

EAST OF HARMS PHASE I FLOOD MITIGATION IMPROVEMENTS

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Quality Assurance Statement

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PROJECT SNAPSHOT AND FACTS

1. INTRODUCTION

1.1. Project Location

The East of Harms (EOH) neighborhood is located in the southeastern part of the Village of Glenview (Village) and is generally bounded by East Lake Avenue on the north, the Middle Fork of the North Branch of the Chicago River (Middle Fork) on the west, Old Orchard Road on the south, and the Village limits to the east. Development within the EOH area consists almost exclusively of single family residential properties.

EOH drains an area of approximately 0.8 square miles (500 acres) within the North Branch of the Chicago River watershed and is located about 0.8 miles (4,000 feet) downstream of the confluence of the Middle Fork with the Skokie River. The portion of the North Branch of the Chicago River watershed located upstream of the northern limit of the EOH area (at East Lake Avenue) is roughly 56.0 square miles (35,800 acres). The total area upstream of Cunliff Park near the southern end of the EOH area is about 57.3 square miles (36,700 acres). The EOH area contributes about 1.4% to the total watershed area at this point along the Middle Fork.

Previous analyses of drainage conditions within the EOH area by MWH have determined that the risk of street and property damage flooding in the area is high due to the combination of the area's low elevation relative to the Middle Fork, the limited conveyance capacity of the existing storm sewer systems serving the area, and the lack of well-defined overland drainage paths¹. Low-lying areas in both the northern and southern parts of the EOH area were identified as Tier 2 flooding problem areas in the Village's April 2010 Flood Risk Reduction Program report.²

1.2. Project Background

The Village has been notified that the Metropolitan Water Reclamation District of Greater Chicago will provide funding support for the implementation of flood mitigation improvements to benefit the EOH area. The flood mitigation improvement project proposed consists of a combination of backflow prevention, outlet pumping and in-line storage. Backflow prevention devices will be installed at three existing storm sewer outlets (Wilmette Avenue, Glenview Road and Central Road) from the EOH area to the Middle Fork. The first of two outlet pumping stations (72cfs) will be located northwest of the Harms Road/Glenview Road intersection. A second outlet pumping station (51cfs) will be located in Cunliff Park near the existing sewer along Central Road extended. A new 84-inch diameter connecting sewer is also proposed to connect the existing Wilmette Avenue and Glenview Road outlets to help alleviate flooding north and east of Wilmette Avenue. Portions of the design drawings showing the general layout of the two projects are provided on **Figures 1 and 2**.

Full sets of detailed design drawings related to the proposed project have been prepared by a third party are provided under a separate cover.

¹ *Phase II Study Drainage Analysis – Areas 1, 4 and 5*. Prepared for the Village of Glenview, Illinois by MWH. December 2007.

² *Flood Risk Reduction Program*. Prepared for the Village of Glenview, Illinois by MWH. April 2010.

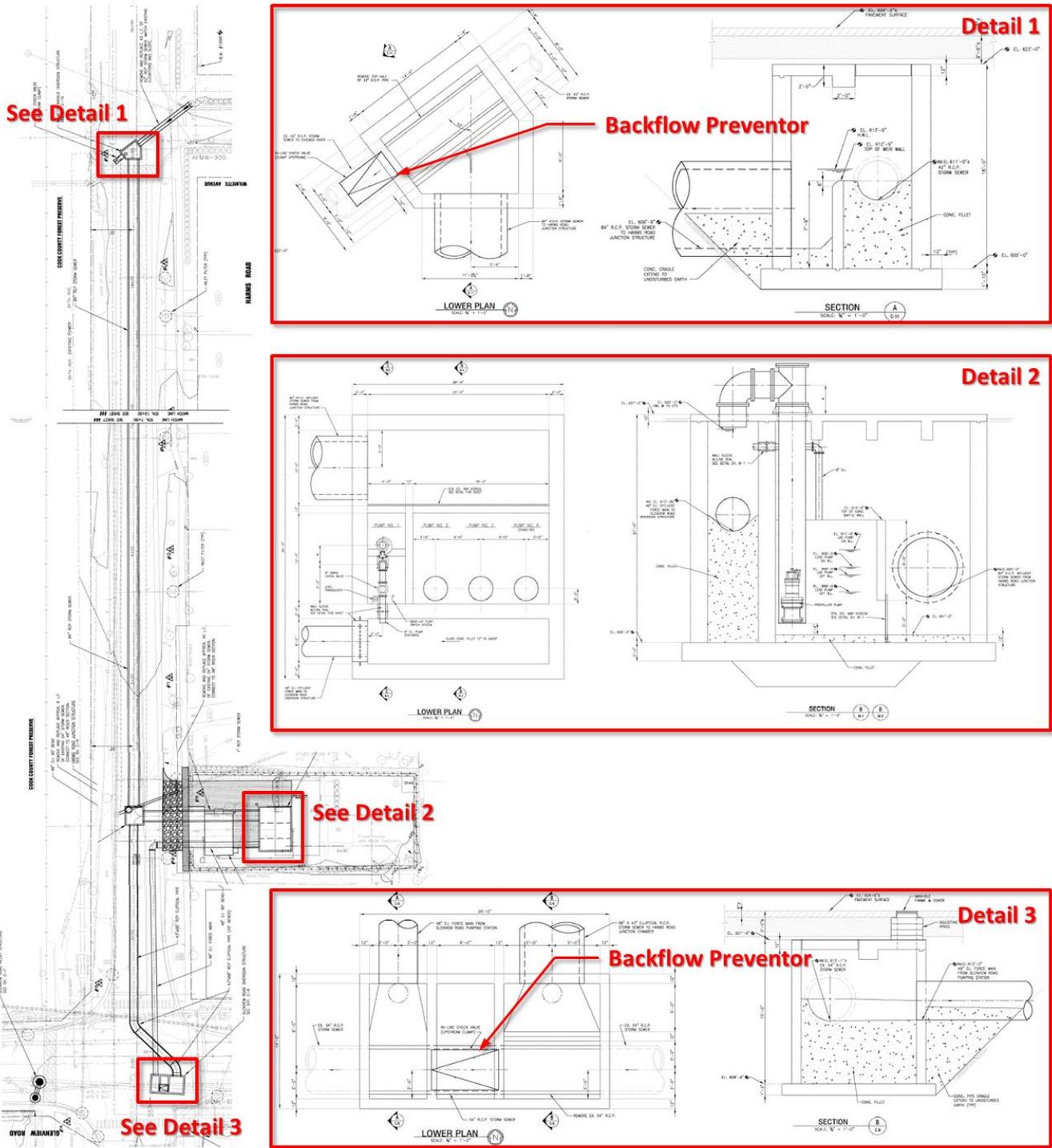


Figure 1
Harms Road Relief Sewers and Pumping Station

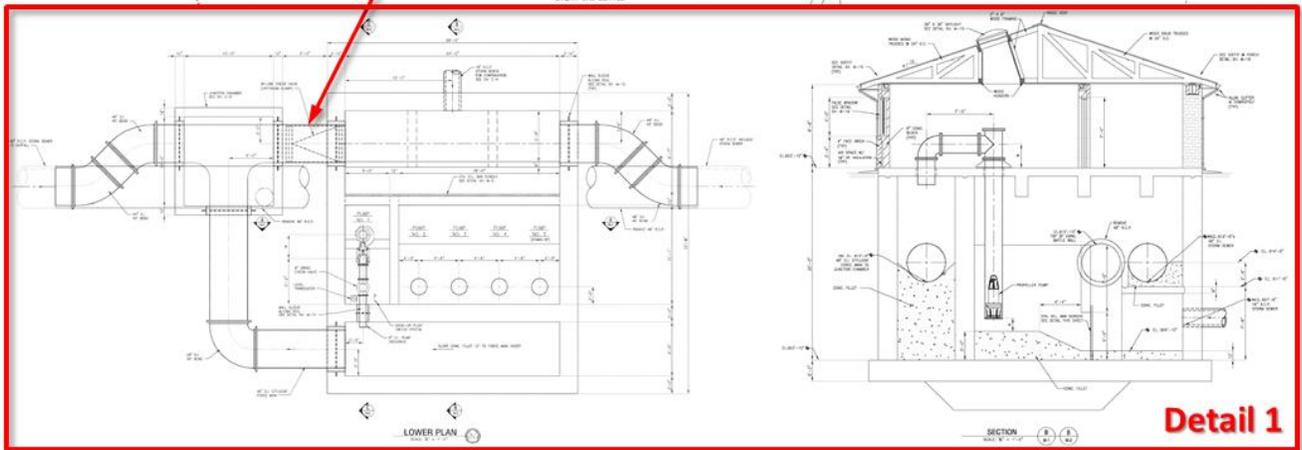
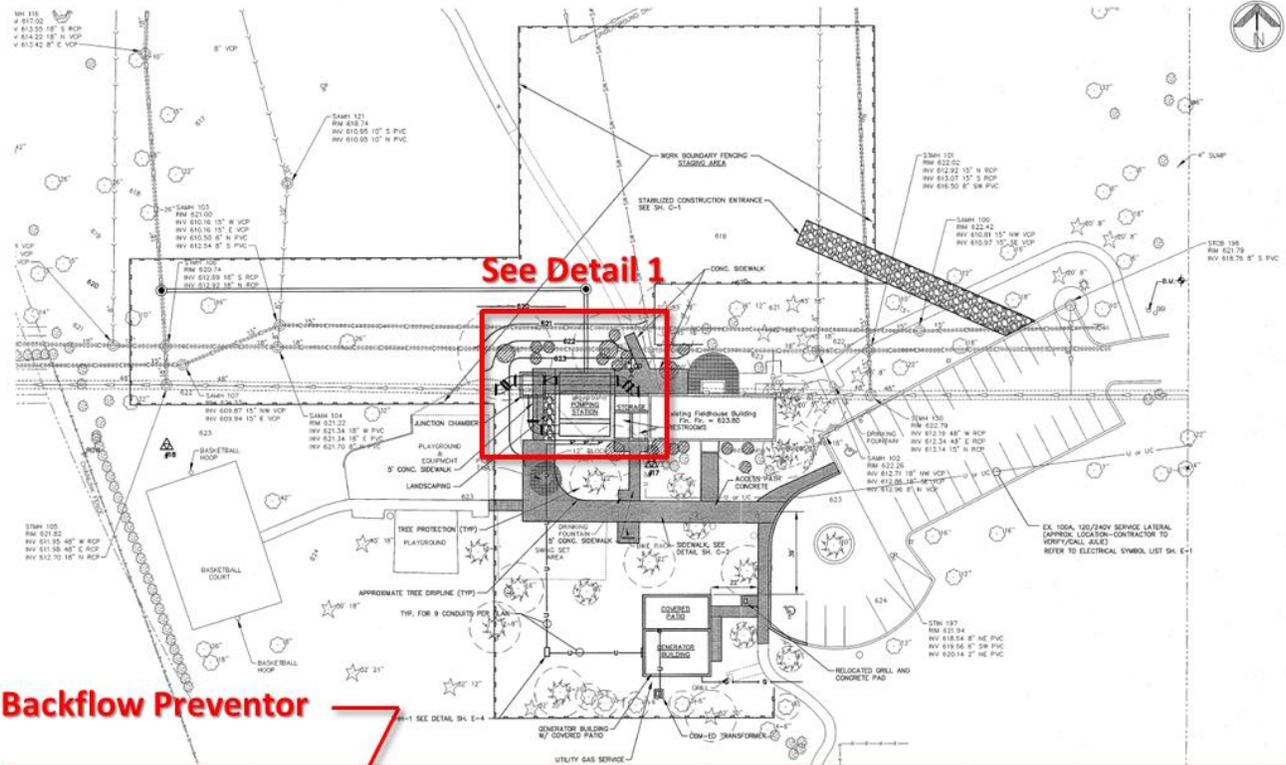


Figure 2
Cunliff Park Pumping Station

During periods of low river stages the exiting EOH drainage systems will discharge via gravity to the Middle Fork as they do now. The new pump stations will only operate when river stages are high enough to limit the storm sewer outlet capacity to the river.

1.3. Project Objectives

The flood mitigation improvements are intended to provide drainage facilities that reliably meet the Village's current performance criteria for stormwater management systems:

- Existing drainage systems should provide sufficient capacity to capture and convey runoff from the 10-year design storm (10% annual chance of occurrence) without significant surface ponding.
- Existing drainage systems should provide sufficient capacity to limit the risk of overfoundation flooding of properties or flooding that impedes emergency access to an area for events up to a 100-year design storm (1% annual chance of occurrence).

Meeting these objectives within the EOH area requires improvements that provide reliable outlets for the drainage systems, increase local conveyance capacity or overland flow routes for critical low-lying areas and mitigate the potential for backwater flooding from the Middle Fork.

NOTE: *The results presented in this document only represent the improvements following the installation of the first phase of drainage improvements to the EOH drainage area. A second phase of improvements, outlined in MWH's 2013 Basis of Design Report would be required to address the remaining conveyance limitations in the EOH area by providing the capacity needed to move runoff away from low-lying areas and through the system to the new outlet pumping stations. Full compliance with the Village's performance criteria for stormwater management systems would only occur after this second phase of improvements are identified, designed and installed.*

1.4. Report Outline

This report presents the evaluation of the impacts of the proposed projects to the flood conditions along the Middle Fork and an illustration of the relative benefits to reduce flooding impacts within the EOH area. The balance of this document is organized as follows:

- Section 2 provides a narrative of the models constructed and/or modified by MWH to evaluate the flood conditions along the Middle Fork and within the EOH area; and
- Section 3 provides an illustration of the model results and relative benefits to be achieved by the proposed flood mitigation improvements in terms of both flood extent and duration along the Middle Fork and within the EOH drainage area.

An Appendix is also included to this report that addresses specific general comments and questions received from stakeholders.

2. MODEL DEVELOPMENT

Models and supporting documents used in this hydrologic and hydraulic analysis include the following:

- North Branch of the Chicago River (NBCR) HEC-HMS and HEC-RAS (unsteady mode) models prepared as part of the Detailed Watershed Plan (DWP) in 2011 by HDR, Inc., for the Metropolitan Reclamation District of Greater Chicago (MWRDGC).
- Drainage Area 1 FEQ unsteady hydraulic models prepared as part of the 2007 Drainage Analysis for Areas 1, 4 and 5 by MWH Americas, Inc., for the Village of Glenview (Village), December 2007.³
- Flood Risk Reduction Report prepared for the Village of Glenview, Illinois by MWH Americas, Inc. (MWH), dated April 2010.⁴
- Basis of Design Report East of Harms Flood Mitigation Improvements by MWH Americas, Inc. for the Village, July 1, 2013.⁵
- Harms Road Relief Sewers and Pumping Station Detail Drawings by Baxter and Woodman, Inc., for the Village, July 1, 2013.
- Cunliff Park Pumping Station Detail Drawings by Baxter and Woodman, Inc., for the Village, October 18, 2013.

2.1. Base Models

The 2011 NBCR DWP models are regional models and lack specific local hydrologic and hydraulic details that were captured in the 2007 FEQ modeling developed by MWH. For this analysis, the NBCR DWP models were modified to better reflect the hydrologic and hydraulic contributions from the EOH area and its impact to/from the Middle Fork. A summary of the models is as follows:

- The **HEC-RAS Base Model** is the original NBCR DWP model without any modifications. This model is considered the baseline condition in this analysis.
- The **FEQ 2007 Model** is the original model developed during the 2007 Drainage Analysis for the Village. This model was developed before the publication of the DWP Models and used constant 10-year tailwater elevations at the three EOH storm sewer outfalls to the Middle Fork.
- Modifications to the **FEQ 2007 Model** were made to include dynamic tailwater levels pulled from the NBCR DWP model. These modifications were required to more accurately reflect the impacts to flooding (both elevations and timing) to/from the Middle Fork. This revised model is referred to as the **FEQ Base Model**.
- In order to link the base HEC-RAS and FEQ models together, the hydrology in the **HEC-RAS Base Model** was modified to account for the storage within the street and low lying areas within the EOH area. To achieve this, the drainage area and storm sewer inflows from the southern 238 acre sub-watershed (designated as Subarea A-1 in the

³ *Phase II Study Drainage Analysis – Areas 1, 4 and 5*. Prepared for the Village of Glenview, Illinois by MWH. December 2007.

⁴ *Flood Risk Reduction Program*. Prepared for the Village of Glenview, Illinois by MWH. April 2010.

⁵ Basis of Design Report East of Harms Flood Mitigation Improvements prepared for the Village of Glenview, Illinois by MWH Americas, Inc., dated July 1, 2013.

2007 Phase II Village Stormwater Study) and the northern 217 acre sub-watershed (designated as Subarea A-2 in the 2007 Phase II Village Stormwater Study) from the [FEQ Base Model](#) were substituted in for the EOH area. This revised model is referred to as the [HEC-RAS Revised Base Model](#).

2.2. With Project Models

Using the [FEQ Base Model](#), an [FEQ w/ Project Model](#) was created to incorporate the Phase I flood mitigation improvement projects proposed in the EOH area. The improvements were based on the detailed design of the two pumping stations and relief sewers called out in [Section 2.0](#).

Storm sewer outflows obtained from the [FEQ w/ Project Model](#) at Wilmette Avenue, Glenview Road and Central Road extended were then used as the inflows into the [HEC-RAS w/ Project Model](#).

3. MODEL RESULTS

Results for the Middle Fork and EOH drainage areas are included in the following sections.

3.1. Middle Fork

Flow and stage hydrographs extracted from the HEC-RAS and FEQ models at Glenview Road and Central Road extended are provided in Figures 3 through 6 for the 10- and 100-year design storms.

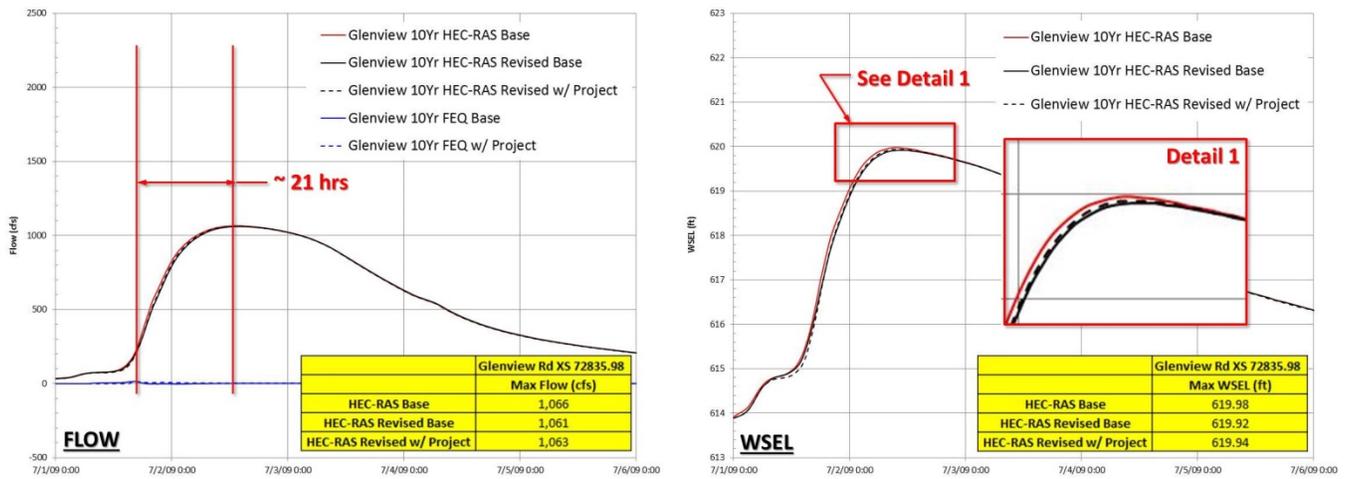


Figure 3
10-year Flow and Stage Results at Glenview Road

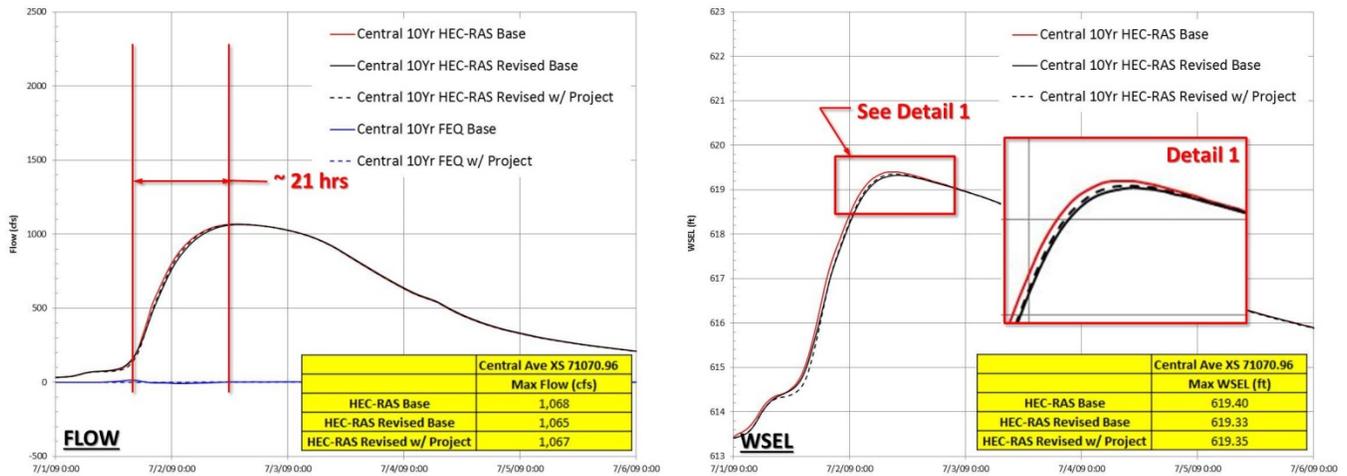


Figure 4
10-year Flow and Stage Results at Central Road Extended

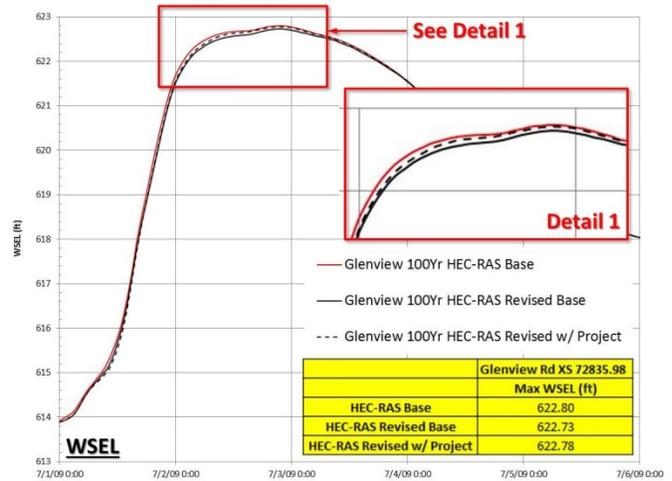
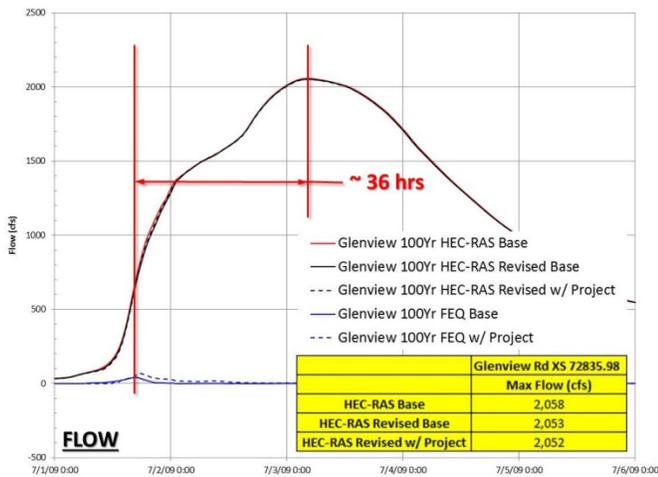


Figure 5

100-year Flow and Stage Results at Glenview Road

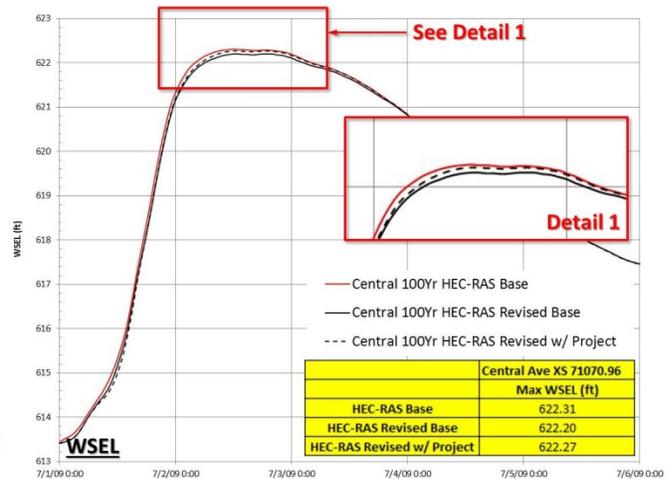
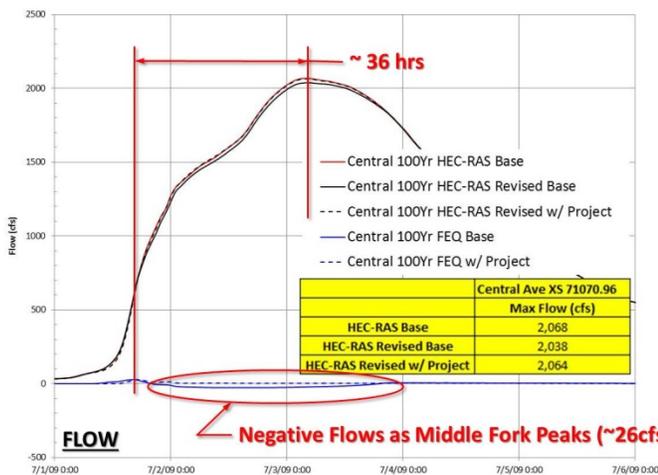


Figure 6

100-year Flow and Stage Results at Central Road Extended

As shown in the figures above, the results from the **HEC-RAS Revised w/ Project** and **FEQ w/Project** models reflect minimal increases in both flows and stages along the Middle Fork near the EOH area. Flows and stages for the 10-year design storm (10% annual chance) were only found to vary by 0.2% (about 2 cfs) and 0.02 feet (less than an a quarter of an inch), respectively. Flows and stages for the 100-year design storm (1% annual chance) varied by less than 1.3% (about 26 cfs) and 0.07 feet (less than an inch), respectively. The reason for the flow and stage variances is due to the additional detail contained within the **FEQ w/Project** model that accounts for the backflow from the Middle Fork (something the regional DWP model neglects). This backflow peaked at roughly 26cfs and last for nearly 42 hours under base conditions.

These figures also help illustrate how the peak flows from the EOH area will occur substantially earlier (~ 21 to 36 hours) than when the Middle Fork peaks. The close proximity to the Middle Fork should allow the EOH area to drain to the river prior to the onset of high river stages during most storm events.

3.2. EOH Drainage Area

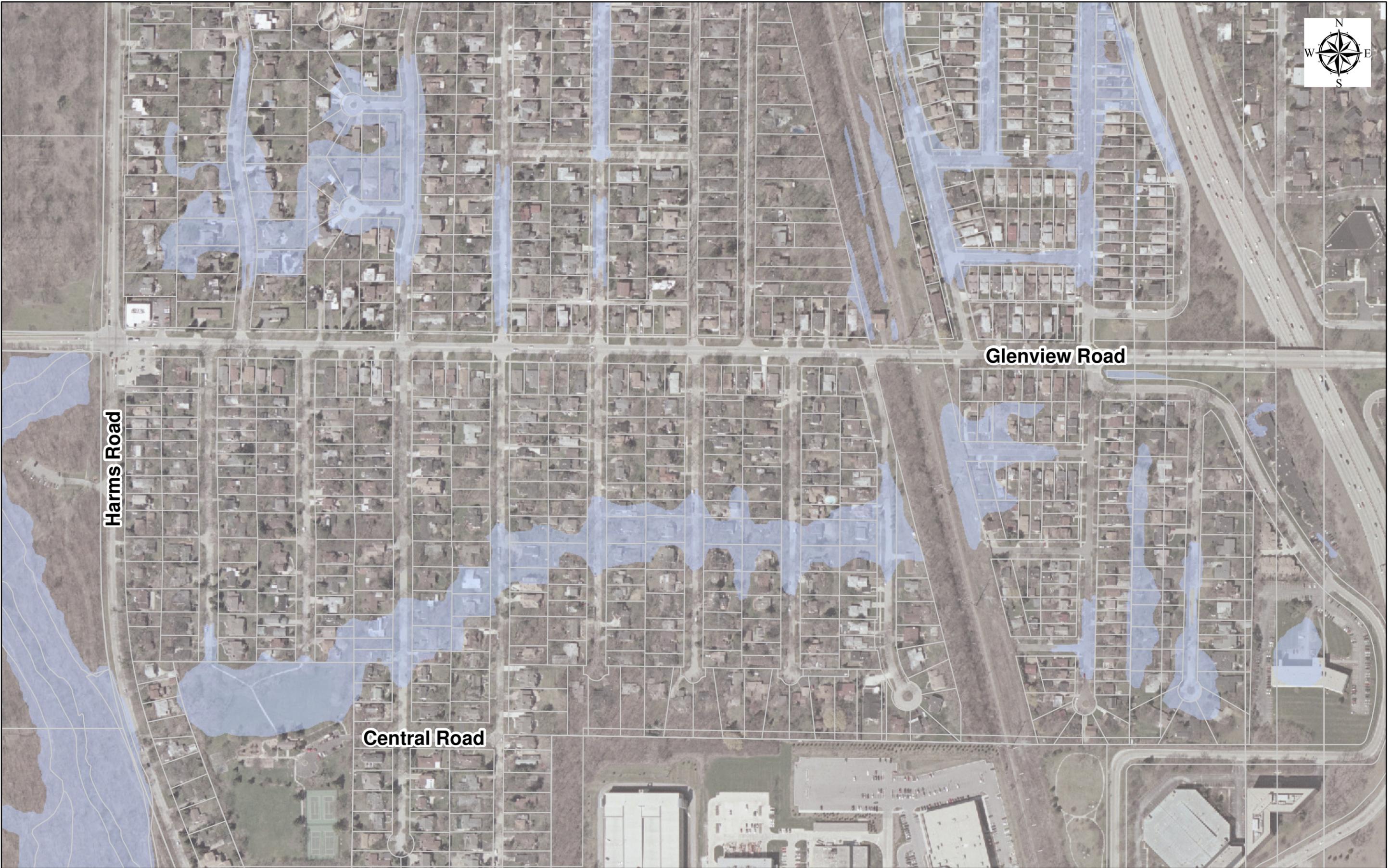
Flood inundation mapping extracted from the base and w/project HEC-RAS and FEQ models are provided in **Figures 7 and 8** for the 100-year design (1% annual chance) storm. Tabular results comparing the 10- and 100-year events for selected locations within the EOH area are provided in **Table 1**. Bolded values shown in the table identify locations where flooding exceeds 6-inches in depth.

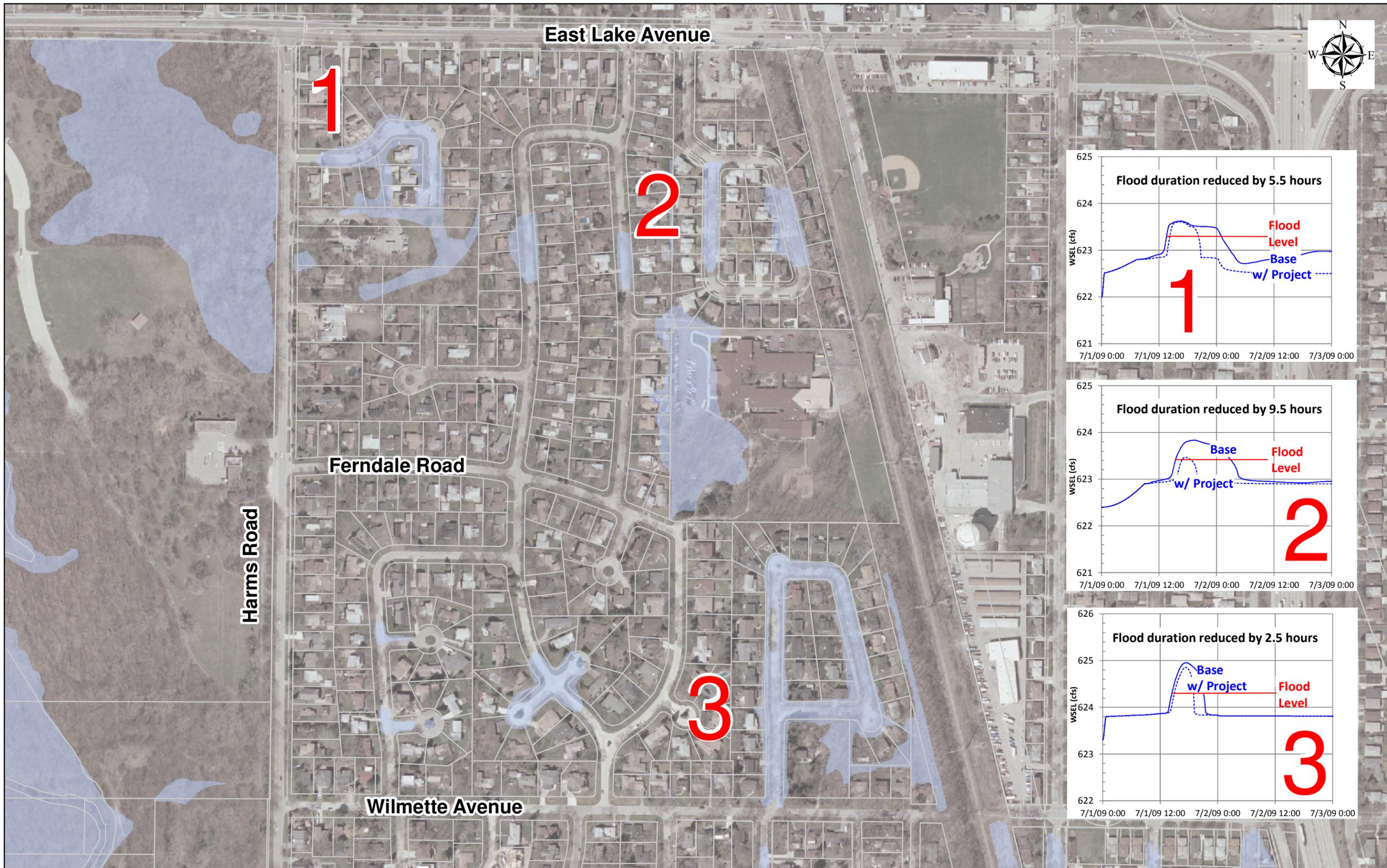
Table 1
Model-Predicted Surface Flooding Elevations with and without Phase 1 Improvements

Location	Flooding Elevation ¹	Existing Conditions		After Construction of Phase 1 Improvements	
		10-Yr Rainfall	100-Yr Rainfall	10-Yr Rainfall	100-Yr Rainfall
		10-Yr Flood Stage ²	100-Yr Flood Stage ²	Pumped Outlet	Pumped Outlet
Long Rd N. of Beverly Ln	622.5	623.2	623.4	622.1	623.2
Forest Rd S. of Glenview Rd	621.9	621.5	622.1	621.4	621.5
Indian Rd S. of Glenview Rd.	620.0	620.7	621.6	619.5	619.6
Echo Lane/Hager Ct	623.2	623.9	624.3	623.5	624.2
Cariann Ln	623.5	624.0	624.4	622.9	623.5
Sherwood Rd/ Ferndale Rd	624.1	623.7	624.3	623.6	623.7
Beech Dr W. of Heatherfield Ln	623.5	623.8	624.3	623.0	623.1
Indian Rd N. of Wilmette Ave	624.4	624.5	625.2	623.4	624.8
Wilmette Ave/ Arbor Ln	623.0	622.6	622.8	622.5	622.6

Note: 1. The flooding elevation represents the lowest ground elevation plus six inches.
2. The 10-Year flood stage represents the water surface elevation within the Middle Fork for the 10% annual chance storm.



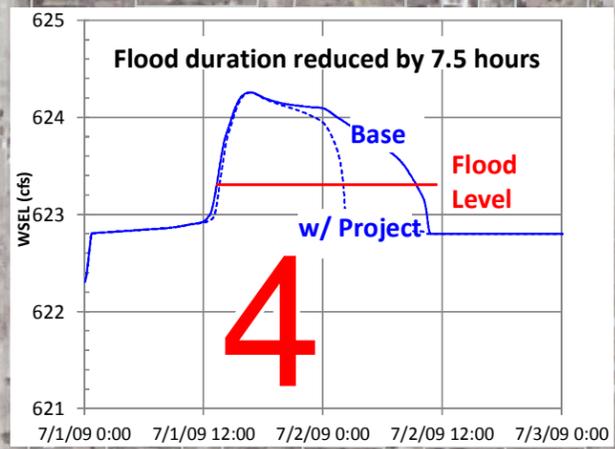






Harms Road

4



Glenview Road

Central Road

As shown in the Figure 7, the results of the base modeling show substantial flooding within the EOH area with an estimated 212 structures being impacted for the 100-year design (1% annual storm) event. These structures are generally located near low lying areas or areas with limited conveyance capacity and/or lacking well defined overland flow paths.

Installation of the Phase 1 flood mitigation projects (Figure 8) will immediately reduce the extent and severity of flooding leading to a reduction of nearly 75 percent in impacted structures. The improvements will help to reduce the time of flooding by roughly 2.5 to 9.5 hours throughout the EOH drainage area.

As mentioned in **Section 1.3**, although not all of the EOH area will meet the Village's current performance criteria for stormwater management systems following the installation of the two Phase 1 projects, the capacity of the new pumping stations and relief sewers will allow the Village to incorporate additional site-specific improvements under subsequent phases of flood mitigation.

3.3. Conclusion

MWH evaluated the flood conditions along the Middle Fork and within the EOH area to address concerns raised by local residents and stakeholder groups that the Phase 1 flood mitigation improvements could increase flood levels along the Middle Fork and put them at greater risk for flood damages. Results of the analysis along the Middle Fork and within the EOH drainage area are summarized below.

3.3.1. Middle Fork

Results of the analysis on the Middle Fork showed:

- Flows and stages near the EOH area for the 10-year design storm (10% annual chance) varied by 0.2% (about 2 cfs) and 0.02 feet (less than an a quarter of an inch), respectively;
- Flows and stages near the EOH area for the 100-year design storm (1% annual chance) varied by 1.3% (about 26 cfs) and 0.07 feet (less than an inch), respectively; and
- The peak flows from the EOH area will occur between 21 and 36 hours earlier than the peak of the Middle Fork for the selected storm events tested.

No significant impact to existing flood levels and/or flows on the Middle Fork will be created by the installation of the Phase 1 flood mitigation projects within the EOH area.

3.3.2. EOH Drainage Area

Results of the analysis on the EOH area showed:

- An estimated 212 structures are currently being impacted during the 100-Year design (1% annual chance) event;
- Installation of the Phase 1 flood mitigation projects will:
 - Reduce the extent and severity of flooding leading to a reduction of nearly 75 percent in impacted structures; and
 - Reduce the time of flooding of roughly 2.5 to 9.5 hours throughout the EOH drainage area.

The proposed Phase 1 improvements will result in a significant reduction in the risk and duration of surface flooding in the EOH area. While the reductions in surface flooding levels are modest in some cases under this first phase of design, the actual reductions in the level and duration of storm sewer surcharging are dramatic.

A second phase of improvements will still be required to address the remaining flooding locations to bring the EOH area into full compliance with the Village's performance criteria for stormwater management systems.

APPENDIX

PROJECT SNAPSHOT AND FACTS

Village of Glenview

Phase I

East of Harms Flood Mitigation Improvements

Project Snapshot and Facts

Questions and comments raised by Glenview residents during the development and design of flood improvements in the East of Harms (EOH) neighborhood have highlighted the need for a go-to FAQ summary to help improve the public's understanding of the EOH flood mitigation project, the relative flood benefits achieved by the project, and address any misconceptions about factors that contribute to existing flooding as well as impacts the future EOH project has to the Middle Fork of the North Branch of the Chicago River (Middle Fork).

The EOH flood mitigation project consists of the following components:

- **Backflow Prevention:** Backflow prevention devices will be installed at three existing storm sewer outlets (Wilmette Avenue, Glenview Road and Central Road) from the EOH neighborhood to the Middle Fork.
- **Outlet Pumping:** Two new pump stations will be constructed as part of the project; one located northwest of the Harms Road/Glenview Road intersection and the second located within Cunliff Park near an existing sewer along Central Road extended.
- **In-line Storm Sewer Storage:** A new 84-inch diameter relief sewer will be installed to connect the existing Wilmette Avenue and Glenview Road outlets. This connection will help alleviate flooding north and east of Wilmette Avenue.

How do the backflow preventers work?

During periods of low river stages, the existing EOH drainage systems will discharge via gravity to the Middle Fork as they do now. When river stages begin to submerge these outlets, the backflow preventers will close and prevent river water from backing up into the EOH sewer system.

Will the pumps run all the time?

The new pump stations will only operate when river stages are high enough to close the backflow preventers on the three existing outlets to the river.

What kind of storm was the project designed for?

These flood mitigation improvements are intended to provide drainage facilities that reliably meet the Village's current performance criteria of providing sufficient capacity to limit the risk of over-foundation flooding of properties or flooding that impedes emergency access to an area for events up to a 100-year storm.

The term "100-year storm" is an industry-standard benchmark used for planning and design of flood mitigation projects. It is intended to describe a rainfall event that has, on average, a 1% chance of being equaled or exceeded each year based on historical rainfall data.

Why are there still of pockets of flooding shown with the project being on-line?

This project (Phase I) represents the first of two flood mitigation improvement phases planned for the EOH neighborhood. The purpose of this project is to create a positive drainage outlet for the EOH neighborhood and reduce existing flood durations. This is a crucial component of the overall flood mitigation improvement plan for the EOH area.

In the next one to three years the Village plans to implement Phase II of the plan will identify additional conveyance projects that will be constructed to eliminate the remaining areas of localized flooding.

What are the benefits of the project?

The proposed Phase I improvements will result in a significant reduction in the risk and duration of surface flooding in the EOH neighborhood. It is anticipated that Phase I will reduce the extent and severity of flooding leading to a reduction of nearly 75% in the number of impacted structures. A reduction in flooding durations by roughly 3 to 10 hours is also expected throughout the EOH neighborhood following the completion of this phase.

Phase II will address the remaining impacted structures.

Won't the project impact flood levels along the Middle Fork?

The project will not have a significant impact to existing flood levels and/or flows along the Middle Fork. The EOH neighborhood contributes only 1.4% of the total watershed area at this point along the Middle Fork. During more frequent storms (less than the 10-year storm or 10% annual chance), flood elevations along the river are predicted to increase by 0.02 feet (less than a quarter of an inch). During more severe storms (1% annual chance or greater), flood elevations along the river are predicted to increase by 0.07 feet (less than an inch).

Wouldn't flooding along the Middle Fork be alleviated if the MWRDGC would open the gates to Lake Michigan sooner?

Water levels along the North Branch of the Chicago River between Glenview and the North Shore Channel in Chicago are controlled by the flow rate in the river and the capacity of the river channel. Neither the dam at the river's confluence with the North Shore Channel, nor the position of the gates between the Chicago River and Lake Michigan have any impact on flood levels in Glenview due to the distance and relative elevation differences between EOH and the gates.

Will the project still work if the river overtops Harms Road at Cunliff Park?

The effectiveness of the project will be reduced when Harms Road overtops as the backflow prevention will be circumvented. However, depending on the degree of overtopping, the project will still provide flood protection to the EOH neighborhood but the primary benefit will shift towards the ability of the outlet pump stations to drain the EOH area quickly after the water level on the Middle Fork recedes.