

# Delugah Woods Subdivision - Orland Township Flood Reduction Alternatives Analysis

*Supplemental Report - March 2024*



Prepared for:

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## CHAPTER 1 PROJECT OVERVIEW

### 1.1 INTRODUCTION

Christopher B. Burke Engineering, LTD. (CBBEL) was tasked by Orland Township to investigate historic and current drainage issues in the Delugah Woods Subdivision and to conduct hydraulic modeling of Spring Creek in Orland Township to address the frequent flooding of 157<sup>th</sup> Street caused by high water levels of Spring Creek during periods of high precipitation.

The Delugah Woods Subdivision is a residential subdivision in Orland Township located north of 159<sup>th</sup> Street between Will-Cook Road and Wolf Road. A primary access road to the Subdivision from the east is 157<sup>th</sup> Street, which crosses Spring Creek approximately 0.25 miles west of Wolf Road. A location map is included as Exhibit 1. 157<sup>th</sup> Street dips significantly at its crossing with Spring Creek resulting in frequent inundation of the roadway and limiting access to the subdivision to Lynch Drive to the west. Hydraulic modeling conducted by CBBEL concluded that 157<sup>th</sup> Street has an approximately ten percent (10%) chance of inundation in any given year. According to the FEMA effective Flood Insurance Map (FIRM) Panel 682 of 832 for Cook County, Illinois and Incorporated Areas, Spring Creek is mapped as studied Zone AE floodplain (Exhibit 2). The FIRM indicates that floodway is delineated and a USGS StreamStats report (Appendix 1) estimates a drainage area 1.29 square miles tributary to the culvert at 157<sup>th</sup> Street.

This study was initiated to investigate what public improvements, if any, were available and feasible to improve drainage in the subdivision. The findings of the study are presented in the following report.

### 1.2 SUBDIVISION DRAINAGE INVESTIGATION (MARCH 2024 SUPPLEMENT)

Delugah Woods subdivision has a long history of reported drainage problems and property flooding. To investigate the current drainage conditions, a flood questionnaire was distributed to 249 properties in the study area as part of a public outreach program. Of the 249, only 13 completed questionnaires were returned. Other aspects of the public outreach process, such as public information meetings for residents, were completed during the study. Addendum 1 of this report contains additional information on the outreach process.

The 13 returned questionnaires were reviewed. The drainage problems described were primarily related to grading resulting from the topography of the area. All were located on private property, outside of the right of way. Several reported basement seepage as the source of flooding. A desktop review of the study areas was completed to understand the topography and drainage patterns, as well as site visits and field review of conditions.

Our review indicates that two main types of “flooding” exist in Delugah Woods subdivision. One is related to Spring Creek. At flood stages, Spring Creek will overtop 157<sup>th</sup> Street, causing road closures and impacting the ability to access the subdivision. Depending on the severity of the storm

event, Spring Creek may remain at flood stage for an extended period of time, which can impact drainage of adjacent properties, can exacerbate subsurface drainage problems such as seepage into basements, and may create water quality issues if any septic fields are located within or near the Spring Creek floodplain.

The second type of flooding is distributed throughout the subdivision and can be characterized as single-lot drainage problems. There are no reports of overland flooding (not seepage related) where floodwater entered a residence unless directly impacted by Spring Creek. Reports typically indicate overland flow routes that have undesirably long draindown times. A review of these locations found that potential grading improvements to resolve the issues would need to occur within private properties and outside of the public right of way.

Based upon these findings, it was concluded that the single-lot issues could not be solved with a regional improvement. Furthermore, the public improvement that would be the most impactful, beneficial, and feasible was to eliminate the roadway flooding associated with Spring Creek at 157<sup>th</sup> Street. Several alternatives related to 157<sup>th</sup> Street were evaluated for consideration and are summarized in the following report.

### 1.3 HYDRAULIC MODEL DEVELOPMENT

In 2016, CBBEL compiled a Letter of Map Revision (LOMR) request for the remapping of the reach of Spring Creek between 108<sup>th</sup> Avenue and immediately downstream of Will-Cook Road (Exhibit 3). The report was submitted in August 2016, revised February 2019, and approved by FEMA in 2019. The LOMR report is included as Appendix 2. The LOMR was based on peak flowrates from a HEC-HMS hydrologic model created as part of the Metropolitan Water Reclamation District of Greater Chicago (MWRD) Detailed Watershed Plan for the Calumet-Sag Channel Watershed (DWP). The DWP is included as Appendix 6 in the attached LOMR report.

CBBEL conducted a critical duration analysis of the DWP HEC-HMS model and determined that the 12-hour storm event produced the maximum water surface elevations for the 100-year event throughout the subject reach. As such, the 12-hour storm event was the storm selected to analyze in the HEC-RAS Hydraulic modeling. Hydrographs generated in the HEC-HMS model were input at eleven (11) locations along the reach within the unsteady HEC-RAS hydraulic model. The existing conditions HEC-RAS hydraulic model used in the analysis was developed by CBBEL as part of same LOMR referenced above. CBBEL modified the existing conditions model to develop the four (4) alternatives presented in this report.

### 1.4 EXISTING CONDITIONS MODEL RESULTS

The level of service of a culvert refers to the storm event which surpasses the conveyance capacity of the culvert and causes the roadway to overtop. Using this criterion, CBBEL determined that the existing 60" CMP

culvert at 157<sup>th</sup> Street has a less-than 10-year level of service, meaning that there is a greater-than 10% chance of 157<sup>th</sup> Street overtopping in any given year.

The cause of roadway overtopping at 157<sup>th</sup> Street was found to have three causes: 1) the low elevation of the roadway at the Spring Creek crossing compared to surrounding topography; 2) a restrictive culvert at 157<sup>th</sup> Street; 3) restrictive culverts downstream of 157<sup>th</sup> Street which raise water surface elevations further upstream. An annotated HEC-RAS water surface profile is included as the existing conditions profile in **Appendix 3** which shows 157<sup>th</sup> Street for the 100-year and 10-year storms. A culvert located approximately 0.7 miles downstream of 157<sup>th</sup> street at a private access drive is shown on the HEC-RAS profile as the most restrictive of the downstream culverts. For the 100-year event, the upstream water surface elevation at the private drive culvert is 2.1-FT higher than the downstream water surface elevation. This restriction propagates upstream to 157<sup>th</sup> street which is inundated frequently due to its low elevation.

## CHAPTER 2 ALTERNATIVES ANALYSIS

This study identifies projects to alleviate flooding on 157<sup>th</sup> Street. A preliminary analysis by CBBEL determined that there was no feasible alternative to alleviate the inundation of 157<sup>th</sup> Street without elevating the roadway. Since the low elevation is a primary factor in the frequent inundation of 157<sup>th</sup> Street, all alternatives presented below involve raising 157<sup>th</sup> Street approximately 2-FT. Each alternative was modeled as providing a 100-year level of service for 157<sup>th</sup> Street. The alternatives are summarized in **Table 1** and detailed in the following sections.

**Table 1. Alternatives Analysis Summary**

Alternative ID	Culverts Improved	Total Stormwater Storage Volume Required	Flood Easements Required	Water Surface Elevation Reduction
1	157 <sup>th</sup> Street, Private Drive	0.55 AC-FT	0.16 AC	0.3 FT
2	157 <sup>th</sup> Street, Private Drive	25 AC-FT	N/A	0.5 FT
3	157 <sup>th</sup> Street	25 AC-FT	N/A	0.2 FT
<b>4 (Preferred)</b>	<b>157<sup>th</sup> Street</b>	<b>0.55 AC-FT</b>	<b>N/A</b>	<b>N/A</b>

### 2.1 ALTERNATIVE 1

The proposed Alternative 1 improvements are shown on Exhibit 4 and include the following:

- Elevating the minimum elevation of 157<sup>th</sup> Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157<sup>th</sup> Street with a 7' X 5' reinforced concrete box culvert
- Replacing the CMP Private Drive culvert with a 5' X 5' reinforced concrete box culvert
- Obtaining flood easements downstream of the Private Drive crossing and upstream of Will-Cook Road

Alternative 1 results in approximately 0.3-FT of flood reduction in the Delugah Woods subdivision which is primarily caused by the increased conveyance of the 5' X 5' RCBC at the Private Drive. Downstream of the Private Drive, flows are increased approximately 10-CFS compared to the existing conditions. The increased flows necessitate approximately 0.16 AC of flood easement between Will-Cook Road and the Private Drive, however no additional structures were within the floodplain. The 0.3-FT of flood reduction does not remove any existing structures from the floodplain upstream of 159<sup>th</sup> Street.

## 2.2 ALTERNATIVE 2

The proposed Alternative 2 improvements are shown on Exhibit 5 and include the following:

- Elevating the minimum elevation of 157<sup>th</sup> Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157<sup>th</sup> Street with a 7' X 5' reinforced concrete box culvert
- Replacing the CMP Private Drive culvert with a 5' X 5' reinforced concrete box culvert
- Providing 25 AC-FT of Storage upstream of 157<sup>th</sup> Street

Alternative 2 results in approximately 0.5-FT of 100-year flood reduction in the Delugah Woods subdivision by increasing conveyance of the 157<sup>th</sup> Street culvert and the Private Drive culvert. Downstream effects are limited to less than 0.1-FT of water surface increase by the creation of 25 AC-FT of online storage along Spring Creek. This alternative does not remove any existing structures from the floodplain upstream of 159<sup>th</sup> Street. The alternative provides a 50-year level of protection to a farm access road immediately upstream of 157<sup>th</sup> Street.

## 2.3 ALTERNATIVE 3

The proposed Alternative 3 improvements are shown on Exhibit 6 and include the following:

- Elevating the minimum elevation of 157<sup>th</sup> Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157<sup>th</sup> Street with a 7' X 5' reinforced concrete box culvert
- Providing 25 AC-FT of Storage upstream of 157<sup>th</sup> Street

Alternative 3 results in an approximately 0.2-FT 100-year flood elevation decrease in the Delugah Woods subdivision resulting from the 25 AC-FT of flood storage provided and the increased conveyance of the 157<sup>th</sup> Street culvert. The storage provided with Alternative 3 also limits downstream impacts to less than 0.1-FT of water surface elevation increase for the 100-year event. The improvements do not remove any existing structures from the floodplain.

## 2.4 ALTERNATIVE 4

The proposed Alternative 4 improvements are shown on Exhibit 7 and include the following:

- Elevating the minimum elevation of 157<sup>th</sup> Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157<sup>th</sup> Street with a 10' X 5' reinforced concrete box culvert

Alternative 4 was designed to eliminate flooding on 157<sup>th</sup> street for the 100-year event while minimizing disturbance to the surrounding area by limiting the scope of work to 157<sup>th</sup> Street. In the existing condition overtopping is a significant mode of conveyance of Spring Creek at the 157<sup>th</sup> Street Crossing. The proposed culvert for Alternative 4 is designed to contain both the existing culvert flows and the existing overtopping

flows entirely within the 5' X 10' culvert. Since the cumulative conveyance is matched for the existing and proposed conditions, the extent and elevation of the floodplain is closely matched throughout the studied reach. An annotated HEC-RAS profile of Alternative 4 for the 100-year event is included as the proposed profile in Appendix 3.

A comparison between the existing and proposed water surface elevations for Alternative 4 is presented in Table 2 below.

**Table 2. 100-Year Water Surface Elevation Summary**

Cross Section	Existing WSE	Proposed WSE	Change in WSE (FT)
Wolf Road	694.75	694.75	0
151st Street. (US)	694.63	694.63	0
151st Street (DS)	692.84	692.84	0
Farm Access Road	691.85	691.91	-0.06
157th Street	691.8	691.86	-0.06
159th Street	691.75	691.69	0.06
Juanita Drive	691.58	691.53	0.05
Private Drive	691.22	691.17	0.05
Field Access Road	688.95	688.95	0
Will Cook Road	688.34	688.34	0
Downstream Extent	684.7	684.7	0

## 2.5 PREFERRED ALTERNATIVE

Alternative 4 was chosen as the preferred alternative due to its constructability and benefits to the inundation experienced on 157<sup>th</sup> Street. It was determined that stormwater storage as proposed in Alternative 2 and Alternative 3 did not provide significant flood elevation benefits. No structures were identified that would benefit from storage that could feasibly be provided near the project area. Alternative 4 was chosen due to it being a lower cost option which provided similar flooding benefits to the other alternatives analyzed.

## CHAPTER 3 CONCLUSION

CBBEL determined Alternative 4 to be the preferred alternative due to the cost effectiveness and practical benefits of the alternative. Alternatives 1, 2, and 3 provide flood elevation benefits in the Delugah Woods subdivision; however, those reductions do not result in structures being removed from the floodplain. As such, the additional cost of storage, flood easements and additional culvert replacements would not provide a functional benefit to the Township.



## CHAPTER 4    ADDENDUM 1

### Public Outreach and Participation Summary

Christopher B. Burke Engineering, Ltd. (CBBEL) has prepared this addendum to the May 2023 “157<sup>th</sup> Street Flood Reduction Alternatives Analysis” report to summarize the public outreach and participation aspects of the study. In June of 2022, a total of 249 flood questionnaires were mailed out by CBBEL on behalf of the Orland Township Highway Department (OTHD) to residents in the general study area (northwest of 159<sup>th</sup> Street and Wolf Road). Of these 249 questionnaires, 14 were returned undeliverable and 13 completed questionnaires were received. The 13 completed questionnaires were reviewed, and in all cases, the flooding described indicated problems that were specific to a single lot and were located on private property. Based on the responses received, Orland Township determined that working on alternatives and solutions that address the historical and chronic flooding of 157<sup>th</sup> Street would provide the most direct and long-lasting benefits for all residents, whether impacted directly or indirectly by the flooding associated with Spring Creek and the 157<sup>th</sup> Street culvert.

A public Information Forum for residents was also held on 7/6/23 at the Orland Park Public Library to discuss critical OTHD projects including the flood study and results. Based on the sign in sheet, there were 21 residents, or otherwise interested parties, in attendance at the informational forum. The flyer created and distributed to inform residents about the forum is attached to this addendum.

Additionally, flood study information including the Final Report are posted and publicly available on the OTHD’s website at [Road District of Orland Township | Road District of Orland Township \(orlandroaddistrict.org\)](https://www.roaddistrictoforlandtownship.org).

# APPENDIX 1

## USGS STREAMSTATS REPORT

## APPENDIX 2

### CBBEL LOMR REPORT FOR SUBJECT REACH

## APPENDIX 3

### HEC-RAS PROFILES