



InterOffice Memo

To: Public Works Committee
From: David A. Dratnol, P.E., Village Engineer *DAE*
Through: Carl Goldsmith, Public Works Director *CG*
Date: September 3, 2009
Subject: Storm Water/ Combined Sewer Modeling Project
Draft Gatz Pond Watershed Sewer Separation Analysis and
Prioritizing Plan

Attached please find a draft summary report for the first phase of the sewer modeling project. The scope of the project is to model our storm sewer, sanitary sewer, and combined sewer systems to determine the extent of sewer separation required and means and methods to separate the systems. The project is divided into two drainage areas. The first drainage area is the Gatz Pond Watershed (covered in this report) and the second is the NAS Watershed. Once the model is complete, the Village will have a total picture of both the storm sewer and sanitary sewer systems, and where the capital improvements will need to be made to separate these systems. Due to the overwhelming investments involved in completing the task of eliminating the combined system, an important task of the model is to identify the most effective and efficient projects to start with and to map out a plan to eventually achieve the desired extent of separation. An important goal of the plan is to reduce and/or eliminate sewer overflows and backups on the combined sewer systems during storm events.

cc: File: SS-08-01

GATZ POND WATERSHED
SEWER SEPARATION ANALYSIS AND PRIORITIZATION PLAN

SUMMARY REPORT

Prepared By

Christopher B. Burke Engineering, Ltd.
9575 W. Higgins Road, Suite 600
Rosemont, IL 60018

Prepared For

Village of Lombard
255 E. Wilson Street
Lombard, IL 60148

CBBEL Project No. 07-0386

SEPTEMBER 2009

Jeff Julkowski, PE
Illinois Registered Professional Engineer
#062-057976

EXECUTIVE SUMMARY

Christopher B. Burke Engineering, Ltd. (CBBEL) has completed an analysis of the watershed tributary to a 108" combined sewer on Hickory Street. This watershed has been referred to as the Gatz Pond watershed due to the large detention basin (Gatz Pond) located within its limits. The purpose of the study was to determine the capacity of the existing storm and combined sewer systems, identify any combined sewer overflows (CSO), and develop a plan to separate the storm and combined sewers in the watershed.

The XP-SWMM modeling software was used to model the existing sewer systems. The model was developed using limited survey data and the Village's sewer atlases and aerial topography. To improve the accuracy of the model, flow meters were installed at two locations in the watershed. Actual storm events were run, and the model results were compared to the measured flows. The existing conditions model was calibrated based on the flow meter data and provides a good representation of the existing system performance. The model indicated several locations throughout the watershed where there is a potential for CSO during 5- and 10-year storm events. These locations are shown on Exhibits 4 and 5 of this report.

A proposed sewer separation plan was developed, which involved sizing of new storm sewer networks. Storm sewers were sized for the 10-year storm event. It was assumed that the existing combined sewers would be removed or abandoned, except in specific locations where overflow capacity is required.

A full sewer separation of the watershed requires significant infrastructure improvements. Aside from the street-by-street sewer separation, the major items include the expansion of a pump station on North Broadway and an outfall sewer to the East Branch DuPage River (EBDR). The existing elements of the pump station were built during the recent North Broadway Improvements, and it was envisioned at that time to be expanded to five cells with a capacity of approximately 400 cfs. The outfall sewer is a 108" pipe to be located along the Illinois Prairie Path (IPP) between the pump station and the EBDR. Both elements are required for a full separation of the watershed.

An interim conditions separation plan was also developed to begin the process of sewer separation without these major elements. The interim conditions plan includes constructing one cell of the North Broadway pump station, and pumping into an existing storm sewer on Hickory Street. The Village's SCADA system would be used to monitor water levels in the system, and the flow from the pump station would be varied depending on the levels. This system will allow use of the existing storm sewer system as an outfall without causing any downstream impacts.

It was assumed that the Village would choose to implement the interim condition plan. Based on this assumption, several projects were identified and prioritized, and concept-level cost estimates were prepared. ***The costs presented in this report are for the sewer separation projects only; they do not include cost for other utility replacement such as watermain, roadway resurfacing, landscaping, etc.*** These projects are listed below:

Project #1 – Interim Pump Station and Forcemain - \$1.2 million
Project #2 – Gatz Pond Outfall Sewer (separation Phase 1)- \$1.1 million
Project #3 – Storm Sewer Separations (broken into Phases 2-5) - \$10.9 million
Project #4 – Illinois Prairie Path Outfall - \$9.9 million
Project #5 – Storm Sewer Separation Phase 6 - \$7.3 million
Project #6 – North Broadway Pump Station Upgrades - \$2.4 million

TOTAL ESTIMATED COST = \$32.8 million

Additional details are provided in the following report.

DRAFT

INTRODUCTION

This report is an abbreviated summary of a sewer separation analysis completed for the Village of Lombard of a +/-1600-acre watershed bounded generally by Illinois Route 53 to the west, the Chicago & Northwestern Railroad to the north, Addison Street to the east, and Wilson Road to the south. This watershed has been referred to as the Gatz Pond watershed for the large detention basin located within its limits. Exhibit 1 shows the watershed limits. This watershed is drained by both separated storm sewer systems as well as combined sewer drainage. The purpose of the study was to develop a sewer separation plan for the entire study area. The main objective is to determine the extent of combined sewer separation needed to reduce or eliminate combined sewer overflows (CSO) that occur when sewer capacities are exceeded during storm events. To accomplish that goal, an XP-SWMM model was developed for existing conditions. The model was calibrated to measured rainfall and sewer flow data so that the runoff parameters of the watershed were understood. Once the parameters were known, a proposed sewer separation plan was developed, which included sizing of new storm sewer laterals and a main outfall to the East Branch DuPage River. An interim conditions plan was also developed to utilize existing infrastructure to the extent possible until the outfall sewer could be constructed. The results of the study and our recommendations are summarized in the following report.

The following are the goals of this study:

- Complete an existing conditions analysis of Gatz Pond Watershed;
- Identify existing conditions CSO locations;
- Develop an interim conditions separation plan;
- Determine location(s) of emergency overflow into the existing combined sewer for the interim separation plan;
- Develop an ultimate separation plan.

EXISTING CONDITIONS

Study Methodology

The main objective of the study is to determine the extent of combined sewer separation needed to reduce or eliminate CSO's that occur when sewer capacities are exceeded during storm events. To create a sewer separation plan, it is critical to understand the function and capacity of the storm and combined sewer systems as well as the operation of any lift stations. To accomplish this goal, a hydrologic and hydraulic model of the Gatz Pond watershed was developed. The model was used to determine the runoff rates for a given storm event, evaluate the storm sewer capacities and resulting water surface elevations, and will determine where CSO's exist. The model was used to evaluate various scenarios for eliminating CSO's to meet regulatory standards and determine the impact of developments on the sewer systems.

Model Development

The XP-SWMM model was developed using information obtained from a limited field survey, the Village's utility atlases, aerial topography, and various other sources of information. The sewer information obtained from these sources was input to the model. Watershed information was obtained from aerial photographs and the Village's 2' aerial topography. Exhibit 3 shows the extent of the storm and combined sewer system included in the model.

To supplement the available information and to more accurately model the existing systems, two flow monitors were installed to measure flows in the combined sewer system. One was located at Fairfield Avenue and North Broadway, and the other at Division Street and Highland Avenue. These monitors recorded flow rates in the system for a period of six months. Two storms during that period of time were selected and analyzed in detail. Rainfall information for these storms were input to the model, the predicted results were compared to the measured values. Based on this comparison, some changes were made in the hydrology parameters to calibrate to the known flow rates. Therefore, the existing conditions model has been "calibrated" to the known flows and is a good indicator of the existing system capacity. A sample plot of the calibrated model versus the actual flow meter data is provided below:

Findings and Conclusions

Using the existing conditions XP-SWMM model, there were several locations where the system is surcharged for the 10-year, 1-hour storm event (the typical design storm event for storm sewers). They are shown on Exhibit 4. These areas are potential Combined Sewer Overflow locations that would require reporting to the Illinois Environmental Protection Agency. Other areas of the watershed showed the potential for CSO during a 5-year storm event. Based on this analysis, it was deemed necessary to develop a sewer separation plan that would eliminate the potential for CSO's.

PROPOSED CONDITIONS

After the existing conditions model was calibrated, a proposed sewer separation plan was developed. Two scenarios were developed. The first was an interim scenario that uses existing infrastructure to convey the separated stormwater to the East Branch DuPage River (EBDR). This scenario determined the maximum flows that can be conveyed by the existing storm sewer system without causing impacts, as well as the suggested staging of areas to be separated. As more area is separated in the interim condition, the percentage of runoff separated during a given storm is decreased since the discharge to the storm system is more or less constant. The interim condition model was used to evaluate the runoff separation percentage for various storms as the separated drainage area increased. The second scenario is the ultimate future conditions, which includes a new storm sewer outfall to the EBDR. This outfall is needed to fully separate the watershed without causing drainage problems from insufficient conveyance capacity. The development of both scenarios is summarized in this section.

Interim Conditions

A portion of the infrastructure needed to develop a separate sewer system was recently constructed with the North Broadway Street Improvements. This project included a large diameter storm sewer on North Broadway that is tributary to a proposed pump station. The concrete vault for one cell of the proposed five cell pump station was also constructed. The large diameter storm sewer also included four stub outs for picking up separated storm sewers. This existing infrastructure, with additional storm sewer to be constructed, will allow the Gatz Pond outfall to be removed from the combined system and discharged to the new storm sewer. As additional areas are separated and tied into the North Broadway storm sewer, the combined sewer areas will be eliminated and the separate sewer watershed will grow. However, these improvements will only convey more stormwater to the proposed pump station. Until there is a new outfall for this stormwater to the EBDR, it will have to temporarily be pumped into the existing storm sewer system. The interim conditions evaluation has determined where and at what rate stormwater can be pumped into the existing storm sewer system without causing impacts.

The interim conditions plan has identified a maximum capacity of 50 cfs to be pumped into the existing 36" storm sewer on Hickory Street. The Village's SCADA system will be used to allow pumping into this sewer when water levels are low enough to accept the flow. A detailed XP-SWMM analysis was completed to determine the appropriate flow to be pumped at various levels in the system. This method will allow pumping into the existing system without causing downstream impacts. Exhibit 6 shows the concept pump station and forcemain plan for interim conditions.

The proposed areas to be separated were broken into six phases, with five being tributary to the sewer stubs provided with the North Broadway project. Exhibit 7 shows the phases. The interim conditions analysis also quantified the benefits of the interim sewer separation. As more areas are separated, there will be more runoff entering the North Broadway Pump Station. Since the pump rate is fixed at a maximum of 50 cfs, there will be greater overflow into the combined sewer as the separation phases progress. Therefore, the percentage of runoff separated from the combined sewer system is reduced. Table 1 below summarizes the percentage of runoff that can be separated in a 10-year storm. Note that Phase 1 and 2 can be separated close to 100% by the interim pumping plan. As the separation phases progress, the percentage drops. The table also shows that the interim plan will separate a greater percentage for longer duration storms; high intensity, short-duration storms will cause overflow to the combined system and a lower percentage of separation.

TABLE 1
Interim Conditions Runoff Separation Summary for North Broadway Pump Station

| Phase | Storm Event | Separation Percentage |
|----------------|-------------|-----------------------|
| 1 & 2 | 10-yr, 1-hr | 99% |
| | 10-yr, 6-hr | 99% |
| 1,2,3,4, and 5 | 10-yr, 1-hr | 29% |
| | 10-yr, 6-hr | 80% |

The interim conditions analysis also concluded that the area shown as Phase 6 cannot be separated until a new stormwater outfall to the East Branch is constructed. This option is discussed in the following section. Several scenarios were investigated that involved draining Phase 6 into the existing storm sewer system, but none that were considered feasible could be accomplished without causing downstream impacts. It was also determined that after Phases 1-5 are completed, there is still a potential for CSO's in the Phase 6 area, therefore it must be separated, which requires a new outfall sewer.

Interim Pump Station Modifications

The pump and forcemain required to implement the concept shown on Exhibit 6 have been conceptually sized. It is estimated that a 36" forcemain will be needed to convey the discharge from the pump station to the storm sewer on Hickory Street. The pump was sized so that it can be used for both interim conditions as well as future scenario. The required pump size is approximately 350-400 horsepower.

Ultimate Conditions

The ultimate condition for separation of sewage in the watershed will require a new outfall from the Grace Street/North Broadway area all the way to the East Branch. It will also require construction of a major pump station. This section describes these elements.

Outfall Sewer

A permanent and complete separation of the watershed will require a new outfall to the East Branch to be constructed. Based on a field investigation, review of atlas data, and limited survey data, we have determined that the preferred route for the outfall sewer would be to follow the alignment of the Illinois Prairie Path (IPP). Exhibit 8 shows the location.

The IPP alignment should minimize utility conflicts with the existing sewer networks. Any storm sewer drainage north of the IPP was assumed to tie into the proposed outfall sewer; the inverts

of the proposed outfall sewer were set low enough to accommodate these connections. The outfall sewer that will receive discharge from the North Broadway pump station is a 108" pipe, as shown on Exhibit 8.

Pump Station Modifications

The North Broadway Pump Station will need to be modified to accomplish the full sewer separation of the watershed. The North Broadway Improvements project constructed a large diameter storm sewer on the south side of North Broadway between Fairfield Avenue and Chase Avenue. This storm sewer flows into a large concrete vault approximately 200' east of Fairfield Avenue. This vault was built to serve as the wet well for a future pump station, and was located to reserve space for four additional wet well chambers.

The future pump station will have the same general requirements as determined previously for the North Broadway project. The remaining four chambers of the pump station will still need to be constructed, however this study has determined that the pump capacity can be reduced from a total of 392 cfs to 315 cfs. This rate is based on the 10-year, 1-hour inflow to the pump station. This change will reduce the required size of the pumps and decrease project costs.

PROJECT PRIORITIZATION AND COST ESTIMATES

Concept cost estimates were prepared for various projects based on the available information. Final design for any project will change the anticipated cost; the estimates below should be used for general budgetary purposes only. The projects have been prioritized assuming a desire to follow a progression of interim to ultimate conditions. The overall costs to separate the sewers in the watershed will be greater if the interim pump scenario is used because the interim forcemain is not needed in an ultimate condition. However, the interim condition plan will allow the separation program to begin with less funding, and can be implemented over time. Without the interim approach, sewer separation will require a large start-up cost.

A brief description of each suggested project is provided below. ***It should be noted that the estimated costs have been limited to the storm and sanitary sewer work.*** Additional utilities that may be replaced during a separation project, such as watermain, etc., were not included. The cost for resurfacing streets, landscaping, etc., were also not included. It was assumed that those costs would generally be budgeted for in an annual streets program; the sewer work for the sewer separation is the only additional cost to be quantified in this report.

Project #1 – North Broadway Interim Pump Station and Forcemain: If the Village decides to implement a sewer separation on an interim basis, the first required project is the pump station and forcemain. This project would include a \pm 350-hp pump to be installed in the existing wet well, and approximately 1700 lineal feet of 36" forcemain. An overflow structure and piping would also be required to allow overflow to the combined system. Note that the forcemain cost is the "extra" cost associated with the interim conditions plan. The pump station cost would be required for either the interim or ultimate conditions plan.

Estimated Pump Station Cost = \$540,000
Estimated Forcemain Cost = \$460,000
Estimated TOTAL Cost = \$1.2 million

Project #2 – Gatz Pond Outfall: This project would involve extending the large diameter storm sewer from North Broadway north on Chase Avenue to Maple Street, and east on Maple to Westmore-Myers Road. This sewer would allow the discharge from Gatz Pond to be separated, which includes the Vista Pond watershed. This project would separate approximately 450 acres.

Estimated Cost = \$1.1 million

Project #3 – Sewer Separation Phases 2-5: These phases have been identified as the logical progression of areas based on the existing drainage patterns and sewer infrastructure.

Estimated Cost (Phase 2) = \$4.0 million
Estimated Cost (Phase 3) = \$2.0 million
Estimated Cost (Phase 4) = \$2.6 million
Estimated Cost (Phase 5) = \$2.2 million

TOTAL Estimated Cost = \$10.9 million

Project #4 – Illinois Prairie Path Outfall: This project involves constructing a large diameter storm sewer (108") along the IPP from the North Broadway Pump Station to the East Branch DuPage River. This project can occur at any time. constructing the outfall allows for the separation of the Phase 6 area, and also allows for the North Broadway Pump Station to be enlarged to its ultimate required capacity.

Estimated Cost = \$9.9 million

Project #5 – Sewer Separation Phase #6: This area cannot be separated until the IPP outfall pipe is constructed.

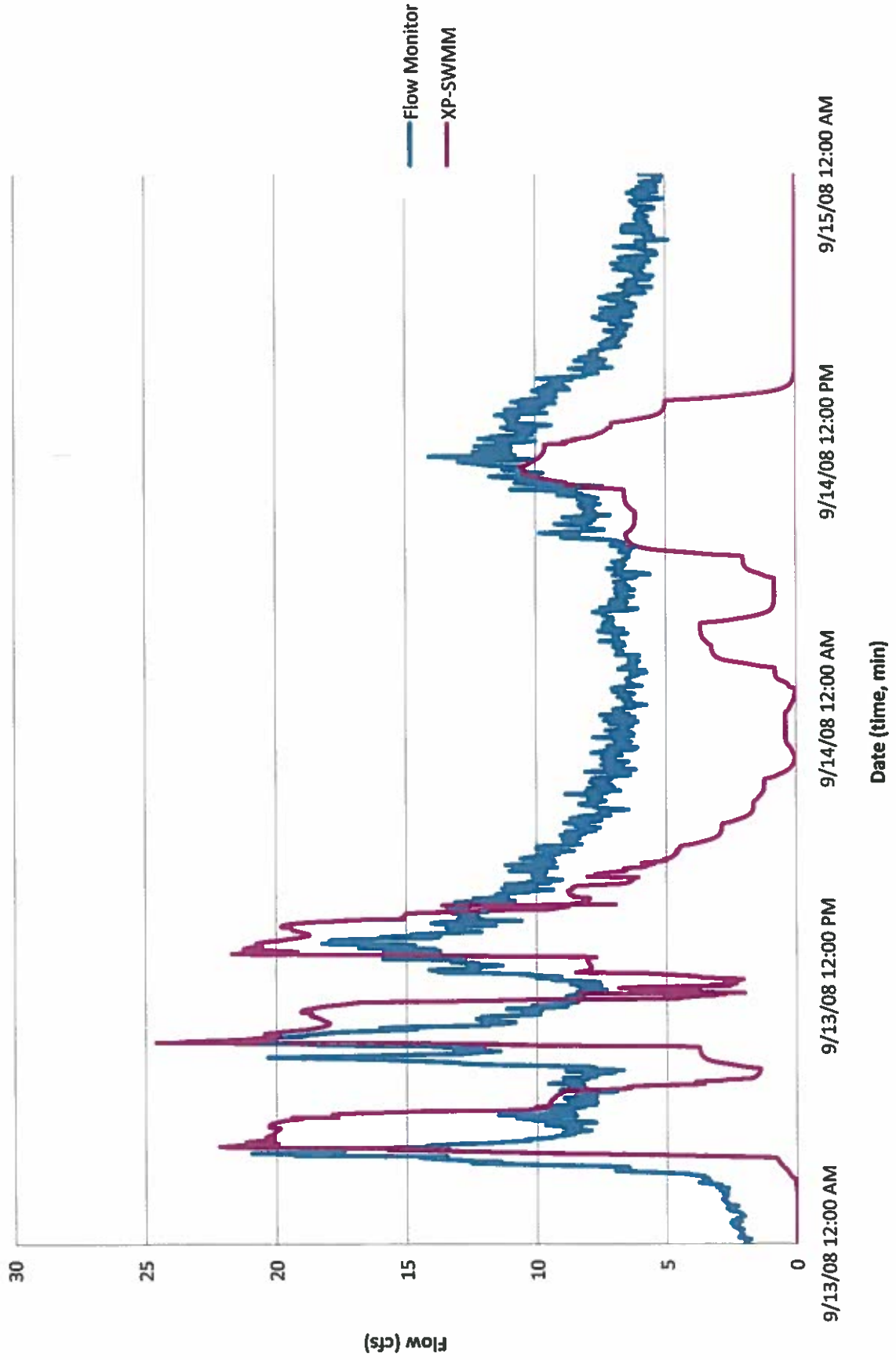
Estimated Cost = \$7.3 million

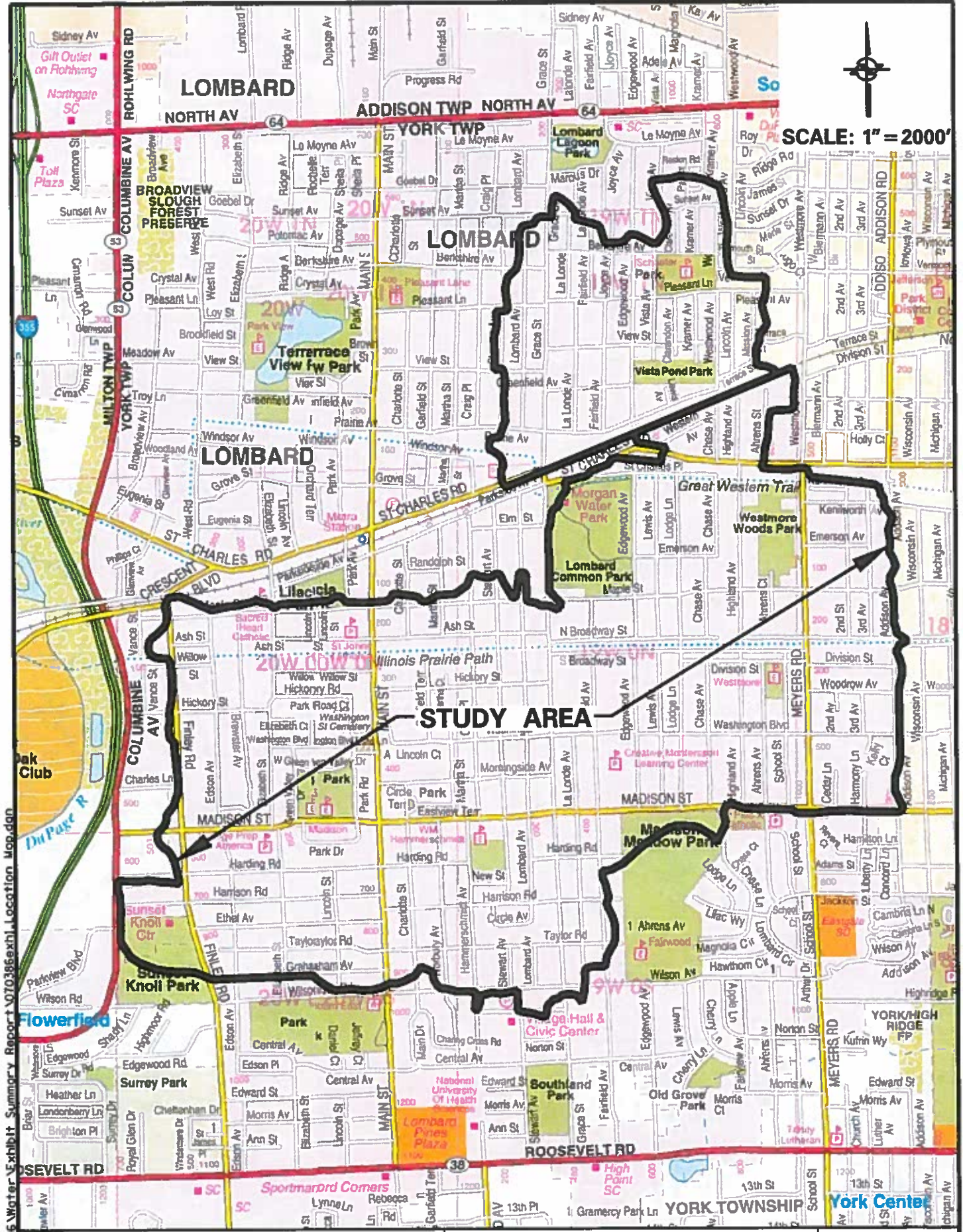
Project #6 – North Broadway Pump Station Upgrades: This project includes expanding the existing pump station to a total of five cells and a capacity of approximately 315 cfs.

Estimated Cost = \$2.4 million

The total estimated cost for all projects is \$32.8 million.

September 12-14, 2008 Storm Event 36" Pipe





SCALE: 1" = 2000'

STUDY AREA

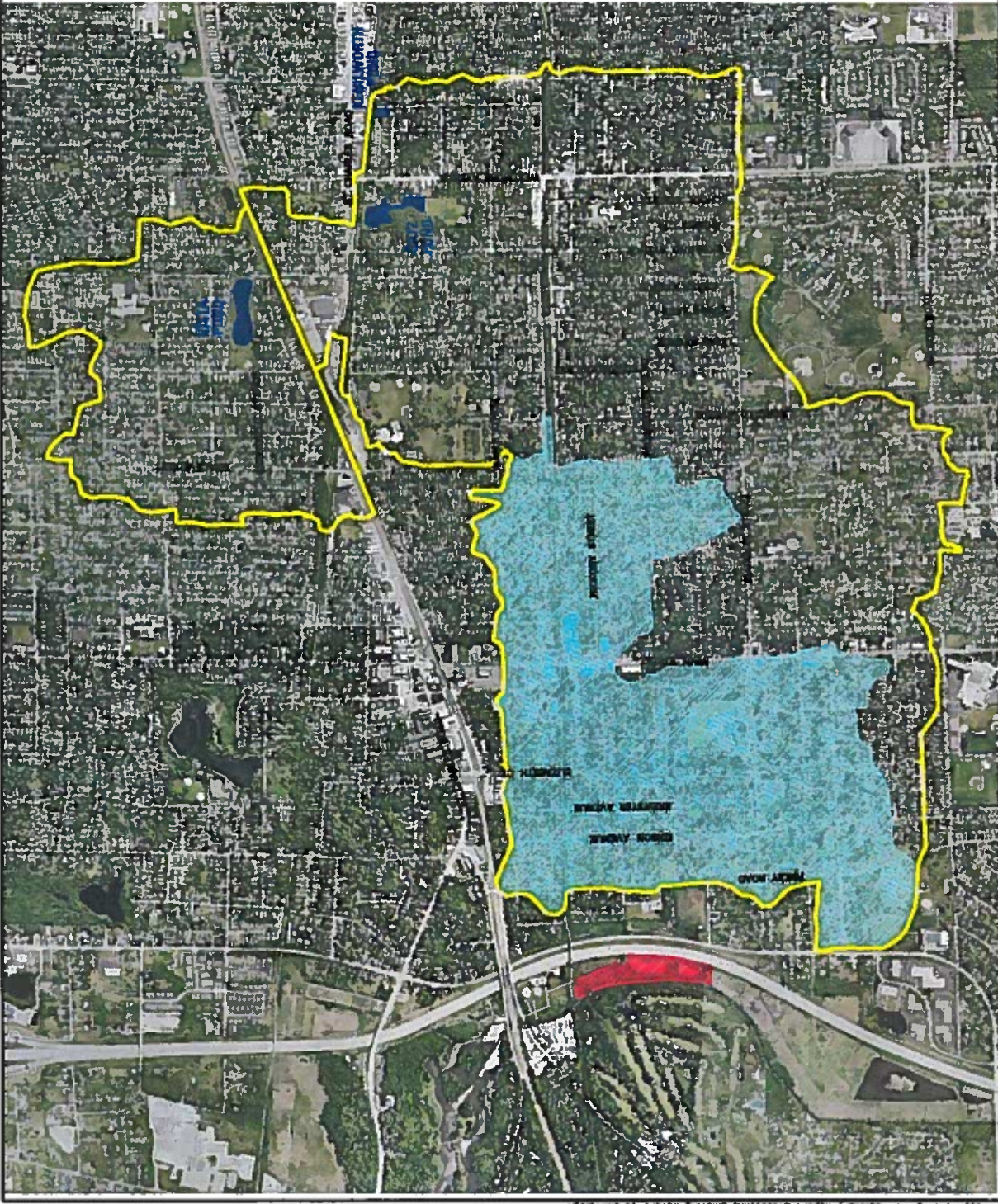
N:\Lombard\070386\Water\Exhibit\Summary Report\070386exh1_Location Map.dgn

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|---------|---------------------------|------------------|-----------------|
| CLIENT: | VILLAGE OF LOMBARD | PROJECT NO. | 07-0386 |
| | LOCATION MAP | DATE | 9/1/2009 |
| | | EXHIBIT 1 | |

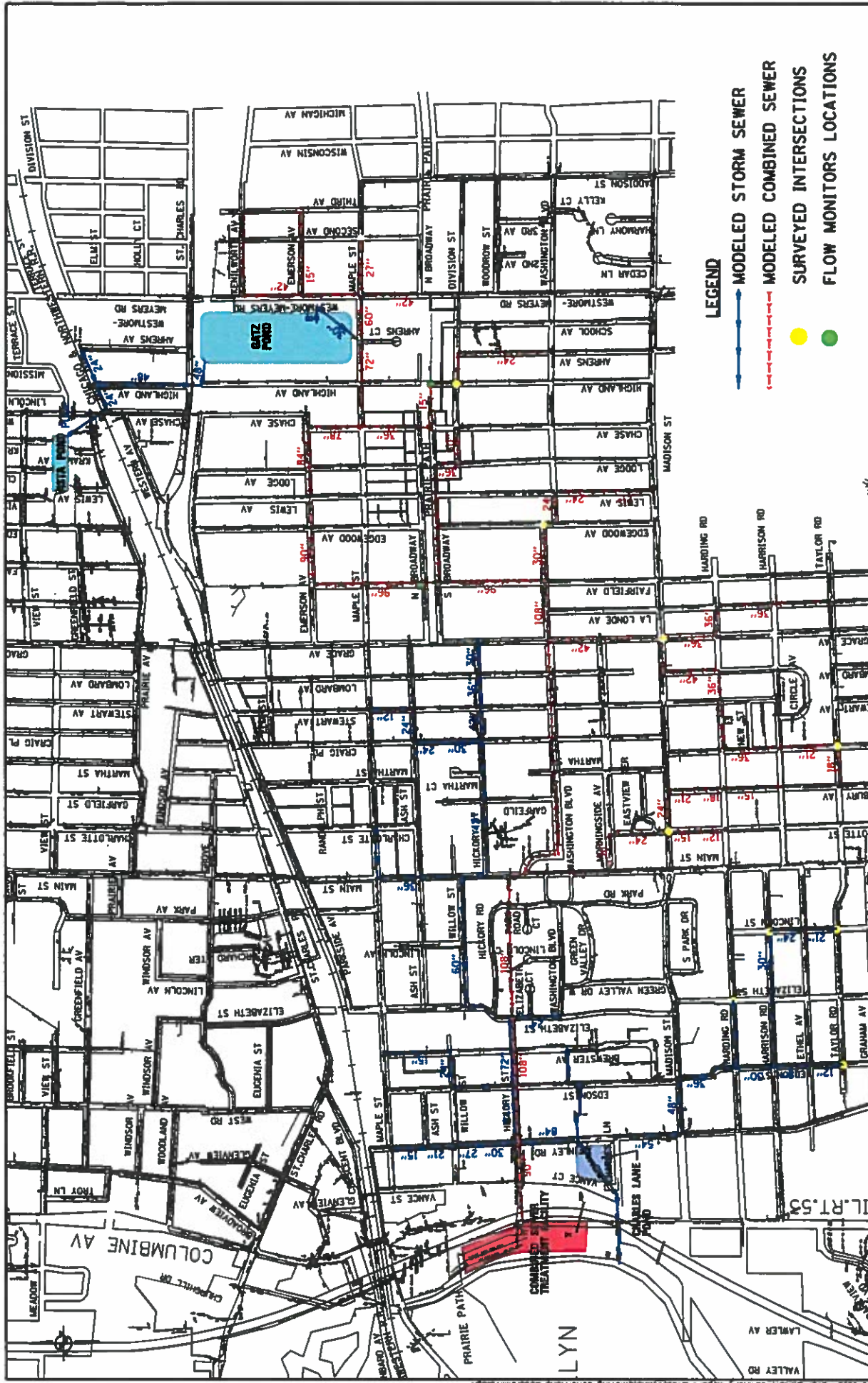
CHRISTOPHER B. BURKE ENGINEERING LTD.
 9575 West Higgins Road, Suite 600
 Rosemont, Illinois 60018 (847) 823-0500



- LEGEND**
- COMBINED SEWER WATERSHED BOUNDARY
 - STORM SEWER WATERSHED BOUNDARY
 - LOMBARD COMBINED SEWER TREATMENT FACILITY (LCSTP)



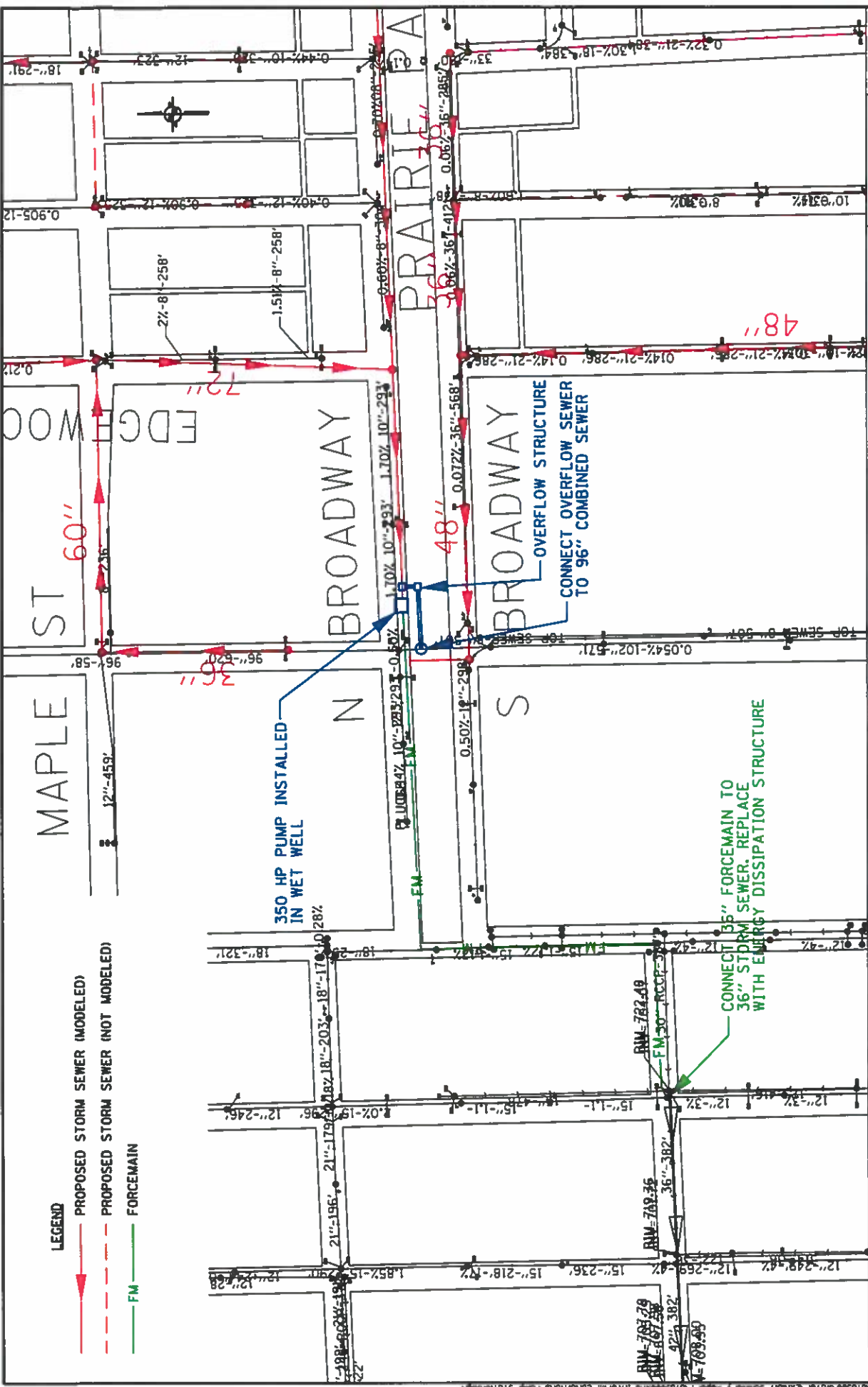
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|-----------|---|----------------------------|----------------------------------|-------|
| CB | CHRISTOPHER B. BURKE ENGINEERING LTD. 3575 West Higgins Road, Suite 600 Rosemont, Illinois 60018 (847) 823-0500 | PROJECT NO. 07-0386 | SCALE 1"=1400' | TITLE |
| | | CLIENT: VILLAGE OF LOMBARD | EXISTING WATERSHED LIMITS | |
| | | ISSN: JJJ | DATE: 9/1/2009 | |
| | | DWN: EAT | EXHIBIT 2 | |



- LEGEND**
- MODELED STORM SEWER
 - MODELED COMBINED SEWER
 - SURVEYED INTERSECTIONS
 - FLOW MONITOR LOCATIONS

| | | | |
|--|---|----------------|-------|
| CLIENT: CHRISTOPHER B. BURKE ENGINEERING LTD. 9575 West Higgins Road, Suite 600 Rosemont, Illinois 60018 | PROJECT NO. 07-0386 | SCALE 1"=1000' | TITLE |
| | EXISTING CONDITIONS MODEL LIMITS | | |
| DESIGNER: JJJ DATE: 9/1/2009 | DRAWN: EAT | EXHIBIT 3 | |

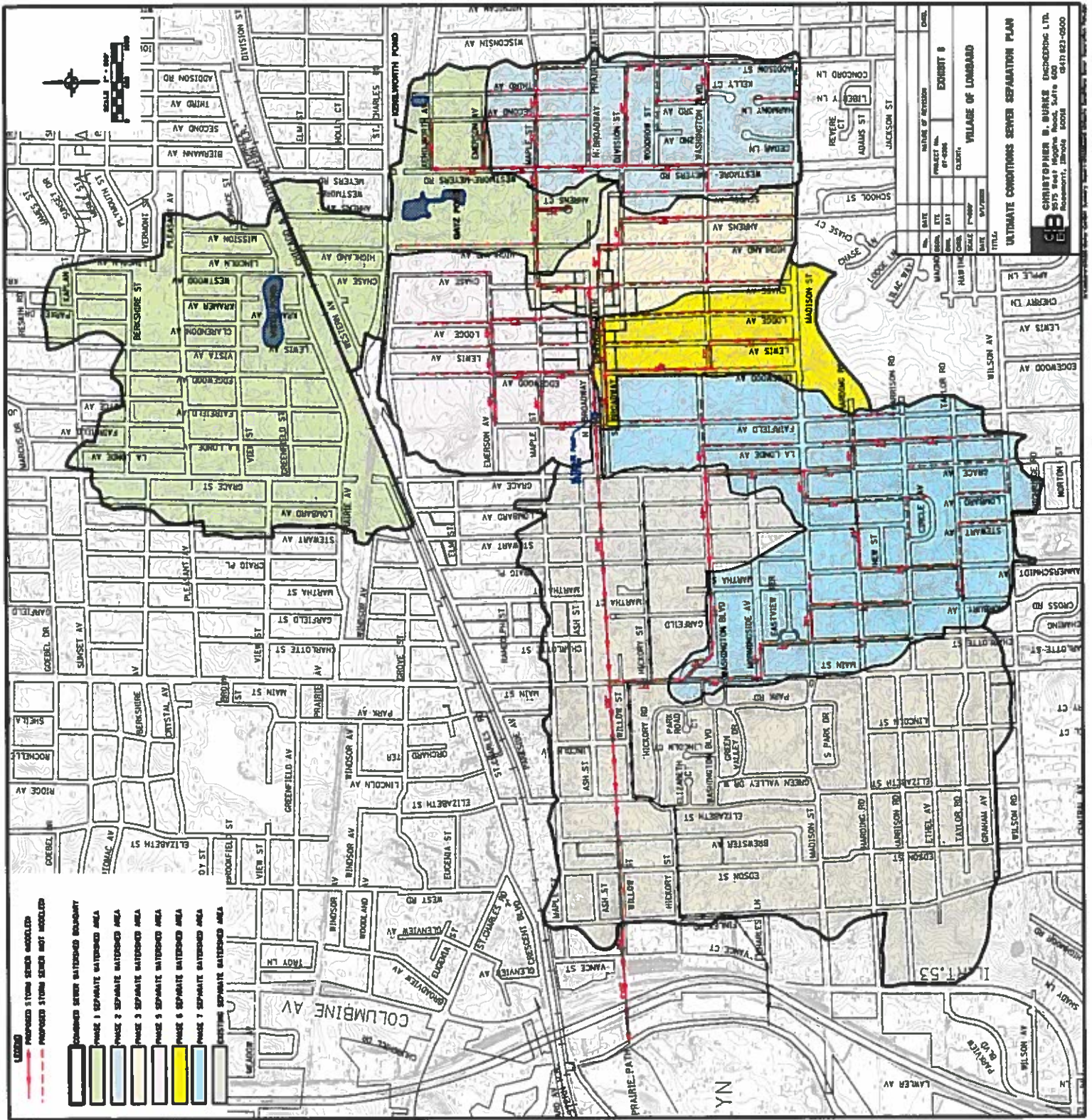




LEGEND

- PROPOSED STORM SEWER (MODELED)
- - - PROPOSED STORM SEWER (NOT MODELED)
- FM — FORCEMAIN

| | | | |
|---|---------------------|-------------------|--|
| CLIENT: CHRISTOPHER B. BURKE ENGINEERING LTD. 3575 West Higgins Road, Suite 600 Rosemont, Illinois 60018 (847) 823-0600 | PROJECT NO. 07-0386 | SCALE: 1"=200' | TITLE: INTERIM CONDITIONS (PUMP STATION AND FORCEMAIN) |
| | DATE: 9/1/2009 | DRAWN: JJJ EAT | EXHIBIT 6 |



| | | | |
|--------------------|--|-----------|--|
| PROJECT NO. | | EXHIBIT 8 | |
| DATE | | DATE | |
| DRAWN BY | | DATE | |
| CHECKED BY | | DATE | |
| SCALE | | SCALE | |
| DATE | | DATE | |
| TITLE | | TITLE | |
| VILLAGE OF LOWLAND | | | |

ULTIMATE CONDITIONS SEWER SEPARATION PLAN

CHRISTOPHER B. BURKE ENGINEERING LTD.
 2075 West Higgins Road, Suite 600
 Rosemead, Illinois 60018 (631) 821-0500