP-SWMM). This software is a two-phase dynamic modeling

program that determines the amount of runoff from a storm event and routes the runoff through a sewer network, along overland flow paths and into depressional storage areas, where appropriate. The software generates runoff rates and volumes, along with high water surface elevations, at each node in the model.

The critical storm duration was determined for each study area utilizing Chicago sectional rainfall depths published in the Illinois State Water Survey's *Bulletin 70*. *Bulletin 70* is the preeminent source for rainfall depths and patterns in Northeast Illinois. The critical storm duration refers to the storm duration that produces the maximum runoff rate or water surface elevation for a storm with a given recurrence interval. For example, the critical duration for the 100-year storm event could be a storm with a 1-, 2-, 3-, 6-, 12-, 18-, 24-, or 48-hour duration. For areas, such as the Additional Study Areas, that have very little depresssional storage and very few stormwater detention basins to slow the rate of runoff, the critical duration tends to be among the shorter duration storm events (1-, 2-, and 3-hour).

The tailwater condition, or the elevation of the water surface immediately downstream of the study area, is an important consideration for a storm sewer system model. If the study area drains to a sewer that is at or exceeding its capacity, it can impose a limit on the capacity of the sewers within the study area. Similarly, the capacity of the sewers within the study area can be limited when they discharge to a waterway with a water surface elevation above the outlet from the study area. For this Assessment, wherever the outlet of an Additional Study Area is connected to another Village storm sewer, the model of the Additional Study Area was added to the model of the downstream sewer so a variable tailwater condition is built into the model.

Wherever the outlet of an Additional Study Area is connected to a MWRD interceptor sewer, a constant tailwater elevation was assumed at the crown of the downstream interceptor sewer. Where the outlet of an Additional Study Area discharges to a waterway, a constant tailwater elevation was assumed at an elevation between the normal water level and the 100-year high water surface elevation.

Neighborhood sized storm sewer networks typically have a relatively short Tc, meaning that the peak discharge from the storm sewer system occurs a short time after the beginning of the storm event. The larger the watershed of the reciving water, the longer it takes for the waterway to reach its peak discharge and corresponding high water level. Therefore, the peak discharge from a neighborhood sized storm sewer system is not likely to coincide with the high water surface elevation of the receiving water. For this reason, the 100-year storm sewer improvements were modeled with a tailwater elevation less than the 100-year high water surface elevation. In cases where the performance of the drainage system in a study area was particularly sensitive to the tailwater elevation, a range of tailwater elevations were tested and the result of this sensitivity analysis are included in this Assessment. It is important to note that later in a storm event, when the rate of discharge from the storm sewer system is receding and the water surface elevation in the receiving water continues to rise, low-lying inlets can be flooded by the waterway backing up into the storm sewer system, unless the system is protected by a flap gate or check valve.

Modeling of the Additional Study Areas was an iterative process. During each iteration, model results were compared with data collected in the resident flooding survey and with input from Village staff familiar with flooding in the Additional Study

Areas. **It should be noted that shallow flooding in the streets was widespread throughout the Additional Study Areas for the 100-year storm event. The flooding problem areas identified in each study area should be understood as those areas with the most severe flooding.**

Once the models of each study area were determined to be sufficiently representative of the existing conditions, the models were then used to analyze potential improvements, including increased storm sewer sizes and increased inlet capacity. Stormwater detention was also considered preliminarily, but the only suitable locations would likely require underground storage vaults and the cost of these structures was found to outweighs the benefits.

Conceptual improvements were modeled in order to reduce flooding in the problem areas to an acceptable level. An acceptable level of flooding was generally considered to be a depth of less than five inches above the street. In cases where the ground elevation adjacent to a residence appeared to be less than one foot above the rim of a storm sewer inlet in a problem area, reasonable efforts were made to reduce the depth of street flooding to less than five inches.

During the course of our analysis, we determined that the improvements necessary to provide 100-year flood protection typically required an increase of only one or two pipe sizes. Consequently, there would be little or no value to the Village in considering 10-, 25- or 50-year improvements for the Additional Study Areas.

This Assessment was based on conceptual plans and limited information. Because of this, there are many unknowns (i.e. soil conditions, utility conflicts and limited rights-of-way) that will affect the ultimate design and the project cost. In order

to account for these uncertainties, the engineer's estimate of probable cost includes a 20 percent contingency. Costs for permitting, design engineering, and construction engineeering are included with the recommended improvements as a percentage of the construction cost.

The following sections of this report have been organized by study area. Each section describes the existing and proposed conditions in detail and provides the engineer's estimate of probable cost for the recommended improvements.

3. FLOOD RISK REDUCTION ASSESSMENT

3.1 Area A Existing Conditions

Area A is comprised of single-family residences and Nick Corwin Park, which is owned by the Winnetka Park District. It is bounded roughly by Grove Street on the east, Tower Road on the south, the lots south of Ivy Lane on the north, and the East Diversion Ditch on the west, as shown in Figure 2 below.

FIGURE 2

Study Area A

The area has two outlets to the East Diversion Ditch: a 12-inch pipe draining the south end of Pine Tree Lane; and a 18-inch pipe draining the north end of Pine Tree

Lane, Asbury Avenue, and Asbury Court. All of the existing storm sewers within Area A are between 12 and 18 inches in diameter.

The lowest points within Area A are located: at the west bend in Pine Tree Lane, near the intersection of Asbury Avenue with Asbury Court, and in a depressional storage area at the southeast corner of Nick Corwin Park. Three property owners within the area reported flooding due to overland flow resulting from the July 2011 storm event. Two of these properties are located near the intersection of Asbury Avenue with Asbury Court. The other is located just east of the problem area along Pine Tree Lane. The depressional storage area in Nick Corwin Park is considered a problem area because the calculated 100-year high water surface elevation (625.5) is higher than the ground elevation adjacent to a residence along the overland flow path to the south. This means that the residence may be at risk of overland flooding.

The residences in Area A are above the 100-year flood elevation of the East Diversion Ditch, but the rising water level in the ditch creates an adverse tailwater effect on the storm sewer outlets. This reduces the capacity of the storm sewer system and results in street flooding. This street flooding is the likely source of the overland flow that flooded residences during the July 2011 storm.

3.2 Area A Proposed Conditions

The street flooding problems in Area A can be alleviated by constructing new, larger storm sewers in place of the existing storm sewers. The new sewers would range from 24 to 36 inches, and be installed in place of the existing sewers, as shown on Exhibit 2. Additional inlet capacity will also be needed to capture the 100-year runoff in these sewers. The increased storm sewer capacity will increase the peak discharge to

the East Diversion Ditch from Area, but the increase in stormwater runoff (10 cfs) will not create flooding problems downstream. The increase in stormwater runoff from Area A represents only 2 percent of the peak flow through the ditch, which is negligible.

Since the 100-year high water elevation of the East Diversion Ditch will approach the rim elevations of drainage structures in the lowest points of Area A (after the area is mostly drained), we recommend fitting the new outlets with flap gates or Tideflex check valves. These will help prevent the ditch from backing up into the storm sewer system and flooding the steets.

The West Tower Road Storm Sewer Improvements are currently under design and they include increased sewer capacity along Grove Street. The flooding problem in Nick Corwin Park can be alleviated by installing a new 12-inch storm sewer to drain the depressional storage area to the storm sewer improvements along Grove Street. CBBEL is designing the West Tower Road Storm Sewer Improvements and has confirmed that the planned sewer improvements will have sufficient capacity to drain the depression.

The total cost of these improvements, including permitting with the U.S. Army Corps of Engineers (USACE) for the new outlets, along with design and construction engineering, is estimated to be $493,408. A detailed calculation of this cost is included as Appendix 1.

One alternative to the recommended improvements was considered, which involved reversing the flow of drainage along Asbury Avenue so that new storm sewers would connect to the planned storm sewer improvements along Grove Street. CBBEL modeled this alternative with the model for their West Tower Road Storm Sewer

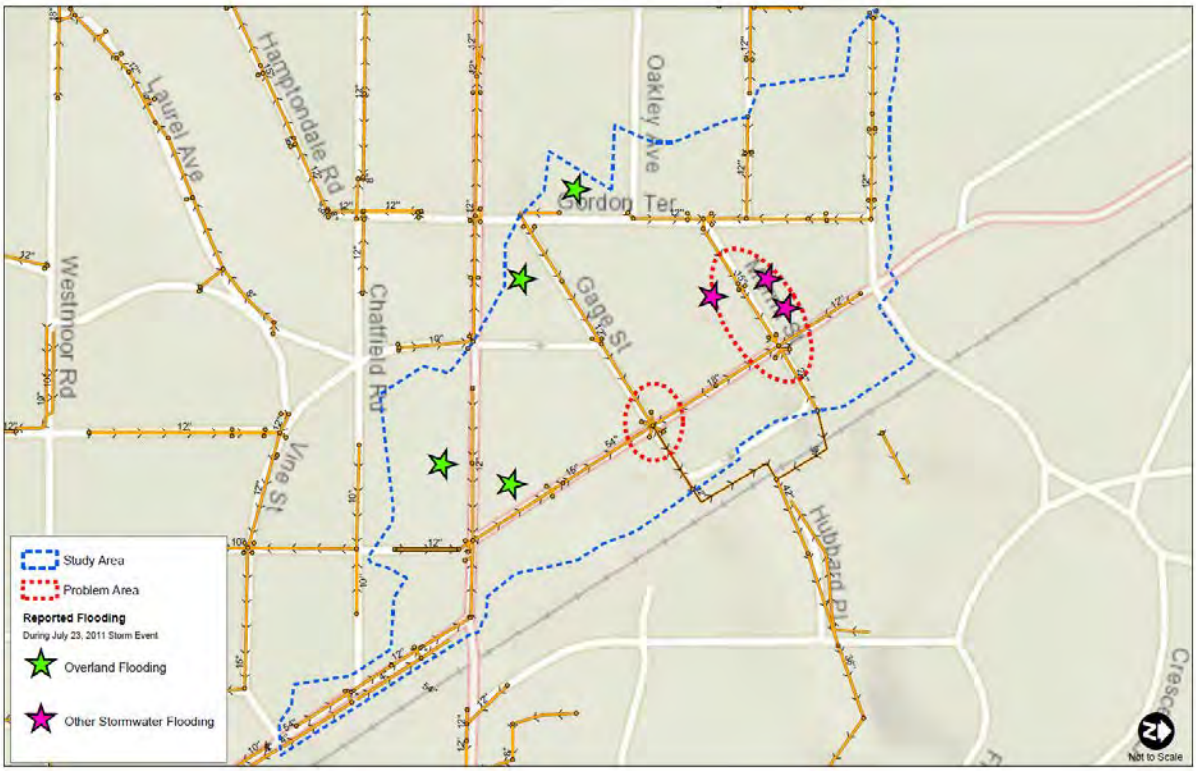
Improvements and determined that the planned sewer improvements cannot accommodate this additional drainage.

3.3 Area C Existing Conditions

Area C is a section of downtown Winnetka between the Union Pacific Railroad on the east, Chatfield Road on the south, Euclid Avenue on the west, and Scott Avenue on the north. Land uses within the area consist mainly of stores and offices, with a number of single-family residences on the west and south. The Hubbard Woods commuter rail station and its parking lot are located on the east side of Area C, immediately adjacent to Hubbard Woods Park. This area is shown in Figure 3 below.

FIGURE 3

Study Area C



Existing storm sewers ranging from 12 to 36 inches drain the northern portion of Area C across the railroad into the Ravine Area, to a storm sewer that discharges into Lake Michigan. The southern portion of Area C is connected to the MWRD interceptor sewer at the intersection of Gage Street and Green Bay Road. From this location, the interceptor sewer runs southeast along Green Bay Road. This connection of the Village storm sewer system to the interceptor sewer is a permitted connection that became necessary when storm sewers to the east were cut-off by the railroad grade separation project in the 1930s.

The lowest points in Area C are located: along Merrill Street, mid-way between Gordon Terrace and Green Bay Road; and at the intersection of Gage Street with Green Bay Road. The Area C model shows significant flooding in both of these locations (1.0-foot and 0.7-foot inundation depths, respectively).

The owners of seven propeties within Area C reported flooding due to the July 2011 storm event. Three of these properties are adjacent to the problem area along Merrill Street. The other four properties are scattered along the west and south boundaries of the study area. The reported types of flooding for these seven properties range from basement seepage and sump pump failure to four instances of overland flow into structures.

3.4 Area C Proposed Conditions

The MWRD may require the disconnection of any improvements made to storm sewers which connect to an interceptor sewer. Therefore, two alternatives were modeled for Area C. Alternative 1 disconnects the Village storm sewer system from the MWRD interceptor sewer. In this alternative, the existing connection to the interceptor

sewer would be abandoned and all the stormwater draining to the intersection of Gage Street and Green Bay Road would be routed northwest along Green Bay Road to Merrill Street, where it would drain across the railroad into the Ravine Area and ultimately to Lake Michigan. Alternate 2 would maintain the exisiting connection to the interceptor sewer, but would not increase the rate of discharge to the interceptor sewer beyond the current level.

3.4.1 Alternate 1 – Disconnect from MWRD - The 100-year peak flows from Area C can be accommodated in a network of new storm sewers ranging in size from 18- to 48 inches, along with significant improvements to inlet capacity. The railroad crossing and connection to the Ravine Area storm sewer is shown on Exhibit 3A. The proposed conditions for Area C were modeled with the planned improvements in the Ravine Study Area. The existing storm sewer discharging to Lake Michigan has sufficient capacity for the planned relief sewer along Old Green Bay Road and the increased runoff resulting from the Area C improvements. These improvements re-route some of the storm sewers within Area C so that improvements are needed to only one crossing of the railroad (the storm sewer draining Merrill Street). The other crossing (which drains Gage Street east of Tower Court) can be abandoned. Re-routing all runoff from Area C into one sewer requires 42-inch and 48-inch storm sewers along Green Bay Road and the east end of Merrill Street, but the cost of an additional railroad crossing would be much greater than the incremental cost of the larger storm sewer required to re-route stormwater from the Gage Street crossing.

Union Pacific is likely to require the Village to minimize construction disturbance within railroad right-of-way. Therefore, new sewers within the right-of-way will almost certainly have to be installed using trenchless methods.

The total cost of these improvements, including permitting with IDOT, Union Pacific and the MWRD, along with design and construction engineering, is estimated to be $1,913,278. A detailed calculation of this cost is included as Appendix 2A.

3.4.2 Alternate 2 – Maintain Connection to MWRD - If the existing connection to the MWRD interceptor sewer is maintained without increasing the rate of discharge to the interceptor sewer, the 100-year peak flows from Area C can be accommodated in a network of new storm sewers ranging in size from 18- to 42 inches, along with significant improvements to inlet capacity as shown on Exhibit 3B. By maintaining the connection to the interceptor sewer at the intersection of Gage Street with Green Bay Road, the storm sewer along Green Bay Road northwest of Gage Street can be reduced from 42-inch and 48-inch (Alternate 1) down to 24-inch and 30-inch. Furthermore, the storm sewer along Merrill Street northeast of Green Bay Road to the connection in the Ravine Area can be reduced from a 48-inch sewer (Alternate 1) down to a 42-inch sewer. All other aspects of Alternate 2 remain unchanged from Alternate 1.

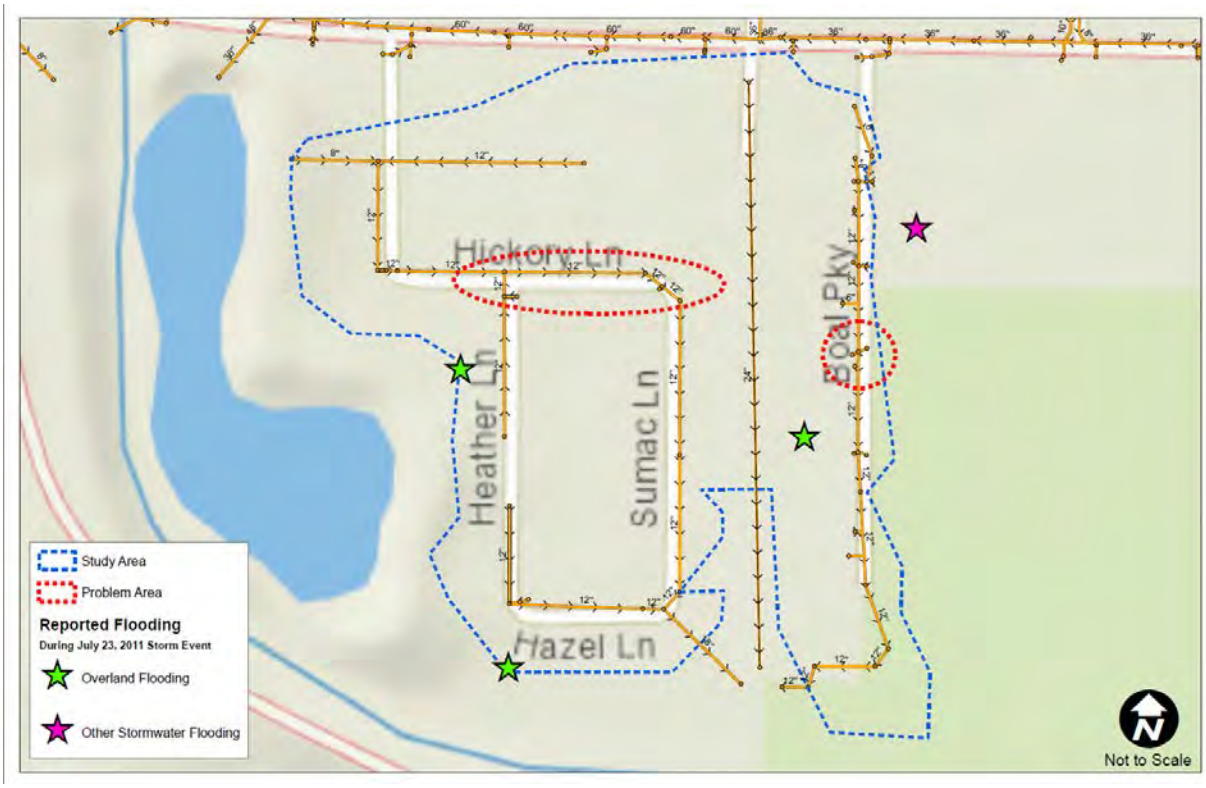
The total cost of these improvements, including permitting with IDOT, Union Pacific and the MWRD, along with design and construction engineering, is estimated to be $1,668,341. A detailed calculation of this cost is included as Appendix 2B.

3.5 Area E Existing Conditions

Area E is a residential neighborhood bounded by Tower Road on the north, Forestway Drive on the west and south, and the Winnetka Golf Club on the east. This area is shown in Figure 4.

FIGURE 4

Study Area E



The study area is drained by three outlets to the East Diversion Ditch: an 18-inch pipe draining Heather, Hickory, Sumac, and Hazel Lanes; a 24-inch pipe running through rear yards of properties along Boal Parkway and Sumac Lane; and a 12-inch pipe carrying the drainage from Boal Parkway. The existing storm sewers within Area E range in size from 8 to 24 inches in diameter. The 24-inch outlet may have drained Nick Corwin Park at some point in the past, but the pipeline has since been severed at

Tower Road. The sewer currently only serves to drain the rear yards directly above it, as several residents have connected area drains to it.

The lowest points within Area E are located at the south end of Boal Parkway and in several undrained depressions southwest of the intersection of Boal Parkway and Tower Road. Four propery owners within the area reported flooding resulting from the July 2011 storm event. Two of these properties are adjacent to the problem area along Boal Parkway and one is adjacent to the problem area along Hickory Lane. The reported types of flooding for these four properties include basement seepage, sump pump failure and overland flow into three of the structures.

Most of the residences along Heather, Hickory, Sumac and Hazel Lanes are elevated above the 100-year flood elevation (625.5, according to the MWRD Inundation Area Maps for Cook County), but all of the residences along Boal Parkway appear to be within the 100-year floodplain. When the water surface in the East Diversion Ditch rises, an adverse tailwater condition is created at the three outlets from Area C. This reduces the capacity of the storm sewer system, which results in street flooding.

3.6 Area E Proposed Conditions

Recommended improvements for Area E include increasing the storm sewer and inlet capacity, as shown on Exhibit 4. The existing 12- and 18-inch pipes along Sumac and Hickory Lanes should be replaced with 18- to 30-inch pipes. The existing 12-inch pipes along the south end of Boal Parkway should be replaced with 18- to 24-inch pipes. Adding inlet capacity will allow the proposed storm sewer system to take full advantage of the increased sewer capacity. The increased storm sewer capacity will increase the peak discharge to the East Diversion Ditch from Area C, but the increase in stormwater

runoff (15 cfs) will not create flooding problems downstream. The increase in stormwater runoff from Area C represents only 3 percent of the peak flow through the ditch, which is negligible.

At first glance, it appears that the existing depressions located southwest of the intersection of Boal Parkway and Tower Road should be drained either to the planned storm sewer improvements along West Tower Road or to the existing 24-inch storm sewer running through the rear yards of properties along Boal Parkway and Sumac Lane. However, draining the depressions to either potential oulet would hydraulically connect the depressions with a sewer or a waterway, and would result in greater depths of flooding within the depressions.

It should be noted that the storm sewer system along Boal Parkway is very sensitive to the tailwater elevation at the outlet. This sensitivity indicates that the benefits of the recommended improvements will be muted when the East Diversion Ditch crests after a significant rainfall. This is due to the ground surface elevation along Boal Parkway, which is relatively low compared to flood stages of the East Diversion Ditch.

It is a generally accepted practice to model a neighborhood sized storm sewer system that discharges to a waterway having a large tributary area, by setting the tailwater on the storm sewer outlet at the 10-year high water surface elevation of the waterway. When an approximation of the 10-year high water surface elevation of the East Diversion Ditch was set as the tailwater elevation at the outlet from the Boal Parkway storm sewer system, the southern end of storm sewer system was submerged with backwater from the East Diversion Ditch. Therefore, the recommended

improvements along Boal Parkway were analyzed with a range of tailwater elevations up to and including an approximation of the 10-year high water surface elevation. The results of this sensitivity analysis demonstrate that the recommended improvements would be very effective with lower tailwater elevations, but less effective under higher tailwater conditions.

Since the 100-year high water elevation of the East Diversion Ditch approaches (even exceeds in some cases) the rim elevations of drainage structures in Area E, we recommend fitting the new outlets with flap gates or Tideflex check valves. These will help prevent the ditch from backing up into the storm sewer system and flooding the streets.

The total cost of these improvements, including permitting with the USACE for the two new outlets, along with design and construction engineering, is estimated to be $862,755. A detailed calculation of this cost is included as Appendix 3.

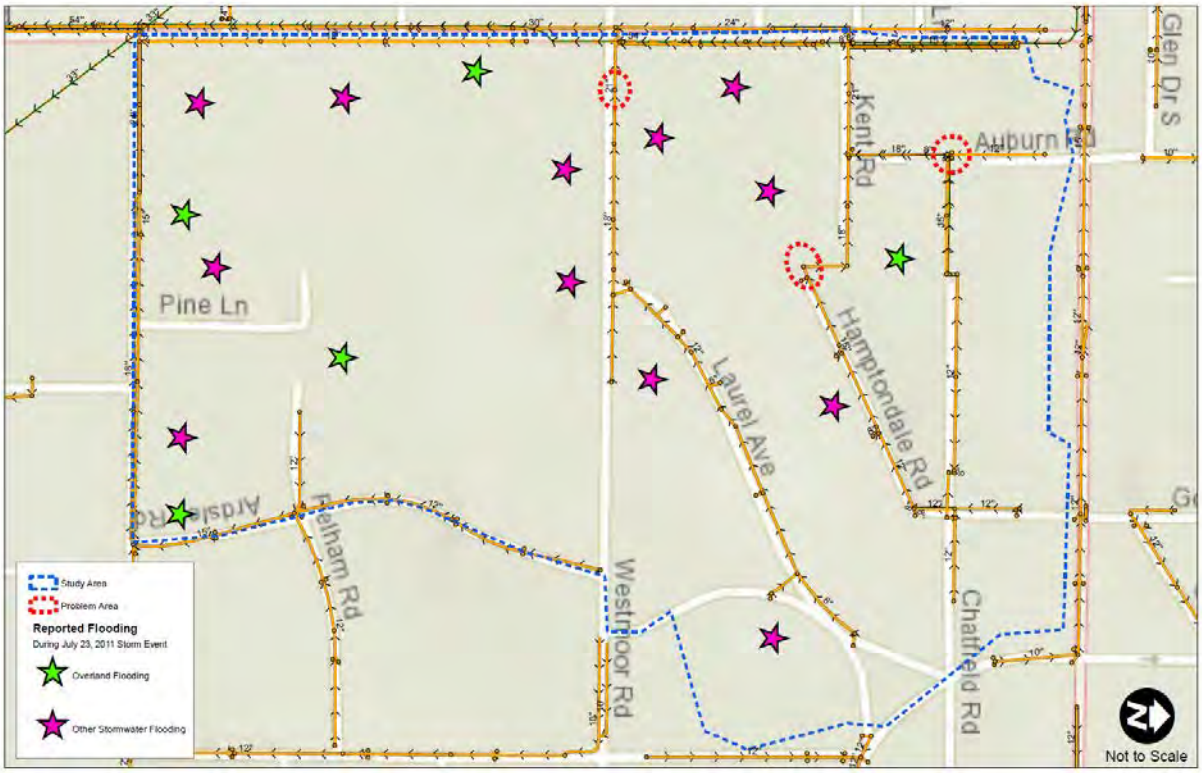
One alternative to the recommended improvements was considered, which involved discharging the runoff from Heather, Hickory, Sumac, and Hazel Lanes west to the Forest Preserve Lagoon, rather than southeast to the East Diversion Ditch. Once it became clear that the tailwater elevation on a potential outlet to the lagoon would essentially match the tailwater elevation of the existing outlet to the East Diversion Ditch, there was no longer any benefit with which to justify the increased cost of piping for this alternative.

3.7 Area G Existing Conditions

Area G is comprised almost exclusively of single-family residences. It is bounded roughly by Tower Road on the north, Hibbard Road on the west, Pine Street on the south, and on the east by Ardsley Road and Burr Avenue, as shown in Figure 5 below.

FIGURE 5

Study Area G



This area currently drains to the existing 30-inch storm sewer running south along the west side of Hibbard Road; however, the planned Lake Michigan Outlet includes the installation of an 84-inch storm sewer along Hibbard Road, between Pine Street and Oak Street. It is anticipated that the Lake Michigan Outlet would be constructed prior to any improvements in Area G, so the Existing Conditions model includes the planned 84-inch storm sewer along Hibbard Road.

Within Area G, the storm sewer sizes range from 8 inches to 30 inches. The main line runs along Hibbard Road and there are three major branches from the main line along Hibbard Road. The north branch collects runoff from Hamptondale Avenue, along with Chatfield, Auburn, and Kent Roads. The central branch collects runoff from Westmoor Road and Laurel Avenue. The south branch collects runoff from Pine Street and Ardsley Road.

Area G slopes steeply from east to west, so the lowest points in the area are along Hibbard Road. Seventeen property owners within the area reported flooding resulting from the July 2011 storm event. The types of flooding reported varied, but the most common types of flooding were basement seepage and sump pump failure. Five of the seventeen properties reported flooding due to overland flow and these properties are scattered across the study area.

3.8 Area G Proposed Conditions

The street flooding problems in Area G can be alleviated by installing new, larger storm sewers in place of the existing storm sewers. The new sewers would range in size from 24 inches to 48 inches and be installed in place of the existing sewers, as shown on Exhibit 5. Additional inlet capacity will also be needed in a few critical locations.

The proposed improvements would increase the peak discharge from Area G, but the additional runoff would not exceed the capacity of the planned 84-inch storm sewer along Hibbard Road.

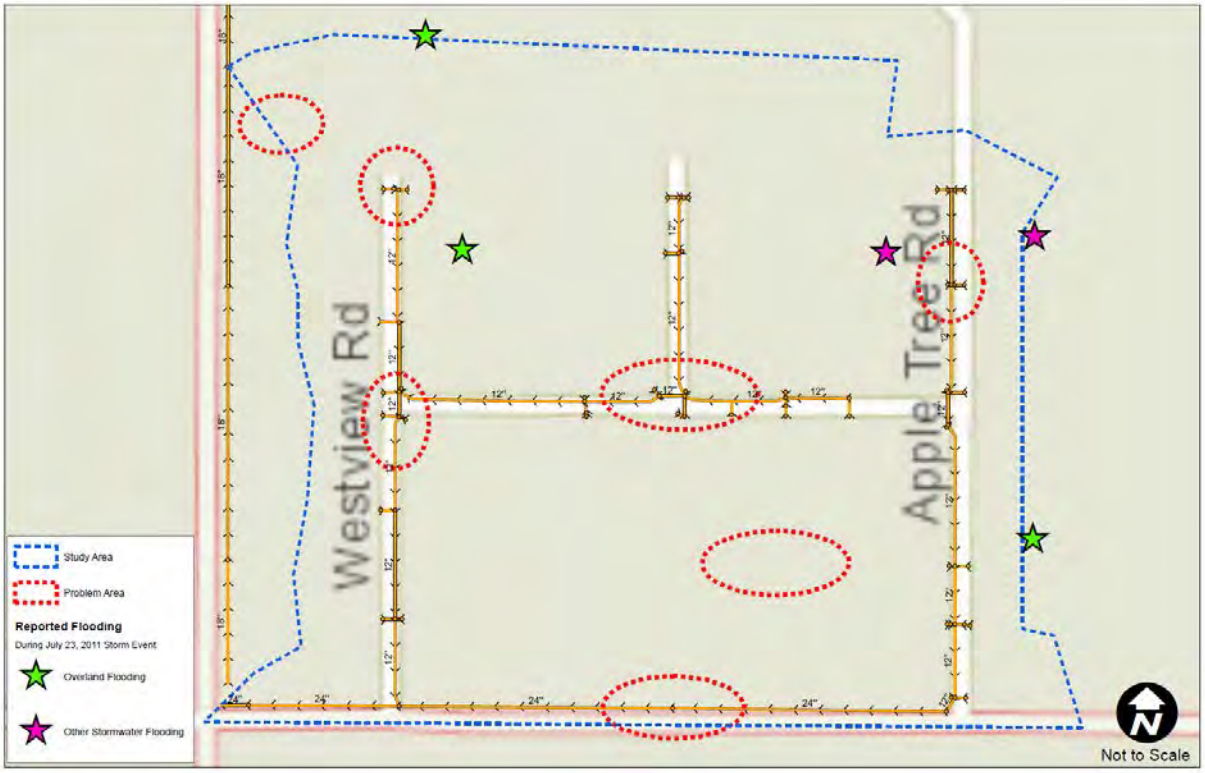
The cost of the improvements recommended for Area G, including design and construction engineering is estimated to be $1,961,270. A detailed calculation of this cost is included as Appendix 4.

3.9 Area N Existing Conditions

Area N is a neighborhood of single-family homes in the southwest corner of the Village, bounded by Hill Road on the south, Hibbard Road on the west, Lindenwood Drive on the north, and Apple Tree Road on the east, as shown in Figure 6 below.

FIGURE 6

Study Area N



The area is served by sewers ranging from 12- to 24 inches in diameter. The 24-inch outlet receives flow from all of the existing sewers in Area N and discharges at the

northwest corner of Hibbard Road and Hill Road to a channel which travels through property owned by the Forest Preserve District of Cook County (FPDCC).

The lowest point in Area N is an undrained sideyard depression at the northwest corner of the study area. Another undrained depression exists in the rear yards of the properties located north of Hill Road and south of Broadmeadow Road. These depressional storage areas are considered problem areas because the calculated 100-year high water surface elevations (623.6 and 624.3, respectively) are higher than the gound elevation adjacent to residences along the overland fow path. This means that the residences may be at risk of overland flooding. The streets in Area N are generally low and very flat so street flooding is a significant concern in this study area.

The owners of five properties within Area N reported flooding due to the July 2011 storm event. Two of these properties are adjacent to the problem area along Apple Tree Road and one is adjacent to the problem area at the north end of Westview Road. The reported types of flooding for the five properties include basement seepage, sump pump failure and overland flow into three of the structures.

Nearly all of Area N is mapped within the 100-year floodplain, but Area N is protected from the Skokie River floodwaters by a levee and a pumping station northwest of the intersection of Hibbard Road and Hill Road. Planned improvements to the pumping station and the Lake Michigan Outlet would both act to lower the tailwater elevation at the Area N outlet. It is anticipated that these improvements would be completed prior to any improvements in Area N, so the Existing Conditions tailwater assumes that the capacity of the pumping station has been increased and that the Lake Michigan Outlet has been constructed.

3.10 Area N Proposed Conditions

Even with the planned improvements to the pumping station and the planned Lake Michigan Outlet, the storm sewer system in Area N is still very sensitive to the tailwater elevation, due to the low ground surface elevations throughout the neighborhood. The timing of the 100-year high water surface elevation at the pumping station is not likely to be significantly offset from the timing of the peak discharge from Area N. Therefore, the tailwater elevation at the outlet from Area N was set at the 100-year high water surface elevation of the pumping station (assuming construction of the planned pumping station improvements and the Lake Michigan Outlet). Under this tailwater condition, the effectiveness of the modeled improvements is limited since many of the inlets in Area N are less than less than 2-1/2 feet above the tailwater elevation. A sensitivity analysis demonstrates that the 100-year high water surface elevation at the pumping station would have to be reduced even further (from 620.8 to approximately 617.7) for the modeled improvements to be effective.

Modeled improvements for Area N included increasing the storm sewer sizes from 12- and 24-inch pipes to 18- and 36-inch pipes, as well as increasing inlet capacity, as shown on Exhibit 6. The total cost of these improvements, including permitting with the USACE, FPDCC, and Cook County Highway Department, along with design and construction engineering, is estimated to be $1,168,115. A detailed calculation of this cost is included as Appendix 5.

Since the storm sewer capacity in Area N is limited by the tailwater to such a great extent, improvements to the overland flow paths would be much more effective for flood risk reduction than storm sewer improvements. A review of the Village topography indicates that when stormwater rises to elevations slightly higher than 623,

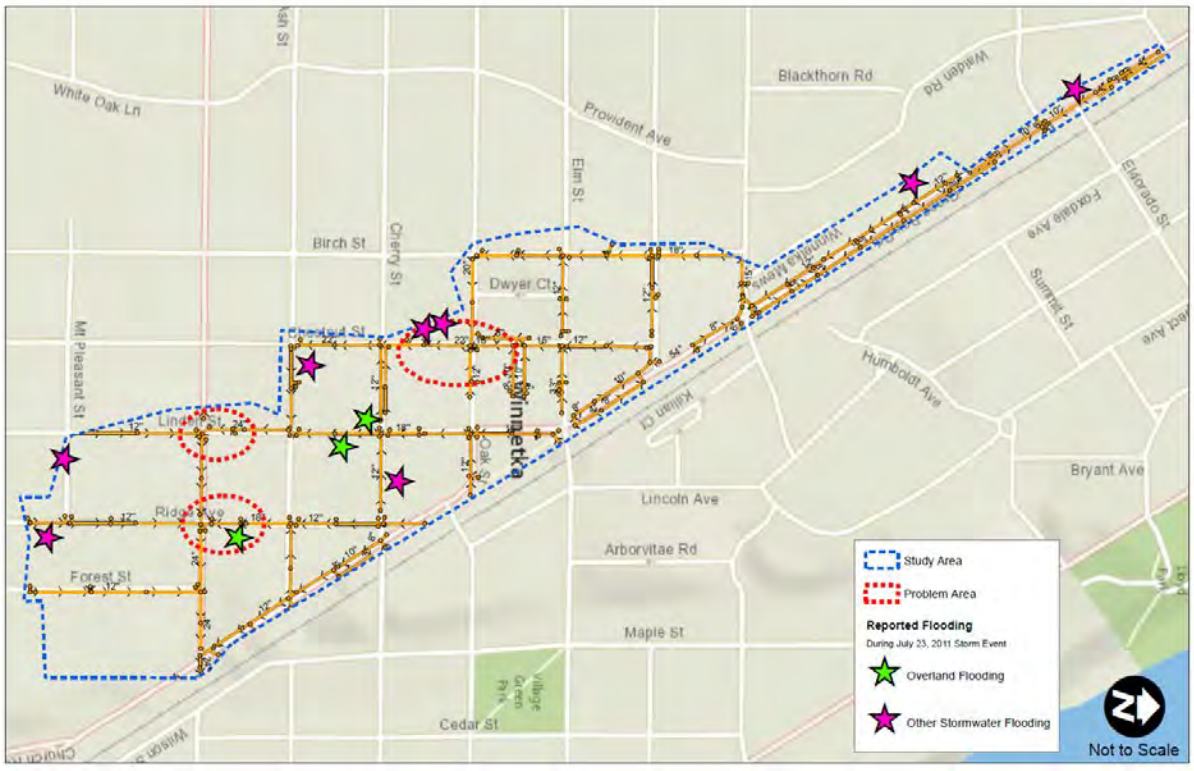
it flows overland along streets and through side yards to the Hibbard Road and Hill Road rights-of-way. Several residences along the overland flow path have adjacent ground at or very near elevation 623 and may be at risk of overland flooding. To protect these properties, the Village could perform a detailed topographic survey of Area N to determine where the overland flow paths may be hindered.

3.11 Area O Existing Conditions

Area O is located south of Area C, along the Union Pacific Railroad. This area includes offices and stores, multi- and single-family dwellings, the Winnetka commuter rail station, and the North Shore Country Day School. It is drained by sewers ranging from 8 inches to 33 inches in diameter, and includes two permitted connections to the MWRD interceptor sewer along Green Bay Road. Area O is shown in Figure 7 below.

FIGURE 7

Study Area O



Nearly all of Area O drains to the south interceptor sewer connection at the intersection of Willow Road and Green Bay Road. The north connection to the interceptor sewer is located at the intersection of Pine Street and Green Bay Road. Only the portion of Area O in the immediate vicinity of that intersection and the area further north drains to the north connection.

The lowest point in Area O occurs at the intersection of Willow Road and Green Bay Road, but that location is not considered a problem area. The owners of eleven properties within Area O reported flooding due to the July 2011 storm event. Two of these properties are adjacent to a problem area near the intersection of Chestnut Street and Oak Street. Another property is adjacent to a problem area at the intersection of Ridge Avenue and Willow Road. The rest of the properties are scattered throughout the Area O. The reported types of flooding for these eleven properties range from basement seepage and sump pump failure to several instances of overland flow into structures.

3.12 Area O Proposed Conditions

The MWRD may require the disconnection of any improvements made to storm sewers which connect to an interceptor sewer. Therefore, two alternatives were modeled for Area O. Alternate 1 disconnects the Village storm sewer system from the MWRD interceptor sewer both locations. Alternate 2 would maintain the exisiting connections to the interceptor sewer, but would not increase the rate of discharge to the interceptor sewer beyond the current level.

The planned Lake Michigan Outlet (CBBEL, October 2011) involves the installation of an 96-inch storm sewer along Willow Road between Glendale Road and

Lake Michigan. It is anticipated that the Lake Michigan Outlet would be constructed prior to any improvements in Area O, so the Existing Conditions model includes the planned 96-inch storm sewer along Willow Road.

3.12.1 Alternate 1 – Disconnect from MWRD - In this alternate, a new drop shaft would be installed at the intersection of Willow Road and Green Bay Road to facilitate disconnection from the south interceptor connection. Also in this alternate, the north connection to the interceptor sewer would be abandoned and all the stormwater draining to the intersection of Pine Street and Green Bay Road would be routed west along Pine Street to the planned 48-inch storm sewer along Provident Avenue. This is shown on Exhibit 7A. No modifications to the conceptual Provident Avenue storm sewer would be necessary to implement this alternate.

The 100-year peak flows from the problem area near the intersection of Chestnut Street and Oak Street can be accomodated by increasing storm sewer sizes along Chestnut Street from 22 and 24 inches to 42 and 48 inches. Since the planned Lake Michigan Outlet would be tunneled between Birch Street and Poplar Street without any intermediate drop structures, the proposed storm sewer running south along Chestnut Street would turn west at Ash Street and then south along Birch Street to connect at the drop structure.

The problem areas near the intersections of Linden Street and Ridge Avenue with Willow Road are similar to each other in that both occur at a low point in the street where adjacent residences can be damaged by overland flow at very shallow depths of street flooding. In both locations, the existing pipe size should be increased and inlet capacity should also be increased to protect the adjacent residences.

The total cost of these improvements, including permitting with MWRD, along with design and construction engineering, is estimated to be $2,303,475. A detailed calculation of this cost is included as Appendix 6A.

3.12.2 Alternate 2 – Maintain Connection to MWRD - If the existing connections to the MWRD interceptor sewer are maintained without increasing the rate of discharge to the interceptor sewer, there is no need for a new drop structure at Willow Road and Green Bay Road, nor is there a need to route stormwater west along Pine Street to the planned 48-inch storm sewer along Provident Avenue. All other aspects of Alternate 2 remain unchanged from Alternate 1. This is shown on Exhibit 7B.

The total cost of these improvements, including permitting with MWRD, along with design and construction engineering, is estimated to be $1,767,074. A detailed calculation of this cost is included as Appendix 6B.

4. CONCLUSIONS AND RECOMMENDATIONS

The improvements recommended in this Assessment were designed to provide relief from flood damages for the Additional Study Areas for storms up to and including the 100-year design event. Conceptual improvements were modeled in order to reduce surface flooding in the problem areas to an acceptable level and below all known low entry elevations.

TABLE 1

Engineer's Estimate of Probable Cost Summary by Study Area

Study Area	Engineer's Estimate of Probable Cost (Millions) 100-year
Area A	$0.5
Area C - Alternate 2	$1.7
Area E	$0.9
Area G	$2.0
Area N	$1.2
Area O - Alternate 2	$1.8
Total =	$8.1

In Areas C and O, where two alternatives were presented, we recommend maintaining the existing connection to the MWRD interceptor sewer (Alternate 2), if this is allowed by the MWRD. Due to a pending consent decree, the MWRD is currently developing a plan to reduce the frequency of combined sewer overflows. Requiring municipalities to disconnect separate storm sewers from the combined sewer system as a condition of a new Sewerage System Permit may very well be a component of the plan. If that is the case, then Alternative 2 may not be feasible for Areas C and O. If, however, the Village is allowed to maintain the existing connections to the MWRD

interceptor sewers, then this would be the recommended alternative since it would save the Village approximately $750,000.

Installation of the recommended improvements for Areas G, N, and O should be delayed until other planned improvements, such as the Lake Michigan Outlet and improvements to the pumping station near the intersection of Hibbard Road and Hill Road, have been constructed, since the recommended improvements in Areas G, N, and O are dependent upon the planned improvements.

The modeled storm sewer improvements in Area N are not recommended since the modeling demonstrates that the adverse tailwater condition limits the effectiveness of potential storm sewer improvements. Instead, the Village should perform a detailed topographic survey of Area N to determine how residences can be protected against overland flooding by making improvements to the overland flow paths.

Appendices

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 1 - Area A Engineeer's Opinion of Probable Cost

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
36" RCP Storm Sewer	Sideyard	0 - 5	282	Foot	$ 265	$ 74,730
24" RCP Storm Sewer	Residential Street	5 - 8	663	Foot	$ 265	$ 175,695
24" RCP Storm Sewer	Sideyard	0 - 5	144	Foot	$ 215	$ 30,960
12" RCP Storm Sewer	Residential Street	0 - 5	64	Foot	$ 200	$ 12,800
Inlet	Residential Street	N/A	6	Each	$ 1,000	$ 6,000
5' Diameter Manhole	Residential Street	0 - 5	3	Each	$ 5,000	$ 15,000
5' Diameter Manhole	Residential Street	5 - 8	3	Each	$ 5,750	$ 17,250
36" Flap Valve	N/A	N/A	1	Each	$ 10,000	$ 10,000
24" Flap Valve	N/A	N/A	1	Each	$ 7,500	$ 7,500

Construction Subtotal		$ 349,935
Construction Contingency	20%	$ 69,987
Construction Total		$ 419,922
Design Engineering	7.5%	$ 31,494
Construction Observation	7.5%	$ 31,494
Permitting (USACE)	2.5%	$ 10,498
Project Total		**$ 493,408**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 2A - Area C Engineeer's Opinion of Probable Cost - Alt 1

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
48" RCP Storm Sewer	Downtown Street	16 - 20	236	Foot	$ 740	$ 174,640
48" RCP Storm Sewer	Downtown Street	12 - 16	232	Foot	$ 665	$ 154,280
48" RCP Storm Sewer	Parallel to Railroad	12 - 16	230	Foot	$ 525	$ 120,750
42" RCP Storm Sewer	Downtown Street	12 - 16	234	Foot	$ 585	$ 136,890
30" RCP Storm Sewer	Residential Street	12 - 16	232	Foot	$ 375	$ 87,000
30" RCP Storm Sewer	Residential Street	8 - 12	203	Foot	$ 330	$ 66,990
24" RCP Storm Sewer	Downtown Street	0 - 5	333	Foot	$ 320	$ 106,560
18" RCP Storm Sewer	Residential Street	5 - 8	301	Foot	$ 245	$ 73,745
18" RCP Storm Sewer	Residential Street	5 - 8	134	Foot	$ 245	$ 32,830
High Capacity Inlet	Downtown Street	N/A	24	Each	$ 3,250	$ 78,000
8' Diameter Manhole	Downtown Street	16 - 20	2	Each	$ 16,000	$ 32,000
8' Diameter Manhole	Downtown Street	12 - 16	4	Each	$ 14,500	$ 58,000
6' Diameter Manhole	Downtown Street	8 - 12	1	Each	$ 9,500	$ 9,500
6' Diameter Manhole	Downtown Street	5 - 8	1	Each	$ 8,500	$ 8,500
5' Diameter Manhole	Residential Street	5 - 8	2	Each	$ 5,750	$ 11,500
Railroad Crossing	N/A	N/A	1	L. Sum	$ 150,000	$ 150,000
Connection to Existing	N/A	N/A	1	L. Sum	$ 50,000	$ 50,000

Construction Subtotal		$ 1,351,185
Construction Contingency	20%	$ 270,237
Construction Total		$ 1,621,422
Design Engineering	7.5%	$ 121,607
Construction Observation	7.5%	$ 121,607
Permitting (IDOT, MWRD, Union Pacific)	3.0%	$ 48,643
Project Total		**$ 1,913,278**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 2B - Area C Engineeer's Opinion of Probable Cost - Alt 2

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
42" RCP Storm Sewer	Downtown Street	16 - 20	236	Foot	$ 645	$ 152,220
30" RCP Storm Sewer	Downtown Street	12 - 16	232	Foot	$ 475	$ 110,200
42" RCP Storm Sewer	Parallel to Railroad	12 - 16	230	Foot	$ 455	$ 104,650
24" RCP Storm Sewer	Downtown Street	12 - 16	234	Foot	$ 430	$ 100,620
30" RCP Storm Sewer	Residential Street	12 - 16	232	Foot	$ 375	$ 87,000
30" RCP Storm Sewer	Residential Street	8 - 12	203	Foot	$ 330	$ 66,990
24" RCP Storm Sewer	Downtown Street	0 - 5	333	Foot	$ 320	$ 106,560
18" RCP Storm Sewer	Residential Street	5 - 8	134	Foot	$ 245	$ 32,830
High Capacity Inlet	Downtown Street	N/A	24	Each	$ 3,250	$ 78,000
8' Diameter Manhole	Downtown Street	16 - 20	2	Each	$ 16,000	$ 32,000
8' Diameter Manhole	Downtown Street	12 - 16	4	Each	$ 14,500	$ 58,000
6' Diameter Manhole	Downtown Street	8 - 12	1	Each	$ 9,500	$ 9,500
6' Diameter Manhole	Downtown Street	5 - 8	1	Each	$ 8,500	$ 8,500
5' Diameter Manhole	Residential Street	5 - 8	2	Each	$ 5,750	$ 11,500
Railroad Crossing	N/A	N/A	1	L. Sum	$ 150,000	$ 150,000
Connection to Existing	N/A	N/A	1	L. Sum	$ 50,000	$ 50,000

Construction Subtotal		$ 1,158,570
Construction Contingency	20%	$ 231,714
Construction Total		$ 1,390,284
Design Engineering	7.5%	$ 104,271
Construction Observation	7.5%	$ 104,271
Permitting (IDOT, MWRD, Union Pacific)	5.0%	$ 69,514
Project Total		**$ 1,668,341**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 3 - Area E Engineeer's Opinion of Probable Cost

Sumac Lane/Hickory Lane

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
30" RCP Storm Sewer	Sideyard	5 - 8	220	Foot	$ 265	$ 58,300
24" RCP Storm Sewer	Residential Street	5 - 8	643	Foot	$ 265	$ 170,395
18" RCP Storm Sewer	Residential Street	5 - 8	288	Foot	$ 245	$ 70,560
High Capacity Inlet	N/A	N/A	4	Each	$ 3,250	$ 13,000
6' Diameter Manhole	Residential Street	5 - 8	1	Each	$ 7,000	$ 7,000
5' Diameter Manhole	Residential Street	5 - 8	4	Each	$ 5,750	$ 23,000
30" Flap Valve	N/A	N/A	1	Each	$ 9,000	$ 9,000
						$ 351,255

Boal Parkway

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
24" RCP Storm Sewer	Sideyard	5 - 8	98	Foot	$ 240	$ 23,520
18" RCP Storm Sewer	Residential Street	5 - 8	533	Foot	$ 245	$ 130,585
18" RCP Storm Sewer	Sideyard	5 - 8	169	Foot	$ 225	$ 38,025
High Capacity Inlet	N/A	N/A	8	Each	$ 3,250	$ 26,000
5' Diameter Manhole	Residential Street	5 - 8	7	Each	$ 5,750	$ 40,250
24" Flap Valve	N/A	N/A	1	Each	$ 7,500	$ 7,500
						$ 265,880

Construction Subtotal		$ 617,135
Construction Contingency	20%	$ 123,427
Construction Total		$ 740,562
Design Engineering	7.5%	$ 55,542
Construction Observation	7.5%	$ 55,542
Permitting (USACE)	1.5%	$ 11,108
Project Total		**$ 862,755**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 4 - Area G Engineeer's Opinion of Probable Cost

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
48" RCP Storm Sewer	Residential Street	12 - 16	287	Foot	$ 550	$ 157,850
48" RCP Storm Sewer	Residential Street	8 - 12	1,038	Foot	$ 480	$ 498,240
30" RCP Storm Sewer	Residential Street	12 - 16	384	Foot	$ 375	$ 144,000
30" RCP Storm Sewer	Residential Street	8 - 12	786	Foot	$ 330	$ 259,380
24" RCP Storm Sewer	Residential Street	8 - 12	275	Foot	$ 295	$ 81,125
24" RCP Storm Sewer	Residential Street	5 - 8	241	Foot	$ 265	$ 63,865
High Capacity Inlet	N/A	N/A	12	Each	$ 3,250	$ 39,000
8' Diameter Manhole	Residential Street	12 - 16	5	Each	$ 12,750	$ 63,750
8' Diameter Manhole	Residential Street	8 - 12	1	Each	$ 11,250	$ 11,250
6' Diameter Manhole	Residential Street	8 - 12	9	Each	$ 8,000	$ 72,000
5' Diameter Manhole	Residential Street	5 - 8	1	Each	$ 5,750	$ 5,750
Connection to Existing	N/A	N/A	1	L. Sum	$ 25,000	$ 25,000

Construction Subtotal		$ 1,421,210
Construction Contingency	20%	$ 284,242
Construction Total		$ 1,705,452
Design Engineering	7.5%	$ 127,909
Construction Observation	7.5%	$ 127,909
Permitting	0.0%	$ -
Project Total		**$ 1,961,270**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 5 - Area N Engineeer's Opinion of Probable Cost

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
36" RCP Storm Sewer	Residential Street	5 - 8	335	Foot	$ 330	$ 110,550
30" RCP Storm Sewer	Residential Street	5 - 8	829	Foot	$ 295	$ 244,555
24" RCP Storm Sewer	Residential Street	5 - 8	714	Foot	$ 265	$ 189,210
24" RCP Storm Sewer	Residential Street	0 - 5	207	Foot	$ 240	$ 49,680
18" RCP Storm Sewer	Residential Street	5 - 8	251	Foot	$ 245	$ 61,495
18" RCP Storm Sewer	Sideyard	0 - 5	210	Foot	$ 200	$ 42,000
15" RCP Storm Sewer	Rearyard	0 - 5	35	Foot	$ 200	$ 7,000
High Capacity Inlet	N/A	N/A	4	Each	$ 3,250	$ 13,000
7' Diameter Manhole	Residential Street	5 - 8	2	Each	$ 8,250	$ 16,500
6' Diameter Manhole	Residential Street	5 - 8	4	Each	$ 7,000	$ 28,000
5' Diameter Manhole	Residential Street	5 - 8	9	Each	$ 5,750	$ 51,750
4' Diameter Manhole	Residential Street	0 - 5	1	Each	$ 4,000	$ 4,000
18" RCP FES	N/A	N/A	1	Each	$ 1,200	$ 1,200
15" RCP FES	N/A	N/A	1	Each	$ 1,000	$ 1,000
Connection to Existing	N/A	N/A	1	Each	$ 5,000	$ 5,000

Construction Subtotal		$ 824,940
Construction Contingency	20%	$ 164,988
Construction Total		$ 989,928
Design Engineering	7.5%	$ 74,245
Construction Observation	7.5%	$ 74,245
Permitting (USACE, FPDCC, CCHD)	3.0%	$ 29,698
Project Total		**$ 1,168,115**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 6A - Area O Engineeer's Opinion of Probable Cost - Alt 1

Oak Street/Chestnut Street

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
48" RCP Storm Sewer	Residential Street	12 - 16	1,270	Foot	$ 550	$ 698,500
42" RCP Storm Sewer	Residential Street	8 - 12	216	Foot	$ 420	$ 90,720
36" RCP Storm Sewer	Residential Street	5 - 8	226	Foot	$ 330	$ 74,580
24" RCP Storm Sewer	Downtown Street	5 - 8	214	Foot	$ 350	$ 74,900
High Capacity Inlet	N/A	N/A	12	Each	$ 3,250	$ 39,000
8' Diameter Manhole	Residential Street	12 - 16	5	Each	$ 12,750	$ 63,750
8' Diameter Manhole	Residential Street	8 - 12	1	Each	$ 11,250	$ 11,250
8' Diameter Manhole	Residential Street	5 - 8	1	Each	$ 9,750	$ 9,750
7' Diameter Manhole	Downtown Street	5 - 8	1	Each	$ 9,750	$ 9,750
5' Diameter Manhole	Downtown Street	5 - 8	1	Each	$ 7,000	$ 7,000
Connect to Existing	N/A	N/A	1	L. Sum	$ 25,000	$ 25,000
						$ 1,104,200

Linden Street/Ridge Avenue

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
30" RCP Storm Sewer	Residential Street	8 - 12	222	Foot	$ 330	$ 73,260
24" RCP Storm Sewer	Residential Street	8 - 12	222	Foot	$ 295	$ 65,490
High Capacity Inlet	N/A	N/A	4	Each	$ 3,250	$ 13,000
5' Diameter Manhole	Residential Street	5 - 8	2	Each	$ 5,750	$ 11,500
Connect to Existing	N/A	N/A	2	L. Sum	$ 1,000	$ 2,000
						$ 165,250

MWRD Disconnection

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
30" RCP Storm Sewer	Residential Street	8 - 12	449	Foot	$ 330	$ 148,170
30" RCP Storm Sewer	Downtown Street	8 - 12	231	Foot	$ 425	$ 98,175
6' Diameter Manhole	Downtown Street	8 - 12	2	Each	$ 9,500	$ 19,000
Connect to Ex-Drop Shaft	N/A	N/A	1	L. Sum	$ 120,000	$ 120,000
						$ 385,345

Construction Subtotal		$ 1,654,795
Construction Contingency	20%	$ 330,959
Construction Total		$ 1,985,754
Design Engineering	7.5%	$ 148,932
Construction Observation	7.5%	$ 148,932
Permitting (MWRD)	1%	$ 19,857.54
Project Total		**$ 2,303,475**

Notes
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization

2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Village of Winnetka
Flood Risk Reduction Assessment - Additional Study Areas
Appendix 6B - Area O Engineeer's Opinion of Probable Cost - Alt 2

Oak Street/Chestnut Street

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
48" RCP Storm Sewer	Residential Street	12 - 16	1,270	Foot	$ 550	$ 698,500
42" RCP Storm Sewer	Residential Street	8 - 12	216	Foot	$ 420	$ 90,720
36" RCP Storm Sewer	Residential Street	5 - 8	226	Foot	$ 330	$ 74,580
24" RCP Storm Sewer	Downtown Street	5 - 8	214	Foot	$ 350	$ 74,900
High Capacity Inlet	N/A	N/A	12	Each	$ 3,250	$ 39,000
8' Diameter Manhole	Residential Street	12 - 16	5	Each	$ 12,750	$ 63,750
8' Diameter Manhole	Residential Street	8 - 12	1	Each	$ 11,250	$ 11,250
8' Diameter Manhole	Residential Street	5 - 8	1	Each	$ 9,750	$ 9,750
7' Diameter Manhole	Downtown Street	5 - 8	1	Each	$ 9,750	$ 9,750
5' Diameter Manhole	Downtown Street	5 - 8	1	Each	$ 7,000	$ 7,000
Connect to Existing	N/A	N/A	1	L. Sum	$ 25,000	$ 25,000
						$ 1,104,200

Linden Street/Ridge Avenue

Item	Location Type	Depth, feet	Quantity	Unit	Unit Price	Item Cost
30" RCP Storm Sewer	Residential Street	8 - 12	222	Foot	$ 330	$ 73,260
24" RCP Storm Sewer	Residential Street	8 - 12	222	Foot	$ 295	$ 65,490
High Capacity Inlet	N/A	N/A	4	Each	$ 3,250	$ 13,000
5' Diameter Manhole	Residential Street	5 - 8	2	Each	$ 5,750	$ 11,500
Connect to Existing	N/A	N/A	2	L. Sum	$ 1,000	$ 2,000
						$ 165,250

Construction Subtotal		$ 1,269,450
Construction Contingency	20%	$ 253,890
Construction Total		$ 1,523,340
Design Engineering	7.5%	$ 114,251
Construction Observation	7.5%	$ 114,251
Permitting (MWRD)	1%	$ 15,233.40
Project Total		**$ 1,767,074**

Notes

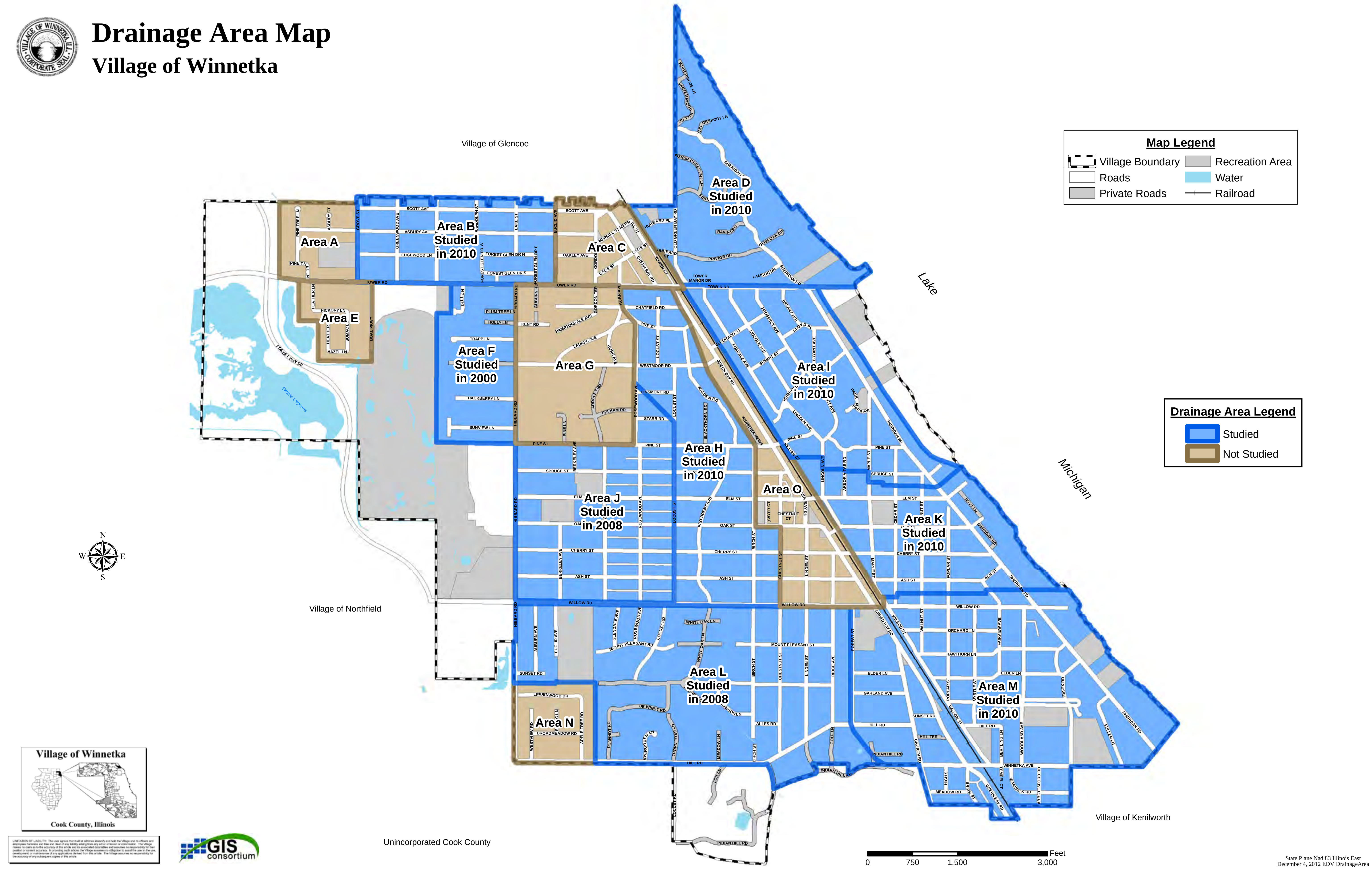
1. Prices include sanitary sewer and water service relocation/adjustment, trench backfill, pavement or lawn restoration, trafffic control, erosion control, construction layout, mobilization

2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.
3. Prices are current for 2012.

Exhibits

Drainage Area Map

Village of Winnetka



VILLAGE OF WINNETKA, ILLINOIS

Exhibit 2

Area A Proposed Conditions

100 Year Inundation Depth
Existing: 1.8 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 1.8 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 1.1 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 1.5 ft
Proposed: 0.2 ft

36"
24"
12"
30"
33"
18"
10"
24"
36"
18"
12"
12"
36"

ASBURY AVE
ASBURY CT
PINE TREE LN
GROVE ST
SCOTT AVE
EDGEWOOD LN
TOWER RD
FOREST WAY DR

- Study Area
- Problem Area
- Increase Inlet Capacity
- Proposed Sewer

Existing Data

- Streets
- Manhole - Combined
- Manhole - Storm
- Catch Basin
- Inlet
- Discharge Point
- Pipe - Combined
- Pipe - Storm

Engineer's Opinion of Probable Cost= $493,408

1 inch = 125 feet

BAXTER WOODMAN Consulting Engineers

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 3A

Area C Proposed Conditions

Alternate 1

100 Year Inundation Depth
Existing: 1.0 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 0.7 ft
Proposed: 0.0 ft

- Study Area
- Problem Area
- Increase Inlet Capacity
- Proposed Sewer
- Proposed Sewer (Separate Study)

Existing Data

- Streets
- Manhole - Combined
- Manhole - Storm
- Catch Basin
- Inlet
- Discharge Point
- Pipe - Combined
- Pipe - Storm

Engineer's Opinion of Probable Cost= $1,913,278

1 inch = 225 feet

BAXTER WOODMAN Consulting Engineers

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 3B

Area C Proposed Conditions

Alternate 2

100 Year Inundation Depth
Existing: 1.0 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 0.7 ft
Proposed: 0.0 ft

GORDON TER
OAKLEY AVE
BURR AVE
LAUREL AVE
CHATFIELD RD
GAGE ST
MERRILL ST
TOWER CT
HUBBARD ST
TOWER RD
PRIVATE RD
VINE ST
OLD GREEN BAY RD
FISHER LN

Study Area
Problem Area
Increase Inlet Capacity
Proposed Sewer
Proposed Sewer
(Separate Study)

Existing Data

Streets
Manhole - Combined
Manhole - Storm
Catch Basin
Inlet
Discharge Point
Pipe - Combined
Pipe - Storm

Engineer's Opinion of Probable Cost= $1,668,341

1 inch = 225 feet

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 4

Area E Proposed Conditions

100 Year Inundation Depth
Existing: 0.7 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 1.6 ft
Proposed: 0.0 ft

100 Year Inundation Depth

	TW=620.00	TW=621.40	TW=622.75
Existing:	0.4	0.5	0.5
Proposed:	0.0	0.0	0.3

TOWER RD
HEATHER LN
HICKORY LN
HEATHER LN
SUMAC LN
HAZEL LN
BOAL PKWY
FOREST WAY DR

Study Area
Problem Area
Increase Inlet Capacity
Proposed Sewer

Existing Data

Streets
Manhole - Combined
Manhole - Storm
Catch Basin
Inlet
Discharge Point
Pipe - Combined
Pipe - Storm

Engineer's Opinion of Probable Cost= $862,755

1 inch = 150 feet

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 5

Area G Proposed Conditions

100 Year Inundation Depth
Existing: 1.5 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 1.1 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 0.6 ft
Proposed: 0.0 ft

HIBBARD RD
HOLLY LN
PINE ST
PINE LN
WESTMOOR RD
FOREST GLEN DR S
BERKELEY AVE
PELHAM RD
BURR AVE
LAUREL AVE
VINE ST
CHATFIELD RD
GAGE ST

- Study Area
- Problem Area
- Increase Inlet Capacity
- Proposed Sewer
- Proposed Sewer (Separate Study)

Existing Data

- Manhole - Combined
- Manhole - Storm
- Catch Basin
- Inlet
- Discharge Point
- Pipe - Combined
- Pipe - Storm

Engineer's Opinion of Probable Cost= $1,961,270

1 inch = 225 feet

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 6

Area N Proposed Conditions

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	4.5	4.5	4.5
Proposed:	2.0	2.0	2.0

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	0.5	0.5	0.5
Proposed:	0.3	0.5	0.5

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	0.2	0.2	0.2
Proposed:	0.1	0.2	0.2

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	0.6	0.6	0.6
Proposed:	0.5	0.6	0.6

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	0.3	0.3	0.3
Proposed:	0.0	0.3	0.3

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	1.8	1.8	1.8
Proposed:	0.6	0.7	0.7

100 Year Inundation Depth	TW=617.70	TW=620.30	TW=620.80
Existing:	1.5	1.5	1.6
Proposed:	0.0	0.3	0.5

HIBBARD RD
WESTVIEW RD
SPRING LN
APPLE TREE RD
BROADMEADOW RD
HILL RD

- Study Area
- Problem Area
- Increase Inlet Capacity
- Proposed Sewer

Existing Data

- Streets
- Manhole - Combined
- Manhole - Storm
- Catch Basin
- Inlet
- Discharge Point
- Pipe - Combined
- Pipe - Storm

Engineer's Opinion of Probable Cost= $1,168,115

1 inch = 100 feet

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 7A

Area O Proposed Conditions

Alternate 1

100 Year Inundation Depth
Existing: 0.5 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 1.1 ft
Proposed: 0.0 ft

100 Year Inundation Depth
Existing: 0.7 ft
Proposed: 0.0 ft

- Study Area
- Problem Area
- Increase Inlet Capacity
- Proposed Sewer
- Proposed Sewer (Separate Study)

Existing Data

- Manhole - Combined
- Manhole - Storm
- Catch Basin
- Inlet
- Discharge Point
- Pipe - Combined
- Pipe - Storm

Engineer's Opinion of Probable Cost= $2,303,475

1 inch = 450 feet

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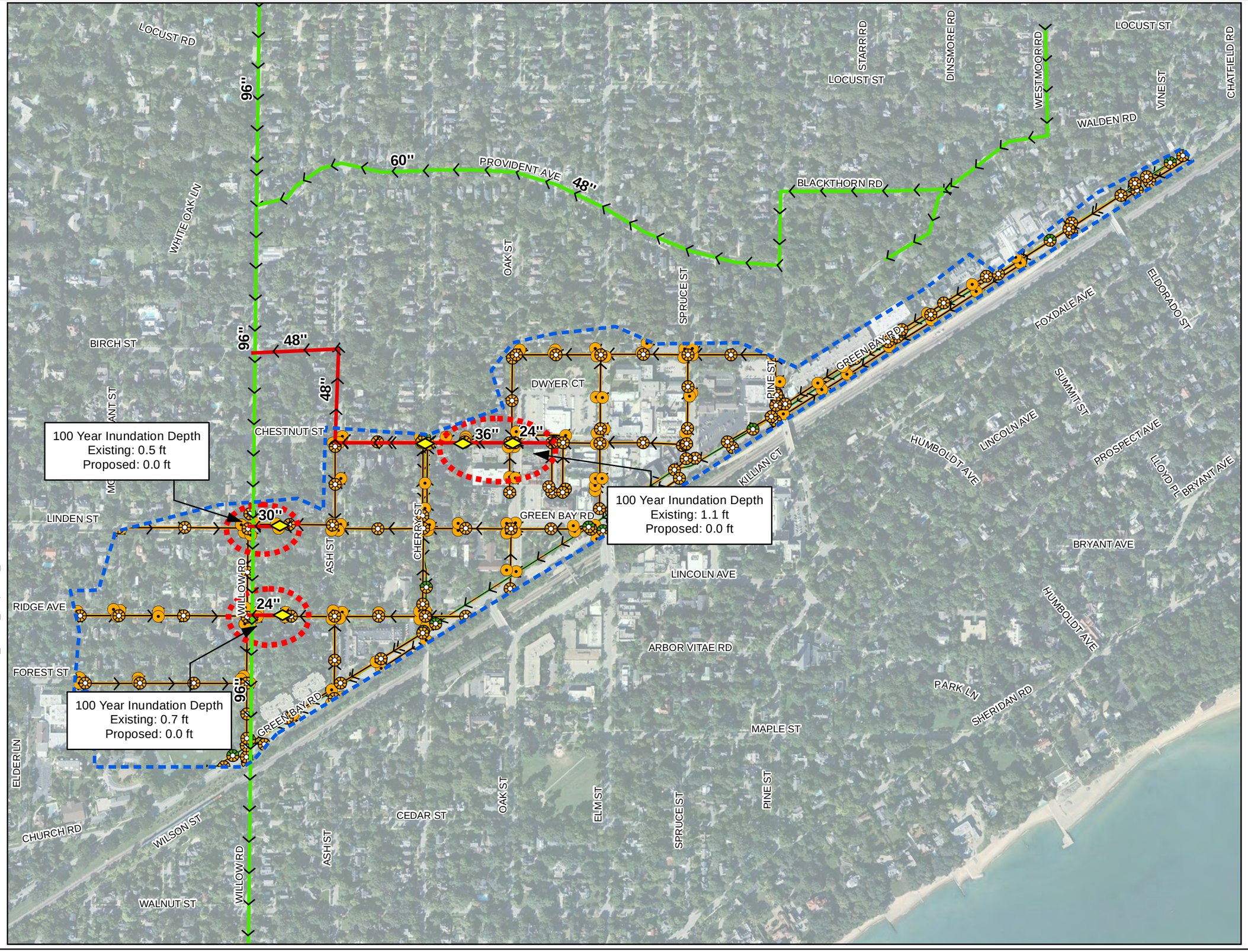

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VILLAGE OF WINNETKA, ILLINOIS

Exhibit 7B

Area O Proposed Conditions

Alternate 2

- Study Area
- Problem Area
- Increase Inlet Capacity
- Proposed Sewer
- Proposed Sewer (Separate Study)

Existing Data

- Manhole - Combined
- Manhole - Storm
- Catch Basin
- Inlet
- Discharge Point
- Pipe - Combined
- Pipe - Storm

Engineer's Opinion of Probable Cost= $1,767,074

1 inch = 450 feet

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