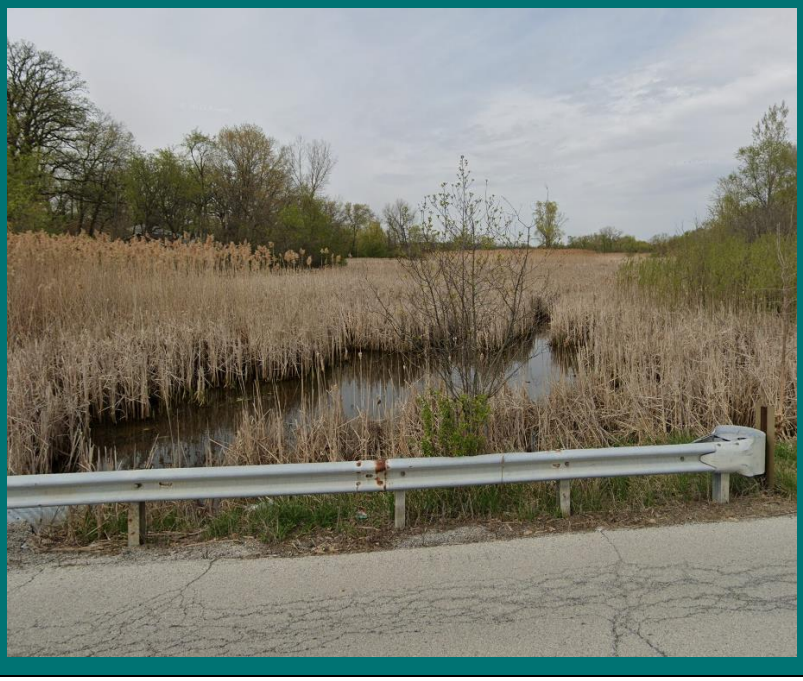
# Orland Township Highway Department
# 157th St. Flood Reduction Alternatives Analysis

May 2023



Prepared for:

Orland Township Highway Department

16125 S Wolf Road

Orland Park, IL 60462


Prepared by:

Christopher B. Burke Engineering

9575 W. Higgins Road

Rosemont, IL 60018

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# CHAPTER 1 PROJECT OVERVIEW

## 1.1 INTRODUCTION

Christopher B. Burke Engineering, LTD. (CBBEL) was tasked by the Orland Township Highway Department to conduct hydraulic modeling of Spring Creek in Orland Township to address the frequent flooding of 157th 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 159th Street between Will-Cook Road and Wolf Road. A primary access road to the Subdivision from the east is 157th Street, which crosses Spring Creek approximately 0.25 miles west of Wolf Road. A location map is included as Exhibit 1. 157th 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 157th 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 157th Street.

On behalf of the Highway Department, CBBEL has prepared this report to summarize the results of hydraulic modeling for Spring Creek to analyze alternatives to alleviate the frequent flooding of 157th Street west of Wolf Road. CBBEL developed four (4) alternatives which provide a 100-year level of protection for 157th street with varying levels of flood reduction. The alternatives are presented within **Chapter 2** of this report. The alternatives were evaluated by flood reduction benefits, cost-effectiveness, and constructibility. The preferred alternative consists of raising 157th Street approximately 2-FT and replacing the existing 60" corrugated metal pipe (CMP) culvert with a 5' X 10' reinforced concrete box culvert (RCBC). This alternative was designed to maintain the existing flows and water surface elevations through the studied reaches of Spring Creek while elevating 157th Street above the floodplain elevation.

## 1.2 HYDRAULIC MODEL DEVELOPMENT

In 2016, CBBEL compiled a Letter of Map Revision (LOMR) request for the remapping of the reach of Spring Creek between 108th 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.

## 1.3 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 157th Street has a less-than 10-year level of service, meaning that there is a greater-than 10% chance of 157th Street overtopping in any given year.

The cause of roadway overtopping at 157th 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 157th Street; 3) restrictive culverts downstream of 157th 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 157th Street for the 100-year and 10-year storms. A culvert located approximately 0.7 miles downstream of 157th 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 157th street which is inundated frequently due to its low elevation.

# CHAPTER 2 ALTERNATIVES ANALYSIS

This study identifies projects to alleviate flooding on 157th Street. A preliminary analysis by CBBEL determined that there was no feasible alternative to alleviate the inundation of 157th Street without elevating the roadway. Since the low elevation is a primary factor in the frequent inundation of 157th Street, all alternatives presented below involve raising 157th Street approximately 2-FT. Each alternative was modeled as providing a 100-year level of service for 157th 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 | 157th Street, Private Drive | 0.55 AC-FT | 0.16 AC | 0.3 FT |
| 2 | 157th Street, Private Drive | 25 AC-FT | N/A | 0.5 FT |
| 3 | 157th Street | 25 AC-FT | N/A | 0.2 FT |
| **4 (Preferred)** | **157th Street** | **0.55 AC-FT** | **N/A** | **N/A** |

## 2.1 ALTERNATIVE 1

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

- Elevating the minimum elevation of 157th Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157th 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 159th Street.

## 2.2 ALTERNATIVE 2

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

- Elevating the minimum elevation of 157th Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157th 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 157th Street

Alternative 2 results in approximately 0.5-FT of 100-year flood reduction in the Delugah Woods subdivision by increasing conveyance of the 157th 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 159th Street. The alternative provides a 50-year level of protection to a farm access road immediately upstream of 157th Street.

## 2.3 ALTERNATIVE 3

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

- Elevating the minimum elevation of 157th Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157th Street with a 7' X 5' reinforced concrete box culvert
- Providing 25 AC-FT of Storage upstream of 157th 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 157th 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 157th Street from 690.1 to 692.0'
- Replacing the existing 60" CMP culvert at 157th Street with a 10' X 5' reinforced concrete box culvert

Alternative 4 was designed to eliminate flooding on 157th street for the 100-year event while minimizing disturbance to the surrounding area by limiting the scope of work to 157th Street. In the existing condition overtopping is a significant mode of conveyance of Spring Creek at the 157th 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**

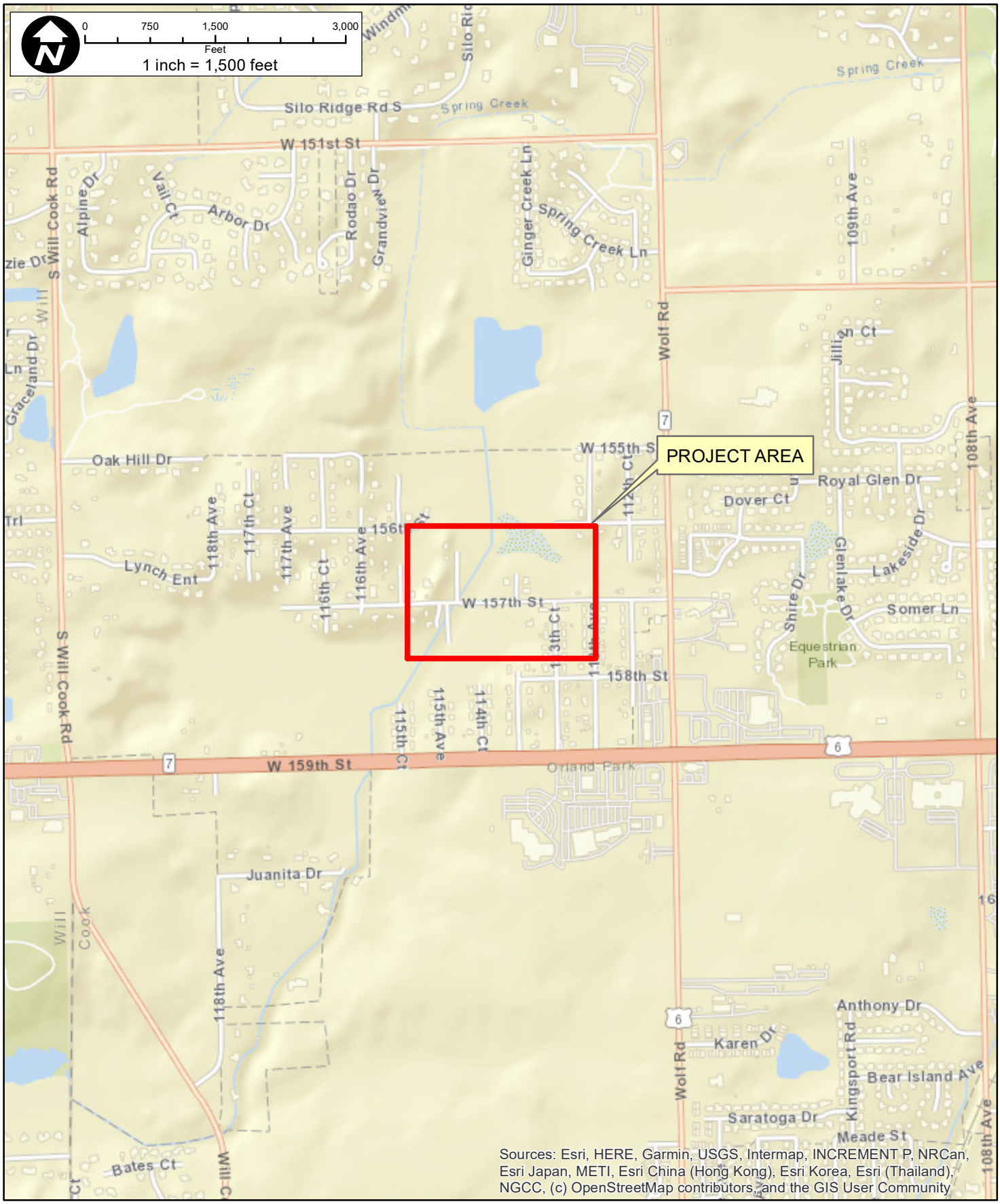
| Cross Section | Existing WSE | Proposed WSE | Change in WSE (FT) |
|---|---|---|---|
| Wolf Road | 694.75 | 694.75 | 0 |
| 151st Street. (US) | 694.63 | 694.63 | 0 |
| 151st Street (DS) | 692.84 | 692.84 | 0 |
| Farm Access Road | 691.85 | 691.91 | -0.06 |
| 157th Street | 691.8 | 691.86 | -0.06 |
| 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 157th 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.




CLIENT: ORLAND TOWNSHIP

TITLE: LOCATION MAP

PROJ. 220268
DATE: 06/07/2023
SHEET 1 OF 1
DRAWING NO. EXH 1

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600, Rosemont, IL 60018
(847) 823-0500 FAX (847) 823-0520

| | | | | |
|---|---|---|---|---|
| DSGN. | | | SCALE: | 1:0 |
| DWN. | JKV | | AUTHOR: | |
| CHKD. | - | | PLOT DATE: | 6/7/2023 |
| FILE: | EXH_1_LOCMAP | | | |

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# NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or flood plain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or flood plain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway fringe** of a studied (AE) stream may have a state regulated floodway. The FIRM may not depict these state regulated floodways.

**Floodways** restricted by anthropogenic features such as bridges and culverts are drawn to reflect natural conditions and may not agree with the model computed widths listed in the Floodway Data table in the Flood Insurance Study report.

Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolution and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided in digital format by the United States Geological Survey. Digital orthoimagery with a spatial resolution of 0.3 meter ground sample distance were photogrammetrically compiled from aerial photography acquired during the leaf-off period of spring 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

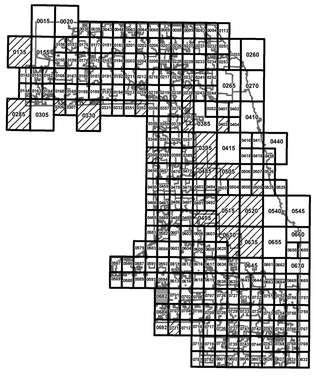
**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital version of this map. The FEMA Map Service Center may also be reached by fax at 1-800-358-9620 and its website at www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov/business/nfip/.

# PANEL INDEX



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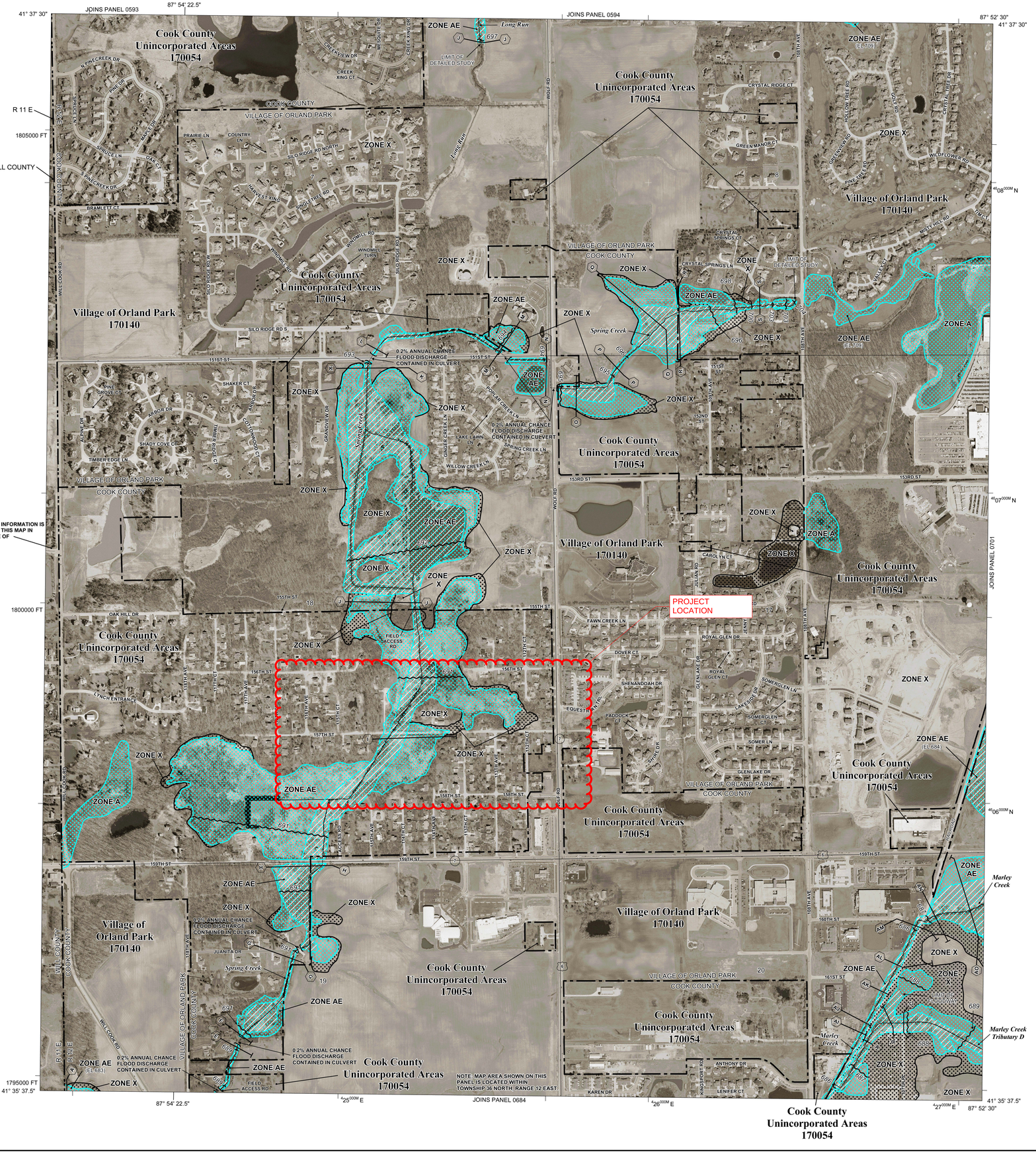



# LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

**OTHER AREAS**

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4689000M N — 1000-meter Universal Transverse Mercator grid values, zone 16
- 1565000 FT — 5000-foot grid tick: Illinois State Plane East Coordinate System, 3776 zone (FIPSZONE 1201) Transverse Mercator
- DX5510 X — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
NOVEMBER 6, 2000

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

December 20, 2002; February 4, 2004; June 2, 2005; December 16, 2005; November 16, 2006; and April 16, 2007

August 19, 2008 - to reflect updated topographic information, to update corporate limits, to add road names, to incorporate previously issued Letters of Map Revision, to change Base Flood Elevations, to add Special Flood Hazard Areas and Base Flood Elevations, and to change zone designations.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0682J**

# FIRM

**FLOOD INSURANCE RATE MAP**

**COOK COUNTY, ILLINOIS**

**AND INCORPORATED AREAS**

**PANEL 682 OF 832**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

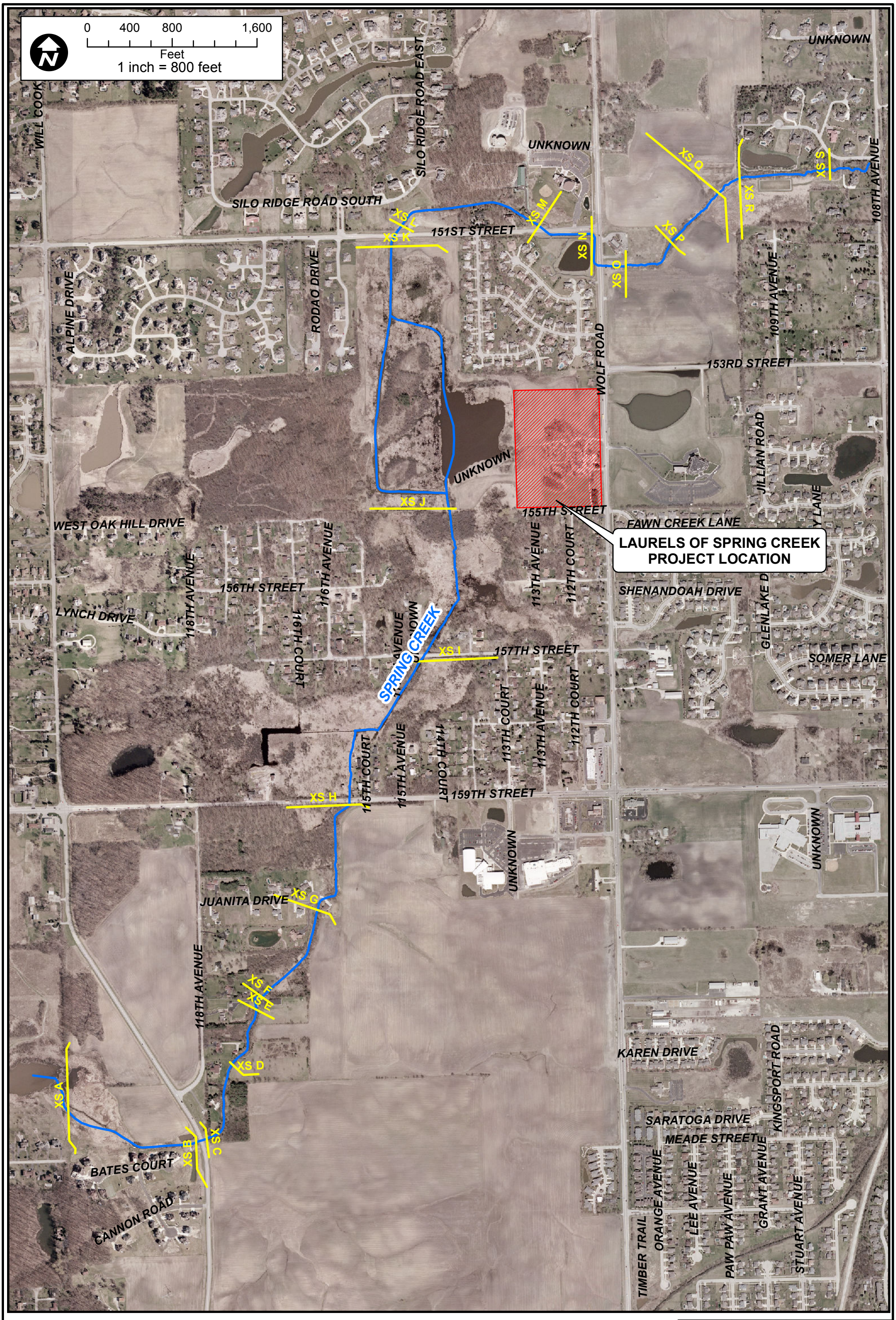
| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COOK COUNTY | 170054 | 0682 | J |
| ORLAND PARK, VILLAGE OF | 170140 | 0682 | J |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**17031C0682J**

**MAP REVISED**
**AUGUST 19, 2008**

Federal Emergency Management Agency

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|---|---|---|---|
| DSGN. | MJB | CHKD. | JJJ |

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

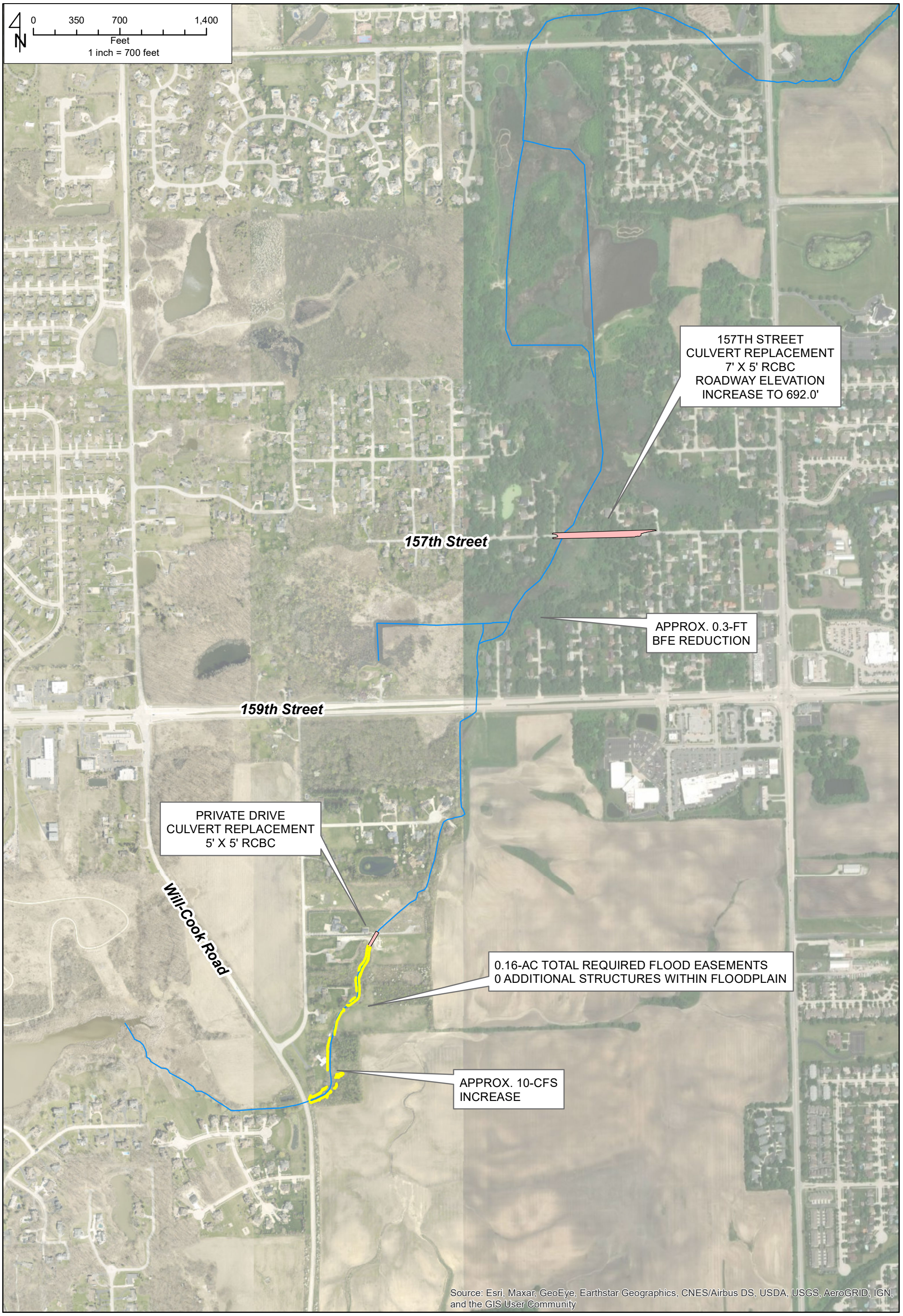
CLIENT: ORLAND TOWNSHIP

PROJECT NO.: 220268

TITLE: **SPRING CREEK LOMR CROSS SECTION LOCATION MAP**

DATE: 2/15/16

**EX 3**

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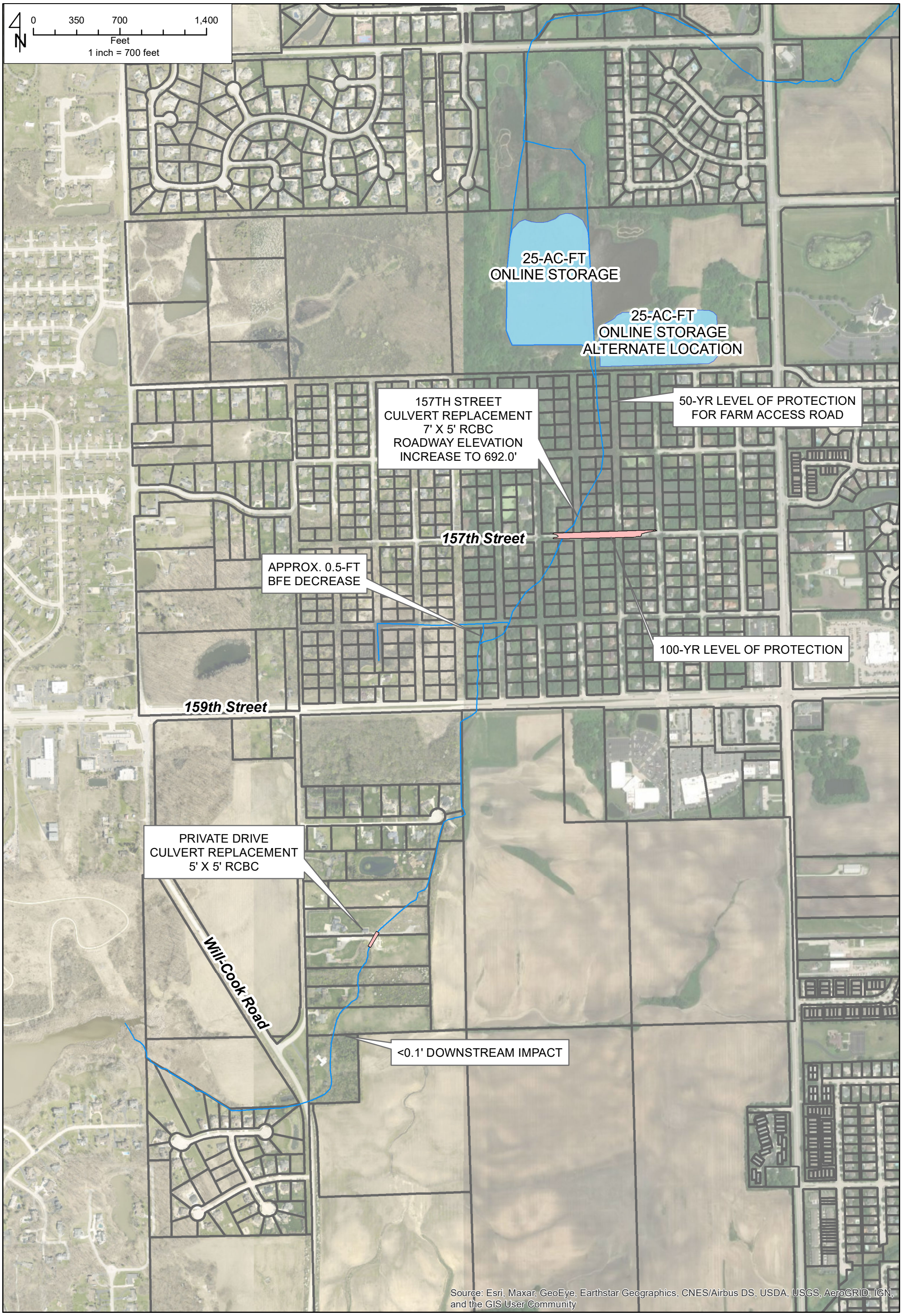


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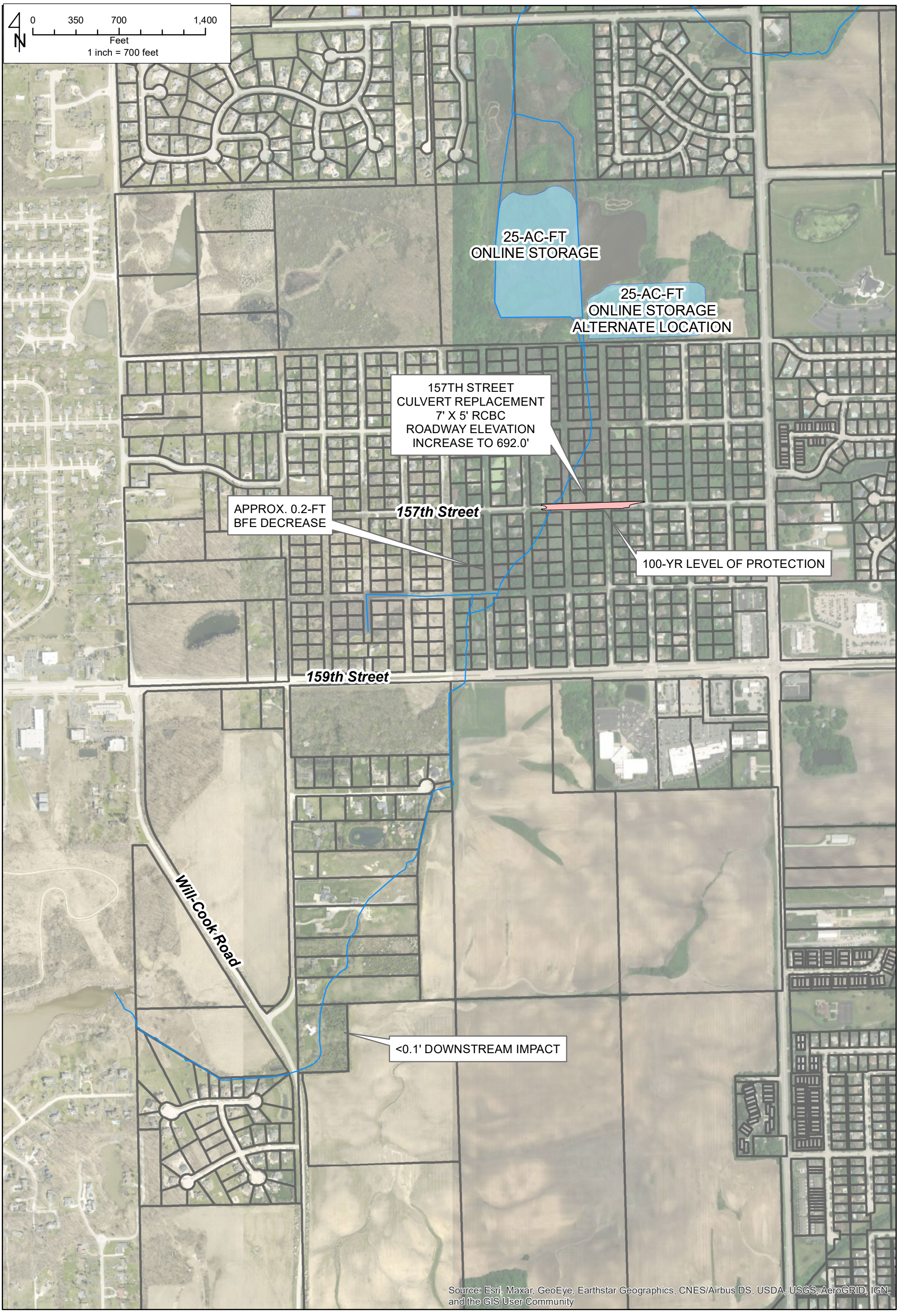


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| **Christopher B. Burke Engineering, Ltd**<br>9575 W. Higgins Rd, Suite 600 • Rosemont, IL 60018 • (847) 823-0500 | DSGN. | | SCALE: | 1:0 | SHEET 1 OF 1 |
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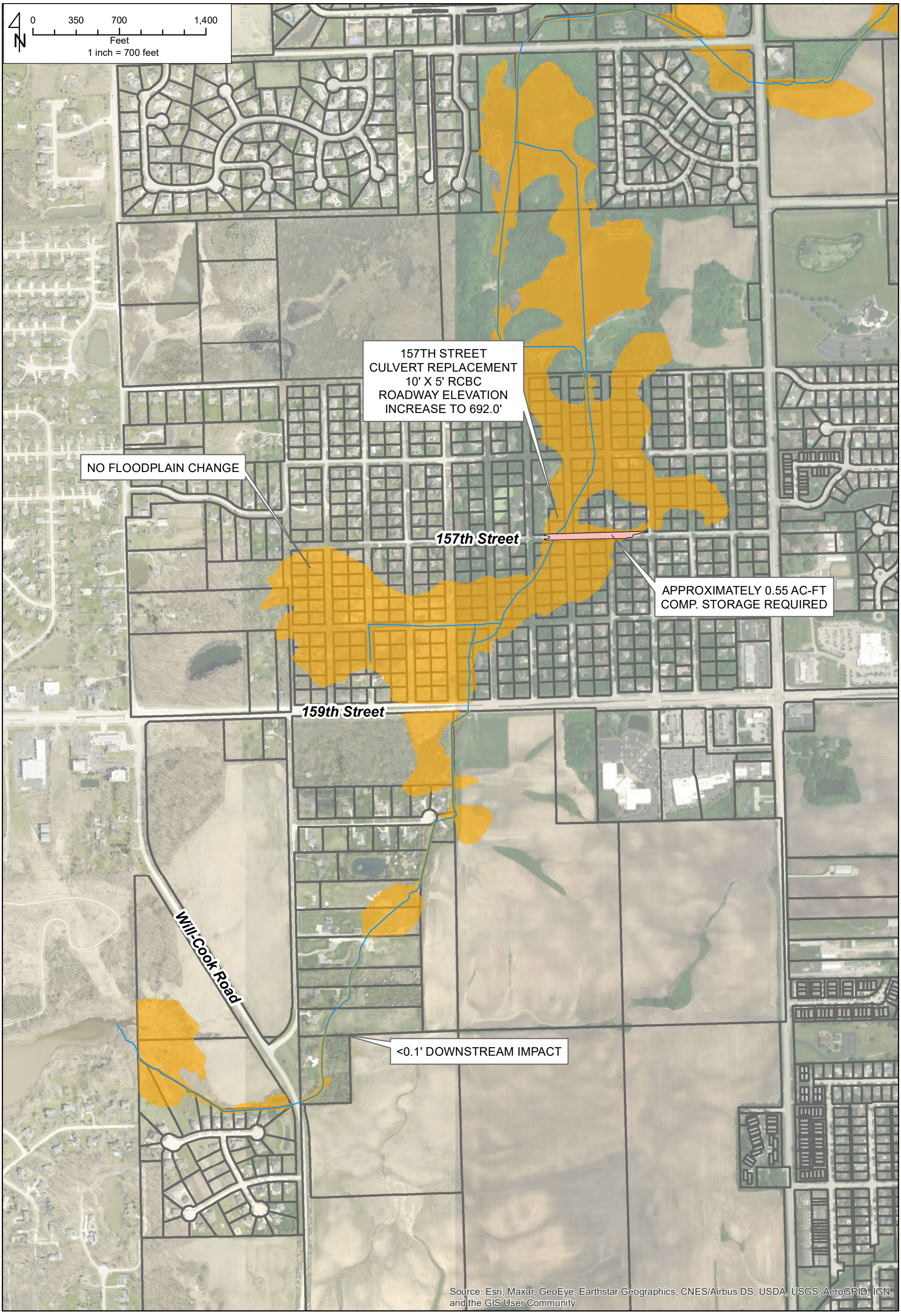


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| **Christopher B. Burke Engineering, Ltd**<br>9575 W. Higgins Rd, Suite 600 • Rosemont, IL 60018 • (847) 823-0500 | DSGN. | | SCALE: | 1:0 | SHEET 1 OF 1 |
| | DWN. JKV | | AUTHOR: | | DRAWING NO. **EXH 4** |
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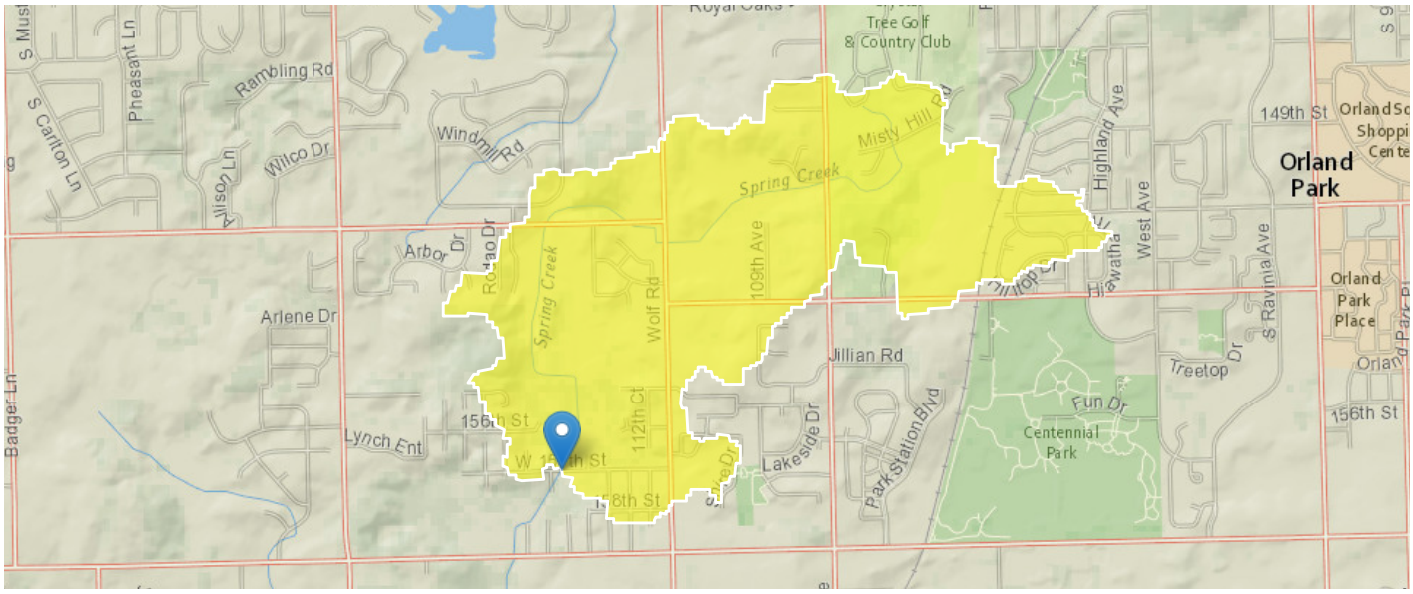
# APPENDIX 1

# USGS STREAMSTATS REPORT

# StreamStats - Spring Creek at 157th Street

**Region ID:** IL
**Workspace ID:** IL20230607142244689000
**Clicked Point (Latitude, Longitude):** 41.60426, -87.89781
**Time:** 2023-06-07 09:23:07 -0500




Collapse All

## Basin Characteristics

| Parameter Code | Parameter Description | Value | Unit |
|---|---|---|---|
| DRNAREA | Area that drains to a point on a stream | 1.29 | square miles |
| FLC11DVLMH | Fraction of drainage area that is in low to high developed land-use classes 22-24 from NLCD 2011 | 0.627 | decimal fraction |
| FSSURGDC78 | Fraction of land area that is in very poorly drained and unknown likely water drainage classes 7 and 8 from SSURGO | 0.233 | decimal fraction |
| RELRELF | Basin relief divided by basin perimeter | 8.03 | feet per mi |

## Bankfull Statistics

### Bankfull Statistics Parameters [Interior Plains D Bieger 2015]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.29 | square miles | 0.19305 | 59927.7393 |

### Bankfull Statistics Parameters [Central Lowland P Bieger 2015]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.29 | square miles | 0.200772 | 59927.66594 |

### Bankfull Statistics Parameters [USA Bieger 2015]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.29 | square miles | 0.07722 | 59927.7393 |

### Bankfull Statistics Flow Report [Interior Plains D Bieger 2015]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_D_channel_width | 12.8 | ft |
| Bieger_D_channel_depth | 1.57 | ft |
| Bieger_D_channel_cross_sectional_area | 24.3 | ft^2 |

### Bankfull Statistics Flow Report [Central Lowland P Bieger 2015]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_P_channel_width | 14.7 | ft |
| Bieger_P_channel_depth | 1.93 | ft |
| Bieger_P_channel_cross_sectional_area | 23.4 | ft^2 |

### Bankfull Statistics Flow Report [USA Bieger 2015]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_USA_channel_width | 13.5 | ft |
| Bieger_USA_channel_depth | 1.27 | ft |
| Bieger_USA_channel_cross_sectional_area | 19.6 | ft^2 |

### Bankfull Statistics Flow Report [Area-Averaged]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_D_channel_width | 12.8 | ft |
| Bieger_D_channel_depth | 1.57 | ft |
| Bieger_D_channel_cross_sectional_area | 24.3 | ft^2 |
| Bieger_P_channel_width | 14.7 | ft |
| Bieger_P_channel_depth | 1.93 | ft |
| Bieger_P_channel_cross_sectional_area | 23.4 | ft^2 |
| Bieger_USA_channel_width | 13.5 | ft |
| Bieger_USA_channel_depth | 1.27 | ft |
| Bieger_USA_channel_cross_sectional_area | 19.6 | ft^2 |

*Bankfull Statistics Citations*

**Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_campaign=PDFCoverPages)**

Application Version: 4.15.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

# APPENDIX 2

# CBBEL LOMR REPORT FOR SUBJECT REACH

# Federal Emergency Management Agency
# Letter of Map Revision Request
# Spring Creek

## Orland Park, Cook County, Illinois

Prepared for

**Village of Orland Park**
14700 Ravinia Avenue
Orland Park, IL 60462

*August 2016*

***Revised: February 2019***


Prepared by

**Christopher B. Burke Engineering, Ltd.**
**9575 West Higgins Road, Suite 600**
**Rosemont, IL 60007**

CBBEL Project No. 15-0582

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# PROJECT OVERVIEW

## INTRODUCTION

On behalf of the Village of Orland Park (Village), Christopher B. Burke Engineering Ltd. (CBBEL) has prepared this report to summarize the results of updated hydrologic and hydraulic modeling for Spring Creek through the Village (Exhibit 1) in support of a Federal Emergency Management Agency (FEMA) Letter of Map Revision (LOMR). The Village has requested the latest hydraulic model be used to update the regulatory flood mapping so any future development along Spring Creek can accurately account for flood risk. According to the FEMA effective Flood Insurance Map (FIRM) Panels 682 and 684 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 the FEMA Flood Insurance Study (FIS) shows that Spring Creek has a tributary area of 2.3 square miles at 118$^{th}$ Avenue which is just upstream of the county boundary.

The effective regulatory models obtained from the Illinois State Water Survey (ISWS) consist of a HEC-1 hydrologic model and WSP-2 hydraulic model both developed by CWR Consultants Inc. (CWR) as part of LOMR completed in 2000. The hydraulic model begins just downstream of 108$^{th}$ avenue and ends at the Will-Cook County boundary. The next section describes the updated analysis using current modeling in support of a LOMR for Spring Creek through the Village.

## PROJECT APPROACH

The Village would like to update the Spring Creek regulatory flood mapping with the latest, most accurate modeling available for Spring Creek. In 2009, the Metropolitan Water Reclamation District of Greater Chicago (MWRD) completed its Detailed Watershed Plan for the Calumet-Sag Channel Watershed (DWP). As part of this study, a new HEC-HMS hydrologic model and a HEC-RAS unsteady-state hydraulic model were developed for Spring Creek. CBBEL is proposing to use these models in the LOMR request.

Spring Creek has many inline storage areas behind culvert crossings that attenuate flows along the reach. In traditional hydrologic and steady-state hydraulic modeling, these storage areas would be input into the hydrologic model to represent the flow attenuation and the generate the resultant maximum flowrate. Conversely, when performing unsteady-state hydraulic modeling, the hydrologic model is setup without inline storage areas. Hydrographs generated from the hydrologic model are input into the unsteady-state hydraulic model at specified locations and the attenuation from the inline storage areas are represented directly in the unsteady-state hydraulic model. Due to the difficulty with trying to define a floodway using unsteady-state hydraulic modeling, CBBEL is proposing to use the maximum resultant flows from the unsteady-state hydraulic model and input them into a steady-state hydraulic model at representative locations. The steady-state hydraulic model would then be the new effective model from which to define the floodway.

# HYDROLOGIC MODELING

Model parameters for the HEC-HMS hydrologic model were generated using HEC-GeoHMS. 14 subbasins with an average drainage area of 118 acres drain to Spring Creek. SCS Curve Numbers (CN) and Time of Concentrations (Tc) were uniquely generated for each subbasin and are described in Table 1 below. A more detailed discussion of the hydrologic modeling is included in the MWRD DWP (Appendix 6).

Table 1 – Hydrologic Parameters Summary

| Subbasin ID | Area (ac) | CN | Tc (min) |
|---|---|---|---|
| W610 | 103.2 | 84.4 | 22.7 |
| W560 | 107.7 | 78.2 | 15.5 |
| W510 | 110.4 | 79.9 | 20.8 |
| W460 | 121.4 | 83.6 | 20.8 |
| W450 | 118.0 | 80.5 | 18.8 |
| W360 | 131.7 | 80.7 | 37.7 |
| W280 | 79.6 | 82.7 | 16.8 |
| W270 | 68.4 | 82.6 | 14.4 |
| W260 | 107.1 | 83.1 | 38.6 |
| W250 | 174.4 | 79.2 | 22.3 |
| W240 | 114.0 | 72.0 | 19.3 |
| W800 | 174.5 | 76.5 | 29.8 |
| W700 | 132.9 | 75.4 | 34.8 |
| W760 | 115.1 | 77.8 | 17.5 |

Hydrographs generated in the HEC-HMS model were input at eleven (11) locations along the reach within the unsteady HEC-RAS hydraulic model. A 100-year critical duration analysis was performed which determined that the 12-hour storm produced the maximum flows on average throughout the reach. The 12-hour critical duration is the same as the current HEC-1 effective hydrologic model. The critical duration analysis is summarized in Table 2.

Table 2 – Critical Duration Analysis Summary

| Location | XS ID | Storm Event | | | |
|---|---|---|---|---|---|
| | | 6-hour | 12-hour | 18-hour | 24-hour |
| Downstream Limit | 482.8005 | 352.3 | 361.2 | 356.0 | 388.1 |
| Will Cook Rd | 1799.666 | 260.1 | 271.7 | 264.6 | 248.9 |
| 159th St | 5556.618 | 102.3 | 113.3 | 116.3 | 117.7 |
| 151st St | 12001.15 | 169.9 | 176.9 | 177.9 | 171.2 |
| Wolf Rd | 14406.13 | 138.1 | 145.5 | 145.4 | 141.3 |

# HYDRAULIC MODELING

## FLOODPLAIN

A steady-state hydraulic model was developed based on the same model geometry used in the unsteady HEC-RAS model. Eleven (11) flow change locations were determined at appropriate locations based on significant changes in flow along the reach shown for the 100-year storm (Appendix 2). 100-year flows were input into the HEC-RAS model and the resulting flood profile was compared to the current regulatory flood profile and summarized in Table 2 below. Cross-section locations are shown on the attached Exhibit 4. Modeling analyses for the 10-, 50-, and 500-year flood events have been performed and are provided in Appendix 1.

Table 3 – Hydraulic Model Summary Table

| FIS XS | FIS Q (cfs) | FIS WSEL | CBBEL HEC-RAS Station | CBBEL Q (cfs) | Current CBBEL WSEL | Difference (Current CBBEL - FIS) |
|---|---|---|---|---|---|---|
| S | 67 | 700.7 | 16983.37 | 69 | 698.96 | -1.74 |
| R | 98 | 695.8 | 16024.4 | 86 | 695.12 | -0.68 |
| Q | 98 | 695.8 | 15850.19 | 86 | 695.11 | -0.69 |
| P | 139 | 695.3 | 15212.53 | 86 | 694.94 | -0.36 |
| O | 139 | 694.7 | 14457.09 | 145 | 694.85 | 0.15 |
| Wolf Road | | | | | | |
| N | 148 | 693.9 | 13981.41 | 153 | 694.76 | 0.86 |
| 151st Street (Upstream Crossing) | | | | | | |
| M | 183 | 693.6 | 13453.85 | 179 | 694.57 | 0.97 |
| L | 183 | 693.1 | 12019.91 | 179 | 692.81 | -0.29 |
| 151st Street (Downstream Crossing) | | | | | | |
| K | 144 | 692.8 | 11831.4 | 179 | 692.61 | -0.19 |
| J | 144 | 691.4 | 8722.829 | 131 | 691.81 | 0.41 |
| 155th Street | | | | | | |
| 157th Street | | | | | | |
| I | 97 | 691.3 | 7193.714 | 117 | 691.78 | 0.48 |
| 159th Street | | | | | | |
| H | 105 | 691.1 | 5490.413 | 113 | 691.63 | 0.53 |
| Jaunita Drive | | | | | | |
| G | 105 | 690.9 | 4346.582 | 113 | 691.28 | 0.38 |
| F | 105 | 690.8 | 3331.113 | 113 | 691.22 | 0.42 |
| Private Drive | | | | | | |
| E | 105 | 689.4 | 3196.567 | 100 | 688.68 | -0.72 |
| Field Access Road | | | | | | |
| D | 107 | 688.4 | 2582.291 | 100 | 687.79 | -0.61 |
| C | 259 | 686.7 | 1799.666 | 304 | 687.55 | 0.85 |
| Will-Cook Road | | | | | | |
| B | 259 | 685.2 | 1670.018 | 304 | 686.97 | 1.77 |
| A | 738 | 682.9 | 482.8005 | 361 | 684.71 | 1.81 |

## FLOODWAY

A new floodway was determined using IDNR-OWR floodway construction criteria where the floodway boundaries were encroached to maintain 90% of the floodplain storage, limit velocity increases to 10% and limit water surface elevation increases to 0.1 feet. The revised floodway data tables are included in Appendix 1. The revised floodway was then scaled onto the annotated FIRM as shown on Exhibit 5.


| | | | |
|---|---|---|---|
| DSGN. | MJB | CHKD. | JJJ |

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

CLIENT: **VILLAGE OF ORLAND PARK**

PROJECT NO.: 15-0582

TITLE: **SPRING CREEK LOCATION MAP**

DATE: 2/15/16

**EX 1**

# NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or flood plain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or flood plain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway fringe** of a studied (AE) stream may have a state regulated floodway. The FIRM may not depict these state regulated floodways.

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Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolution and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided in digital format by the United States Geological Survey. Digital orthoimagery with a spatial resolution of 0.3 meter ground sample distance were photogrammetrically compiled from aerial photography acquired during the leaf-off period of spring 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

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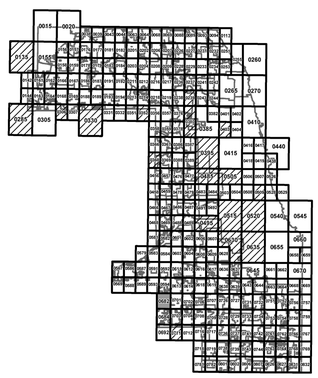
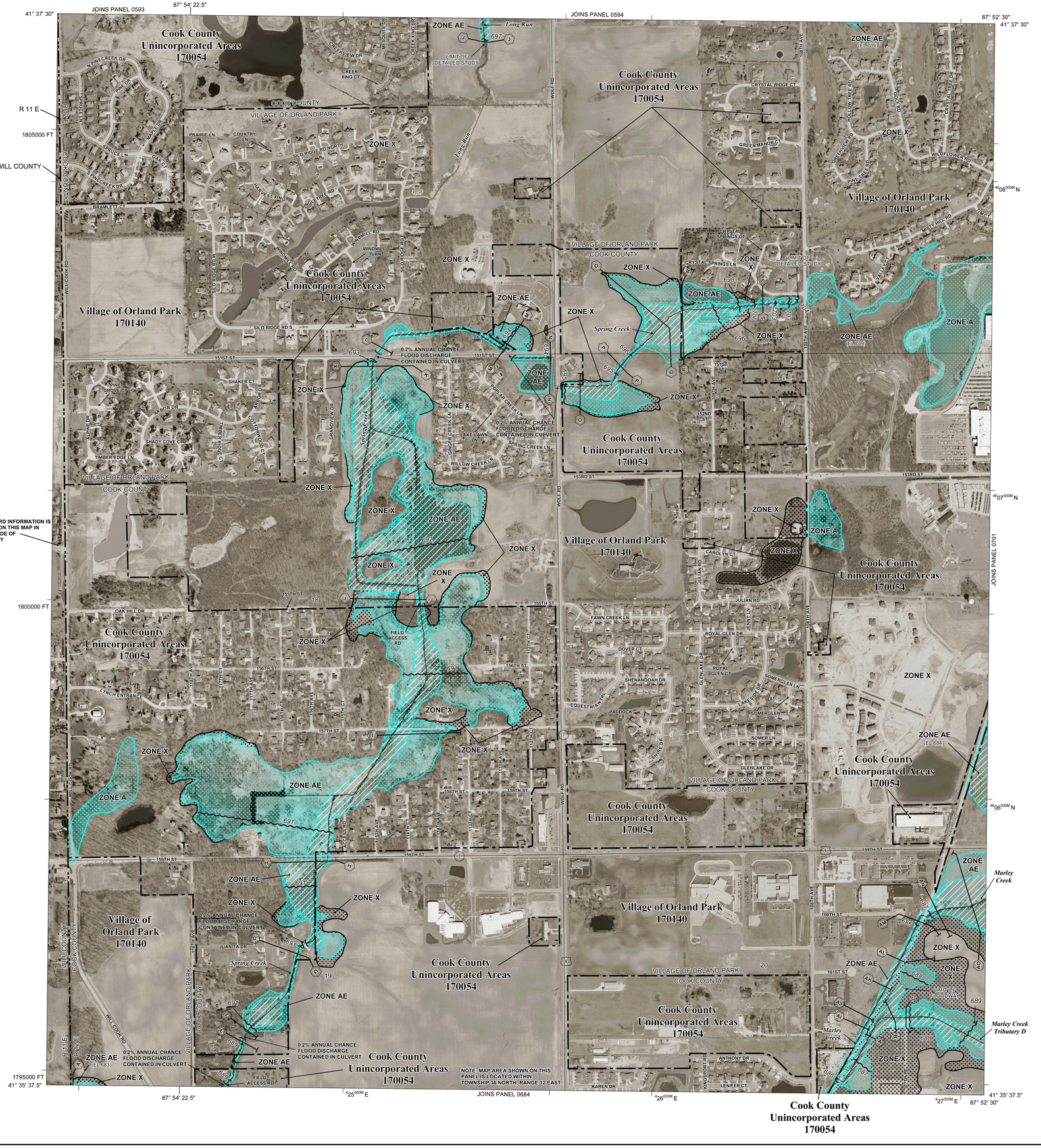
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital version of this map. The FEMA Map Service Center may also be reached by fax at 1-800-358-9620 and its website at www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov/business/nfip/.

# PANEL INDEX




# LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

**OTHER AREAS**

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4689000M N — 1000-meter Universal Transverse Mercator grid values, zone 16
- 1565000 FT — 5000-foot grid tick: Illinois State Plane East Coordinate System, 3776 zone (FIPSZONE 1201) Transverse Mercator
- DX5510 X — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
NOVEMBER 6, 2000

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

December 20, 2002; February 4, 2004; June 2, 2005; December 16, 2005; November 16, 2006; and April 16, 2007

August 19, 2008 - to reflect updated topographic information, to update corporate limits, to add road names, to incorporate previously issued Letters of Map Revision, to change Base Flood Elevations, to add Special Flood Hazard Areas and Base Flood Elevations, and to change zone designations.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0682J

# FIRM
## FLOOD INSURANCE RATE MAP
## COOK COUNTY, ILLINOIS
## AND INCORPORATED AREAS

**PANEL 682 OF 832**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COOK COUNTY | 170054 | 0682 | J |
| ORLAND PARK, VILLAGE OF | 170140 | 0682 | J |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**17031C0682J**

**MAP REVISED**
**AUGUST 19, 2008**

Federal Emergency Management Agency

EXHIBIT 2A

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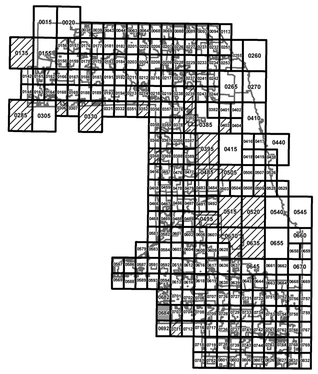
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

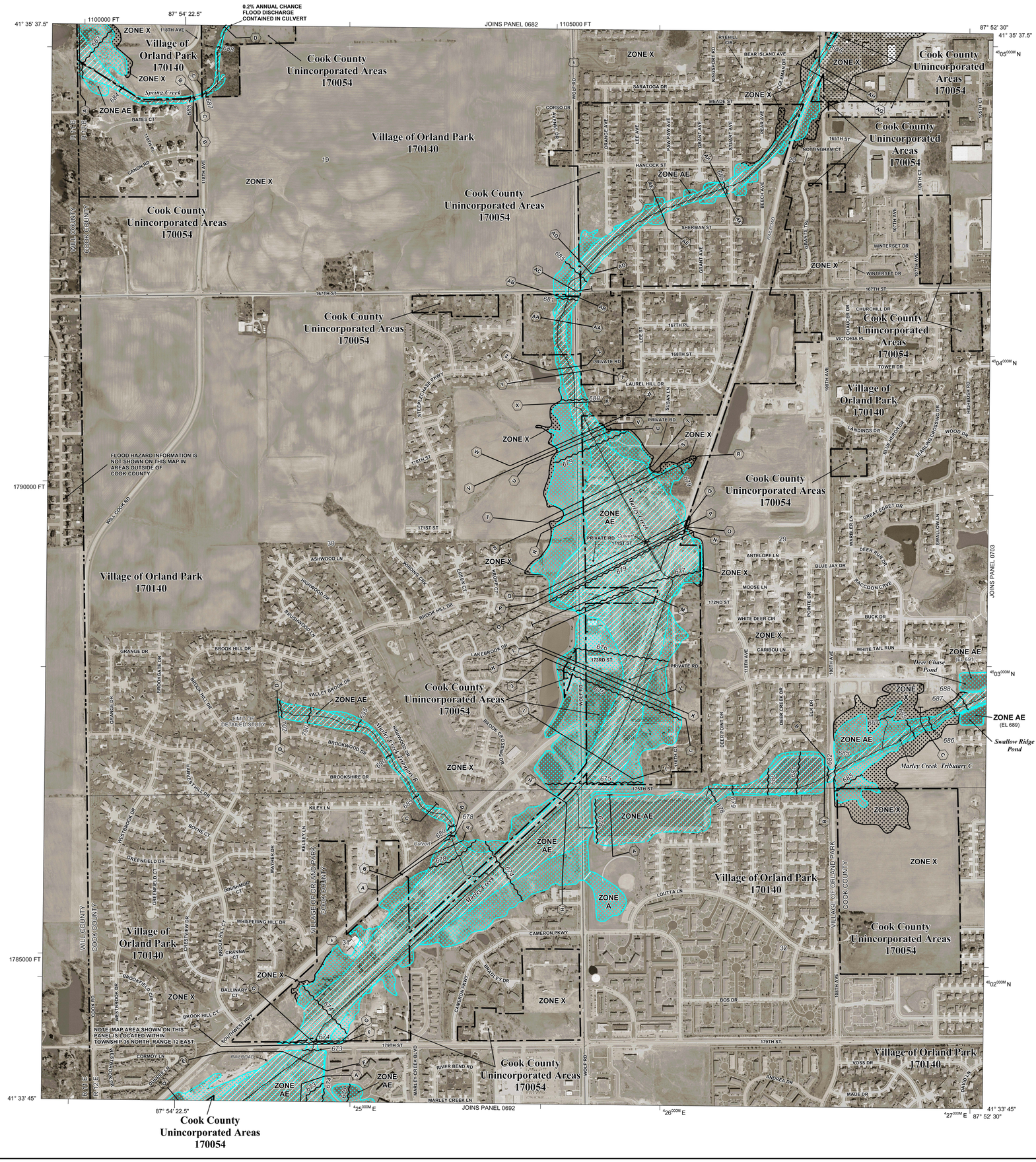
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital version of this map. The FEMA Map Service Center may also be reached by fax at 1-800-358-9620 and its website at www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov/business/nfip/.

# PANEL INDEX




Panel Not Printed




# LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

| | |
|---|---|
| | 1% annual chance floodplain boundary |
| | 0.2% annual chance floodplain boundary |
| | Floodway boundary |
| | Zone D boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

*Referenced to the North American Vertical Datum of 1988

| | |
|---|---|
| A — A | Cross section line |
| 23 — 23 | Transect line |
| 45° 02' 08", 93° 02' 12" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) |
| 4989000M N | 1000-meter Universal Transverse Mercator grid values, zone 16 |
| 1565000 FT | 5000-foot grid tick: Illinois State Plane East Coordinate System, 3776 zone (FIPSZONE 1201) Transverse Mercator |
| DX5510 X | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
NOVEMBER 6, 2000

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

December 20, 2002; February 4, 2004; June 2, 2005; December 16, 2005; November 16, 2006; and April 16, 2007

August 19, 2008 - to reflect updated topographic information, to update corporate limits, to add road names, to incorporate previously issued Letters of Map Revision, to change Base Flood Elevations, to add Special Flood Hazard Areas and Base Flood Elevations, and to change zone designations.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0684J

# FIRM
## FLOOD INSURANCE RATE MAP
## COOK COUNTY, ILLINOIS
### AND INCORPORATED AREAS

**PANEL 684 OF 832**
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

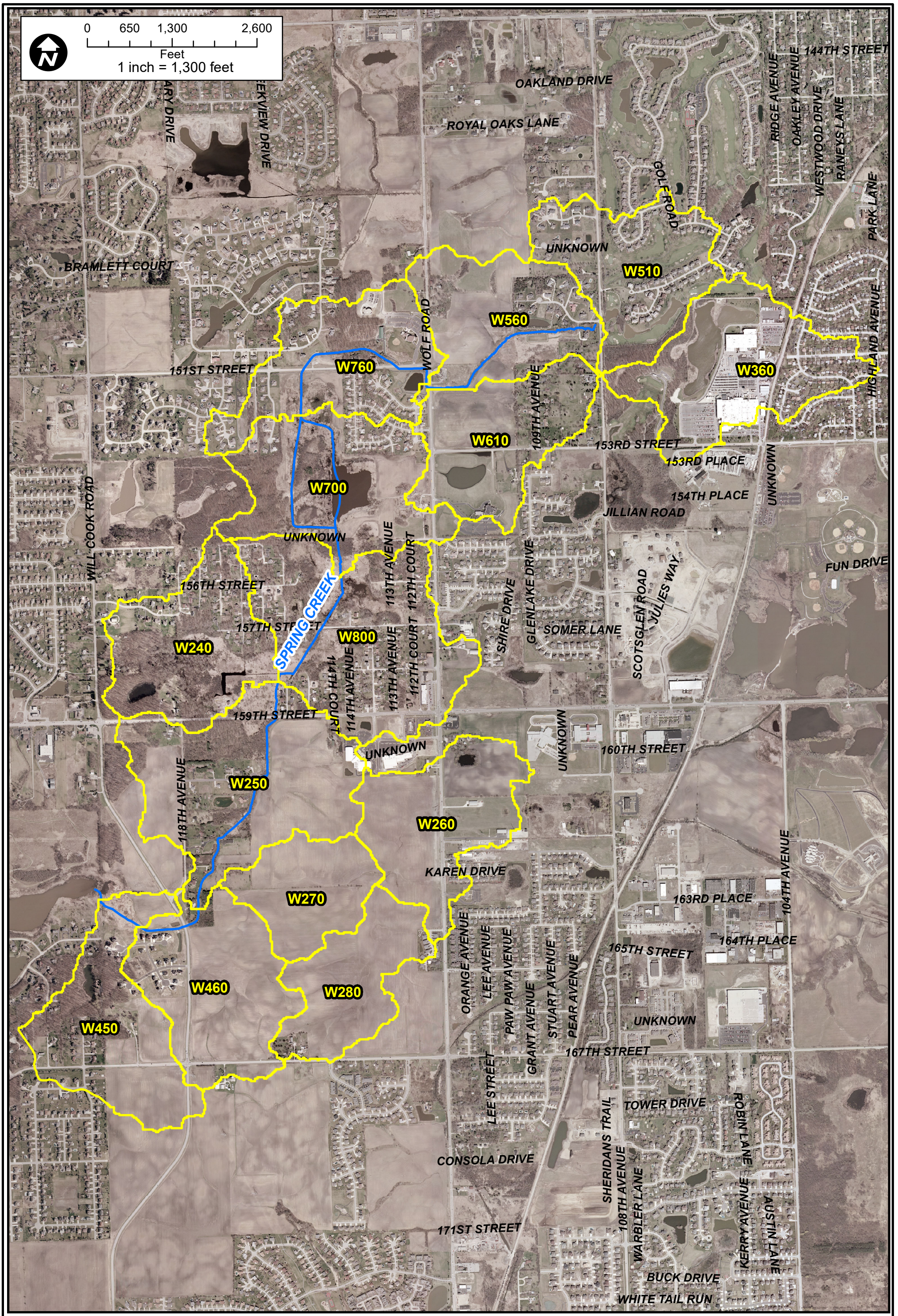
| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COOK COUNTY | 170054 | 0684 | J |
| ORLAND PARK, VILLAGE OF | 170140 | 0684 | J |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**17031C0684J**
**MAP REVISED**
**AUGUST 19, 2008**

Federal Emergency Management Agency

EXHIBIT 2B




| | | | |
|---|---|---|---|
| DSGN. | MJB | CHKD. | JJJ |

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

CLIENT: **VILLAGE OF ORLAND PARK**

PROJECT NO. 15-0582

TITLE: **SPRING CREEK SUBBASIN MAP**

DATE 8/31/18

**EX 3**

0 400 800 1,600

Feet

1 inch = 400 feet

N

## Legend

- Floodway
- 100-Year Floodplain
- 500-Year Floodplain
- Hydraulic Cross Section

MICHAEL J. BURKE
062-066808
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS
EXP. 11/30/19


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


CLIENT:

**VILLAGE OF ORLAND PARK**

| No. | DATE | NATURE OF REVISION | | | |
|---|---|---|---|---|---|
| 1 | 02/13/19 | PE STAMP & DOWNSTREAM EDITS | DSN. | MJB | |
| | | | CHKD. | JJJ | |
| | | | SCALE | | |
| | | | GIS USER | | |
| | | | MODEL | ArcGIS 9.2 | |
| FILE NAME: | | | | | |
| DATE: | | 05/06/16 | | | |

TITLE:

**SPRING CREEK HYDRAULIC EXHIBIT**

PROJ. NO. 15-0225

SHEET 1 OF 1

DRAWING NO.

**EX 4**

0 400 800 1,600
Feet
1 inch = 400 feet

N

Cook County Unincorporated Areas 170054
Village of Orland Park 170140
Village of O 170
ZONE X
ZONE AE
ZONE A
VILLAGE OF ORLAND PARK
COOK COUNTY
0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
Spring Creek
LIMIT OF DETAILED STUDY
ZONE AE (EL 709)
ZONE AE (EL 683)
SILO RIDGE RD NORTH
SILO RIDGE RD S
SILO RIDGE RD W
SILO RIDGE RD E
WINDMILL RD
WINDMILL TURN
SINGLETREE RD
HARVEST XING
BRAMLETT CT
SPRUCE LN
OAK CT
S PINECREEK DR
WILL COOK RD
CRYSTAL SPRINGS CT
CRYSTAL SPRINGS LN
PINE TREE RD
VALLEY CT
GREENVIEW
151ST ST
153RD ST
155TH ST
156TH ST
157TH ST
158TH ST
159TH ST
167TH ST
103RD AVE
107TH AVE
109TH AVE
112TH CT
113TH AVE
114TH AVE
115TH AVE
116TH AVE
117TH AVE
117TH CT
118TH AVE
118TH PL
152ND ST
SHAKER CT
PINE GROVE CT
ARBOR DR
ALPINE DR
COTTONWOOD CT
TIMBER RIDGE CT
SHADY COVE CT
TIMBER EDGE LN
GRANDVIEW DR
POPLAR CREEK LN
GINGER CREEK LN
LAKE LAWN LN
SPRING CREEK LN
WILLOW CREEK LN
WOLF RD
ACCESS RD
FIELD ACCESS RD
OAK HILL DR
LYNCH ENTRANCE
JUANITA DR
BATES CT
CANON RD
FAWN CREEK LN
DOVER CT
SHENANDOAH DR
EQUESTRIAN TRL
PADDOCK CT
R 11 E
R 12 E

## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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| | |
|---|---|
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FLOODWAY AREAS IN ZONE AE

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OTHER FLOOD AREAS

| | |
|---|---|
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- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4689000M N — 1000-meter Universal Transverse Mercator grid values, zone 16
- 1565000 FT — 5000-foot grid tick: Illinois State Plane East Coordinate System, 3776 zone (FIPSZONE 1201) Transverse Mercator
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

## Legend

- Revised Floodway
- Revised 100-Year Floodplain
- Revised 500-Year Floodplain

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0682J

# FIRM
FLOOD INSURANCE RATE MAP
COOK COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 682 OF 832
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COOK COUNTY | 170054 | 0682 | J |
| ORLAND PARK, VILLAGE OF | 170140 | 0682 | J |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17031C0682J
MAP REVISED
AUGUST 19, 2008

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0684J

# FIRM
FLOOD INSURANCE RATE MAP
COOK COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 684 OF 832
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COOK COUNTY | 170054 | 0684 | J |
| ORLAND PARK, VILLAGE OF | 170140 | 0684 | J |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17031C0684J
MAP REVISED
AUGUST 19, 2008

Federal Emergency Management Agency


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


CLIENT: ***VILLAGE OF ORLAND PARK***

| No. | DATE | NATURE OF REVISION | | |
|---|---|---|---|---|
| MJB | 02/13/19 | DOWNSTREAM EDITS | DSN. | MJB |
| | | | CHKD. | JJJ |
| | | | SCALE | |
| | | | GIS USER | |
| | | | MODEL | ArcGIS 9.2 |
| FILE NAME: | | | | |
| DATE: | | 05/17/16 | | |

TITLE: ***SPRING CREEK ANNOTATED FIRM***

PROJ. NO. 15-0582
SHEET 1 OF 1
DRAWING NO. ***EX 5***

# *Appendix 1*

# *Hydraulic Modeling Summary Tables*

# FLOODWAY RESULTS TABLE

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| Main | 17035.08 | 100-YR | 20.44 | 699.31 | 28.27 | 2.44 |
| Main | 17035.08 | Floodway | 20.44 | 699.31 | 28.27 | 2.44 |
| | | | | | | |
| Main | 16983.37 | 100-YR | 16.81 | 698.96 | 18.26 | 3.78 |
| Main | 16983.37 | Floodway | 16.81 | 698.96 | 18.26 | 3.78 |
| | | | | | | |
| Main | 16899.4* | 100-YR | 17.45 | 698.31 | 18.49 | 3.73 |
| Main | 16899.4* | Floodway | 17.45 | 698.31 | 18.49 | 3.73 |
| | | | | | | |
| Main | 16815.4* | 100-YR | 17.95 | 697.65 | 18.53 | 3.72 |
| Main | 16815.4* | Floodway | 17.95 | 697.65 | 18.53 | 3.72 |
| | | | | | | |
| Main | 16731.5* | 100-YR | 18.49 | 696.99 | 18.77 | 3.68 |
| Main | 16731.5* | Floodway | 18.49 | 696.99 | 18.77 | 3.68 |
| | | | | | | |
| Main | 16647.5* | 100-YR | 18.90 | 696.32 | 18.60 | 3.71 |
| Main | 16647.5* | Floodway | 18.90 | 696.32 | 18.60 | 3.71 |
| | | | | | | |
| Main | 16563.6* | 100-YR | 19.20 | 695.74 | 20.13 | 3.43 |
| Main | 16563.6* | Floodway | 19.21 | 695.74 | 20.15 | 3.42 |
| | | | | | | |
| Main | 16479.65 | 100-YR | 20.84 | 695.48 | 27.42 | 2.52 |
| Main | 16479.65 | Floodway | 20.86 | 695.48 | 27.45 | 2.51 |
| | | | | | | |
| Main | 16403.7* | 100-YR | 26.84 | 695.35 | 34.31 | 2.01 |
| Main | 16403.7* | Floodway | 26.86 | 695.35 | 34.37 | 2.01 |
| | | | | | | |
| Main | 16327.7* | 100-YR | 39.63 | 695.26 | 42.54 | 1.62 |
| Main | 16327.7* | Floodway | 33.68 | 695.27 | 42.51 | 1.62 |
| | | | | | | |
| Main | 16251.7* | 100-YR | 122.38 | 695.21 | 63.41 | 1.09 |
| Main | 16251.7* | Floodway | 98.29 | 695.21 | 59.46 | 1.16 |
| | | | | | | |
| Main | 16175.84 | 100-YR | 192.14 | 695.16 | 102.23 | 0.84 |
| Main | 16175.84 | Floodway | 166.39 | 695.16 | 94.68 | 0.91 |
| | | | | | | |
| Main | 16100.* | 100-YR | 143.40 | 695.12 | 92.52 | 0.93 |
| Main | 16100.* | Floodway | 126.81 | 695.12 | 87.86 | 0.98 |
| | | | | | | |
| Main | 16024.40 | 100-YR | 595.71 | 695.12 | 420.15 | 0.24 |
| Main | 16024.40 | Floodway | 464.99 | 695.12 | 400.85 | 0.25 |
| | | | | | | |
| Main | 15850.19 | 100-YR | 700.51 | 695.11 | 622.51 | 0.16 |
| Main | 15850.19 | Floodway | 540.00 | 695.11 | 583.13 | 0.17 |
| | | | | | | |
| Main | 15434.41 | 100-YR | 19.93 | 695.01 | 54.88 | 1.57 |
| Main | 15434.41 | Floodway | 19.93 | 695.01 | 54.92 | 1.57 |
| | | | | | | |
| Main | 15212.53 | 100-YR | 21.26 | 694.94 | 62.31 | 1.38 |
| Main | 15212.53 | Floodway | 21.27 | 694.94 | 62.35 | 1.38 |
| | | | | | | |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| Main | 14922.76 | 100-YR | 432.27 | 694.92 | 502.15 | 0.40 |
| Main | 14922.76 | Floodway | 337.78 | 694.93 | 459.11 | 0.40 |
| | | | | | | |
| Main | 14774.58 | 100-YR | 325.76 | 694.89 | 418.90 | 0.55 |
| Main | 14774.58 | Floodway | 266.56 | 694.90 | 382.77 | 0.55 |
| | | | | | | |
| Main | 14457.09 | 100-YR | 219.32 | 694.85 | 316.04 | 0.64 |
| Main | 14457.09 | Floodway | 175.72 | 694.85 | 290.76 | 0.64 |
| | | | | | | |
| Main | 14406.13 | 100-YR | 140.46 | 694.84 | 301.17 | 0.64 |
| Main | 14406.13 | Floodway | 100.46 | 694.84 | 273.88 | 0.64 |
| | | | | | | |
| Main | 14204.08 | | Culvert | | | |
| | | | | | | |
| Main | 13981.41 | 100-YR | 32.88 | 694.76 | 154.62 | 1.03 |
| Main | 13981.41 | Floodway | 32.89 | 694.76 | 154.69 | 1.03 |
| | | | | | | |
| Main | 13949.59 | 100-YR | 325.68 | 694.75 | 1370.05 | 1.12 |
| Main | 13949.59 | Floodway | 287.37 | 694.75 | 1241.85 | 1.12 |
| | | | | | | |
| Main | 13839.56 | 100-YR | 351.53 | 694.74 | 1466.90 | 1.03 |
| Main | 13839.56 | Floodway | 313.35 | 694.74 | 1329.57 | 1.03 |
| | | | | | | |
| Main | 13732.13 | 100-YR | 365.00 | 694.75 | 1188.71 | 0.38 |
| Main | 13732.13 | Floodway | 331.88 | 694.75 | 1075.03 | 0.41 |
| | | | | | | |
| Main | 13662.15 | 100-YR | 261.68 | 694.73 | 239.07 | 0.80 |
| Main | 13662.15 | Floodway | 222.09 | 694.73 | 217.55 | 0.80 |
| | | | | | | |
| Main | 13628.36 | 100-YR | 205.13 | 694.73 | 238.97 | 0.86 |
| Main | 13628.36 | Floodway | 145.69 | 694.73 | 220.38 | 0.86 |
| | | | | | | |
| Main | 13536.36 | | Culvert | | | |
| | | | | | | |
| Main | 13453.85 | 100-YR | 333.16 | 694.57 | 399.70 | 1.08 |
| Main | 13453.85 | Floodway | 272.58 | 694.58 | 360.29 | 1.08 |
| | | | | | | |
| Main | 13414.20 | 100-YR | 346.75 | 694.56 | 377.63 | 0.93 |
| Main | 13414.20 | Floodway | 274.00 | 694.57 | 348.71 | 0.93 |
| | | | | | | |
| Main | 13217.08 | 100-YR | 174.43 | 694.44 | 169.00 | 1.32 |
| Main | 13217.08 | Floodway | 150.54 | 694.44 | 155.50 | 1.32 |
| | | | | | | |
| Main | 13001.02 | 100-YR | 23.89 | 694.13 | 80.14 | 2.23 |
| Main | 13001.02 | Floodway | 23.89 | 694.13 | 80.21 | 2.23 |
| | | | | | | |
| Main | 12615.85 | 100-YR | 26.44 | 693.43 | 84.13 | 2.13 |
| Main | 12615.85 | Floodway | 26.46 | 693.44 | 84.28 | 2.12 |
| | | | | | | |
| Main | 12216.99 | 100-YR | 34.73 | 693.08 | 101.96 | 1.76 |
| Main | 12216.99 | Floodway | 34.76 | 693.09 | 102.23 | 1.75 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| | | | | | | |
| Main | 12019.91 | 100-YR | 23.02 | 692.81 | 62.36 | 2.87 |
| Main | 12019.91 | Floodway | 23.00 | 692.82 | 62.60 | 2.86 |
| | | | | | | |
| Main | 12001.15 | 100-YR | 28.52 | 692.84 | 102.38 | 1.75 |
| Main | 12001.15 | Floodway | 28.49 | 692.85 | 102.67 | 1.74 |
| | | | | | | |
| Main | 11937.42 | | Culvert | | | |
| | | | | | | |
| Main | 11882.28 | 100-YR | 40.35 | 692.70 | 143.14 | 1.48 |
| Main | 11882.28 | Floodway | 33.85 | 692.71 | 129.64 | 1.49 |
| | | | | | | |
| Main | 11831.40 | 100-YR | 94.42 | 692.61 | 100.95 | 2.34 |
| Main | 11831.40 | Floodway | 68.60 | 692.62 | 91.95 | 2.33 |
| | | | | | | |
| Main | 11746.9* | 100-YR | 128.19 | 692.52 | 107.78 | 1.66 |
| Main | 11746.9* | Floodway | 90.08 | 692.53 | 102.03 | 1.75 |
| | | | | | | |
| Main | 11662.5* | 100-YR | 219.12 | 692.40 | 132.20 | 1.35 |
| Main | 11662.5* | Floodway | 141.02 | 692.42 | 120.05 | 1.49 |
| | | | | | | |
| Main | 11578.0* | 100-YR | 449.36 | 692.28 | 221.17 | 0.81 |
| Main | 11578.0* | Floodway | 362.20 | 692.29 | 200.98 | 0.89 |
| | | | | | | |
| Main | 11493.63 | 100-YR | 808.64 | 692.24 | 683.14 | 0.26 |
| Main | 11493.63 | Floodway | 709.04 | 692.26 | 633.46 | 0.28 |
| | | | | | | |
| Main | 11398.6* | 100-YR | 801.35 | 692.19 | 583.66 | 0.31 |
| Main | 11398.6* | Floodway | 627.99 | 692.21 | 523.81 | 0.34 |
| | | | | | | |
| Main | 11303.5* | 100-YR | 795.41 | 692.13 | 529.62 | 0.34 |
| Main | 11303.5* | Floodway | 610.08 | 692.14 | 475.69 | 0.38 |
| | | | | | | |
| Main | 11208.5* | 100-YR | 714.98 | 692.07 | 521.27 | 0.34 |
| Main | 11208.5* | Floodway | 576.29 | 692.08 | 467.59 | 0.38 |
| | | | | | | |
| Main | 11113.5* | 100-YR | 662.36 | 692.02 | 547.72 | 0.33 |
| Main | 11113.5* | Floodway | 528.12 | 692.03 | 494.29 | 0.36 |
| | | | | | | |
| Main | 11018.49 | 100-YR | 648.72 | 692.00 | 605.90 | 0.22 |
| Main | 11018.49 | Floodway | 533.79 | 692.01 | 553.44 | 0.24 |
| | | | | | | |
| Main | 10922.5* | 100-YR | 566.51 | 691.97 | 506.63 | 0.26 |
| Main | 10922.5* | Floodway | 424.96 | 691.98 | 467.01 | 0.28 |
| | | | | | | |
| Main | 10826.6* | 100-YR | 525.08 | 691.96 | 519.77 | 0.25 |
| Main | 10826.6* | Floodway | 410.55 | 691.96 | 484.08 | 0.27 |
| | | | | | | |
| Main | 10730.67 | 100-YR | 501.77 | 691.94 | 547.90 | 0.24 |
| Main | 10730.67 | Floodway | 402.18 | 691.95 | 513.20 | 0.26 |
| | | | | | | |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| Main | 10638.0* | 100-YR | 553.90 | 691.94 | 665.50 | 0.20 |
| Main | 10638.0* | Floodway | 382.33 | 691.95 | 604.58 | 0.22 |
| | | | | | | |
| Main | 10545.5* | 100-YR | 617.16 | 691.94 | 894.09 | 0.15 |
| Main | 10545.5* | Floodway | 459.42 | 691.94 | 808.14 | 0.16 |
| | | | | | | |
| Main | 10452.9* | 100-YR | 710.06 | 691.93 | 1222.49 | 0.11 |
| Main | 10452.9* | Floodway | 551.22 | 691.94 | 1100.28 | 0.12 |
| | | | | | | |
| Main | 10360.3* | 100-YR | 740.01 | 691.93 | 1636.75 | 0.08 |
| Main | 10360.3* | Floodway | 634.48 | 691.94 | 1492.99 | 0.09 |
| | | | | | | |
| Main | 10267.74 | 100-YR | 815.73 | 691.93 | 2125.62 | 0.40 |
| Main | 10267.74 | Floodway | 708.47 | 691.94 | 1983.21 | 0.41 |
| | | | | | | |
| Main | 10182.4* | 100-YR | 768.42 | 691.93 | 2038.32 | 0.06 |
| Main | 10182.4* | Floodway | 673.29 | 691.94 | 1853.78 | 0.07 |
| | | | | | | |
| Main | 10097.1* | 100-YR | 765.46 | 691.93 | 1965.85 | 0.07 |
| Main | 10097.1* | Floodway | 678.75 | 691.94 | 1797.19 | 0.07 |
| | | | | | | |
| Main | 10011.8* | 100-YR | 790.61 | 691.93 | 1901.31 | 0.07 |
| Main | 10011.8* | Floodway | 707.39 | 691.94 | 1733.40 | 0.08 |
| | | | | | | |
| Main | 9926.510 | 100-YR | 881.45 | 691.93 | 1918.46 | 0.39 |
| Main | 9926.510 | Floodway | 793.18 | 691.93 | 1720.70 | 0.39 |
| | | | | | | |
| Main | 9491.793 | 100-YR | 436.45 | 691.89 | 967.13 | 0.49 |
| Main | 9491.793 | Floodway | 380.34 | 691.90 | 878.70 | 0.49 |
| | | | | | | |
| Main | 9382.780 | | Inl Struct | | | |
| | | | | | | |
| Main | 8939.248 | 100-YR | 847.33 | 691.89 | 743.79 | 0.18 |
| Main | 8939.248 | Floodway | 646.47 | 691.89 | 678.25 | 0.20 |
| | | | | | | |
| Main | 8784.397 | 100-YR | 885.21 | 691.86 | 906.16 | 0.30 |
| Main | 8784.397 | Floodway | 713.96 | 691.87 | 821.41 | 0.31 |
| | | | | | | |
| Main | 8722.829 | 100-YR | 594.57 | 691.81 | 749.82 | 0.30 |
| Main | 8722.829 | Floodway | 513.55 | 691.82 | 677.28 | 0.33 |
| | | | | | | |
| Main | 8695.034 | | Culvert | | | |
| | | | | | | |
| Main | 8674.268 | 100-YR | 659.81 | 691.81 | 830.50 | 0.25 |
| Main | 8674.268 | Floodway | 567.19 | 691.82 | 747.13 | 0.26 |
| | | | | | | |
| Main | 8631.519 | 100-YR | 612.68 | 691.81 | 796.76 | 0.26 |
| Main | 8631.519 | Floodway | 487.74 | 691.81 | 713.98 | 0.26 |
| | | | | | | |
| Main | 8345.665 | 100-YR | 1240.99 | 691.80 | 1780.23 | 0.08 |
| Main | 8345.665 | Floodway | 1047.74 | 691.80 | 1601.29 | 0.09 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| | | | | | | |
| Main | 8047.118 | 100-YR | 746.24 | 691.79 | 1631.94 | 0.11 |
| Main | 8047.118 | Floodway | 615.00 | 691.80 | 1469.77 | 0.12 |
| | | | | | | |
| Main | 7739.449 | 100-YR | 1501.85 | 691.79 | 2501.67 | 0.10 |
| Main | 7739.449 | Floodway | 1153.00 | 691.79 | 2241.54 | 0.11 |
| | | | | | | |
| Main | 7515.565 | 100-YR | 332.20 | 691.79 | 747.61 | 0.23 |
| Main | 7515.565 | Floodway | 288.42 | 691.79 | 677.40 | 0.23 |
| | | | | | | |
| Main | 7272.821 | 100-YR | 909.38 | 691.78 | 1444.37 | 0.11 |
| Main | 7272.821 | Floodway | 680.00 | 691.78 | 1299.06 | 0.12 |
| | | | | | | |
| Main | 7255.385 | 100-YR | 811.72 | 691.78 | 2077.96 | 0.10 |
| Main | 7255.385 | Floodway | 620.00 | 691.78 | 1893.19 | 0.11 |
| | | | | | | |
| Main | 7226.812 | | Culvert | | | |
| | | | | | | |
| Main | 7193.714 | 100-YR | 667.23 | 691.78 | 1769.09 | 0.07 |
| Main | 7193.714 | Floodway | 535.00 | 691.78 | 1593.66 | 0.08 |
| | | | | | | |
| Main | 7141.580 | 100-YR | 609.82 | 691.78 | 1175.11 | 0.11 |
| Main | 7141.580 | Floodway | 515.00 | 691.78 | 1052.10 | 0.11 |
| | | | | | | |
| Main | 7071.87* | 100-YR | 558.56 | 691.77 | 1173.94 | 0.10 |
| Main | 7071.87* | Floodway | 463.00 | 691.78 | 1053.05 | 0.11 |
| | | | | | | |
| Main | 7002.16* | 100-YR | 547.70 | 691.77 | 1181.38 | 0.10 |
| Main | 7002.16* | Floodway | 430.00 | 691.77 | 1063.98 | 0.11 |
| | | | | | | |
| Main | 6932.458 | 100-YR | 513.27 | 691.77 | 1203.73 | 0.10 |
| Main | 6932.458 | Floodway | 418.00 | 691.77 | 1088.43 | 0.11 |
| | | | | | | |
| Main | 6846.57* | 100-YR | 444.15 | 691.77 | 779.47 | 0.15 |
| Main | 6846.57* | Floodway | 332.00 | 691.77 | 731.46 | 0.16 |
| | | | | | | |
| Main | 6760.7* | 100-YR | 313.07 | 691.76 | 536.42 | 0.22 |
| Main | 6760.7* | Floodway | 215.00 | 691.76 | 483.08 | 0.24 |
| | | | | | | |
| Main | 6674.82* | 100-YR | 349.69 | 691.76 | 470.26 | 0.25 |
| Main | 6674.82* | Floodway | 221.45 | 691.76 | 431.11 | 0.27 |
| | | | | | | |
| Main | 6588.943 | 100-YR | 526.88 | 691.76 | 1002.16 | 0.12 |
| Main | 6588.943 | Floodway | 476.59 | 691.76 | 903.15 | 0.13 |
| | | | | | | |
| Main | 6495.53* | 100-YR | 712.80 | 691.75 | 1432.96 | 0.08 |
| Main | 6495.53* | Floodway | 631.44 | 691.76 | 1287.40 | 0.09 |
| | | | | | | |
| Main | 6402.13* | 100-YR | 906.49 | 691.75 | 1878.17 | 0.06 |
| Main | 6402.13* | Floodway | 789.38 | 691.75 | 1689.07 | 0.07 |
| | | | | | | |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| Main | 6308.73* | 100-YR | 1141.81 | 691.75 | 2345.54 | 0.06 |
| Main | 6308.73* | Floodway | 956.08 | 691.75 | 2116.43 | 0.06 |
| | | | | | | |
| Main | 6215.32* | 100-YR | 1485.95 | 691.75 | 2900.12 | 0.06 |
| Main | 6215.32* | Floodway | 1153.92 | 691.75 | 2628.16 | 0.06 |
| | | | | | | |
| Main | 6121.924 | 100-YR | 1805.53 | 691.75 | 3649.23 | 0.07 |
| Main | 6121.924 | Floodway | 1522.04 | 691.75 | 3327.81 | 0.07 |
| | | | | | | |
| Main | 6035.96* | 100-YR | 1748.64 | 691.75 | 3579.73 | 0.08 |
| Main | 6035.96* | Floodway | 1446.54 | 691.75 | 3242.90 | 0.08 |
| | | | | | | |
| Main | 5950.01* | 100-YR | 1703.48 | 691.75 | 3556.17 | 0.09 |
| Main | 5950.01* | Floodway | 1417.91 | 691.75 | 3246.43 | 0.09 |
| | | | | | | |
| Main | 5864.05* | 100-YR | 1677.45 | 691.75 | 3569.02 | 0.11 |
| Main | 5864.05* | Floodway | 1358.99 | 691.75 | 3218.99 | 0.10 |
| | | | | | | |
| Main | 5778.104 | 100-YR | 1651.33 | 691.75 | 3599.88 | 0.14 |
| Main | 5778.104 | Floodway | 1364.84 | 691.75 | 3293.75 | 0.14 |
| | | | | | | |
| Main | 5687.63* | 100-YR | 1144.72 | 691.74 | 2724.66 | 0.23 |
| Main | 5687.63* | Floodway | 1018.52 | 691.75 | 2554.39 | 0.23 |
| | | | | | | |
| Main | 5597.166 | 100-YR | 647.62 | 691.73 | 1655.24 | 0.53 |
| Main | 5597.166 | Floodway | 573.61 | 691.74 | 1503.24 | 0.53 |
| | | | | | | |
| Main | 5556.618 | 100-YR | 534.54 | 691.72 | 1041.92 | 0.91 |
| Main | 5556.618 | Floodway | 426.28 | 691.72 | 950.96 | 0.91 |
| | | | | | | |
| Main | 5525.006 | | Culvert | | | |
| | | | | | | |
| Main | 5490.413 | 100-YR | 375.60 | 691.63 | 334.72 | 0.90 |
| Main | 5490.413 | Floodway | 329.52 | 691.63 | 304.80 | 0.90 |
| | | | | | | |
| Main | 5437.667 | 100-YR | 474.11 | 691.64 | 1131.93 | 0.44 |
| Main | 5437.667 | Floodway | 400.73 | 691.64 | 1025.33 | 0.44 |
| | | | | | | |
| Main | 5357.86* | 100-YR | 408.08 | 691.63 | 926.63 | 0.54 |
| Main | 5357.86* | Floodway | 344.74 | 691.63 | 832.76 | 0.54 |
| | | | | | | |
| Main | 5278.05* | 100-YR | 347.05 | 691.62 | 752.99 | 0.68 |
| Main | 5278.05* | Floodway | 300.41 | 691.62 | 683.09 | 0.68 |
| | | | | | | |
| Main | 5198.254 | 100-YR | 283.19 | 691.61 | 605.26 | 0.87 |
| Main | 5198.254 | Floodway | 249.73 | 691.61 | 551.24 | 0.87 |
| | | | | | | |
| Main | 5121.63* | 100-YR | 311.87 | 691.60 | 595.50 | 0.81 |
| Main | 5121.63* | Floodway | 262.34 | 691.60 | 543.37 | 0.81 |
| | | | | | | |
| Main | 5045.01* | 100-YR | 321.91 | 691.59 | 619.70 | 0.74 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| Main | 5045.01* | Floodway | 263.28 | 691.59 | 565.89 | 0.74 |
| | | | | | | |
| Main | 4968.39* | 100-YR | 343.05 | 691.59 | 695.60 | 0.59 |
| Main | 4968.39* | Floodway | 279.00 | 691.59 | 630.29 | 0.59 |
| | | | | | | |
| Main | 4891.776 | 100-YR | 531.24 | 691.58 | 864.78 | 0.36 |
| Main | 4891.776 | Floodway | 410.00 | 691.59 | 790.14 | 0.37 |
| | | | | | | |
| Main | 4810.20* | 100-YR | 452.48 | 691.58 | 410.14 | 0.38 |
| Main | 4810.20* | Floodway | 322.00 | 691.58 | 376.24 | 0.40 |
| | | | | | | |
| Main | 4728.63* | 100-YR | 296.53 | 691.57 | 278.18 | 0.41 |
| Main | 4728.63* | Floodway | 278.12 | 691.57 | 249.97 | 0.45 |
| | | | | | | |
| Main | 4647.06* | 100-YR | 278.97 | 691.56 | 274.52 | 0.41 |
| Main | 4647.06* | Floodway | 263.89 | 691.56 | 248.78 | 0.45 |
| | | | | | | |
| Main | 4565.488 | 100-YR | 260.73 | 691.55 | 269.96 | 0.51 |
| Main | 4565.488 | Floodway | 186.61 | 691.55 | 242.82 | 0.51 |
| | | | | | | |
| Main | 4504.263 | 100-YR | 69.61 | 691.54 | 157.14 | 0.81 |
| Main | 4504.263 | Floodway | 52.32 | 691.54 | 142.47 | 0.81 |
| | | | | | | |
| Main | 4461.252 | | Culvert | | | |
| | | | | | | |
| Main | 4430.212 | 100-YR | 28.57 | 691.29 | 120.83 | 1.14 |
| Main | 4430.212 | Floodway | 28.00 | 691.29 | 120.74 | 1.14 |
| | | | | | | |
| Main | 4346.582 | 100-YR | 30.16 | 691.28 | 117.13 | 0.96 |
| Main | 4346.582 | Floodway | 30.16 | 691.28 | 117.14 | 0.96 |
| | | | | | | |
| Main | 4194.408 | 100-YR | 30.00 | 691.25 | 109.41 | 1.03 |
| Main | 4194.408 | Floodway | 30.00 | 691.25 | 109.43 | 1.03 |
| | | | | | | |
| Main | 3788.373 | 100-YR | 283.09 | 691.24 | 575.05 | 0.20 |
| Main | 3788.373 | Floodway | 220.00 | 691.24 | 525.61 | 0.21 |
| | | | | | | |
| Main | 3395.646 | 100-YR | 218.85 | 691.23 | 533.36 | 0.23 |
| Main | 3395.646 | Floodway | 160.00 | 691.23 | 493.01 | 0.23 |
| | | | | | | |
| Main | 3331.113 | 100-YR | 91.03 | 691.22 | 189.34 | 0.72 |
| Main | 3331.113 | Floodway | 60.00 | 691.22 | 179.06 | 0.72 |
| | | | | | | |
| Main | 3265.168 | | Culvert | | | |
| | | | | | | |
| Main | 3196.567 | 100-YR | 20.85 | 688.68 | 61.40 | 1.88 |
| Main | 3196.567 | Floodway | 20.67 | 688.69 | 61.65 | 1.87 |
| | | | | | | |
| Main | 3141.921 | 100-YR | 17.34 | 688.65 | 52.66 | 1.90 |
| Main | 3141.921 | Floodway | 17.38 | 688.66 | 52.88 | 1.89 |
| | | | | | | |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main (Continued)

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total |
|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) |
| Main | 3004.055 | 100-YR | 22.57 | 688.60 | 75.51 | 1.32 |
| Main | 3004.055 | Floodway | 22.60 | 688.62 | 75.81 | 1.32 |
| | | | | | | |
| Main | 2734.719 | 100-YR | 21.54 | 688.49 | 62.22 | 1.61 |
| Main | 2734.719 | Floodway | 21.59 | 688.50 | 62.54 | 1.60 |
| | | | | | | |
| Main | 2688.915 | 100-YR | 21.62 | 688.45 | 58.31 | 1.72 |
| Main | 2688.915 | Floodway | 21.68 | 688.47 | 58.64 | 1.71 |
| | | | | | | |
| Main | 2653.174 | | Culvert | | | |
| | | | | | | |
| Main | 2626.817 | 100-YR | 11.41 | 687.84 | 36.90 | 2.71 |
| Main | 2626.817 | Floodway | 11.46 | 687.86 | 37.17 | 2.69 |
| | | | | | | |
| Main | 2582.291 | 100-YR | 14.48 | 687.79 | 43.97 | 2.27 |
| Main | 2582.291 | Floodway | 14.52 | 687.82 | 44.33 | 2.26 |
| | | | | | | |
| Main | 2218.895 | 100-YR | 34.14 | 687.76 | 123.53 | 0.81 |
| Main | 2218.895 | Floodway | 34.22 | 687.78 | 124.39 | 0.80 |
| | | | | | | |
| Main | 2049.666 | 100-YR | 81.10 | 687.74 | 158.02 | 0.63 |
| Main | 2049.666 | Floodway | 76.61 | 687.77 | 158.54 | 0.63 |
| | | | | | | |
| Main | 1853.478 | 100-YR | 37.65 | 687.60 | 135.87 | 2.24 |
| Main | 1853.478 | Floodway | 37.86 | 687.63 | 136.94 | 2.22 |
| | | | | | | |
| Main | 1799.666 | 100-YR | 37.60 | 687.55 | 132.27 | 2.30 |
| Main | 1799.666 | Floodway | 33.00 | 687.58 | 131.03 | 2.32 |
| | | | | | | |
| Main | 1727.858 | | Culvert | | | |
| | | | | | | |
| Main | 1670.018 | 100-YR | 37.57 | 686.97 | 115.43 | 2.89 |
| Main | 1670.018 | Floodway | 29.07 | 687.00 | 108.04 | 2.87 |
| | | | | | | |
| Main | 1606.765 | 100-YR | 426.71 | 686.96 | 395.62 | 1.75 |
| Main | 1606.765 | Floodway | 126.26 | 686.99 | 357.50 | 1.72 |
| | | | | | | |
| Main | 1475.852 | 100-YR | 54.44 | 686.64 | 94.39 | 3.22 |
| Main | 1475.852 | Floodway | 32.00 | 686.66 | 88.09 | 3.45 |
| | | | | | | |
| Main | 1134.554 | 100-YR | 37.17 | 685.92 | 101.35 | 3.00 |
| Main | 1134.554 | Floodway | 27.00 | 685.92 | 91.99 | 3.30 |
| | | | | | | |
| Main | 792.3003 | 100-YR | 194.29 | 684.65 | 115.08 | 2.64 |
| Main | 792.3003 | Floodway | 129.58 | 684.65 | 104.55 | 2.91 |
| | | | | | | |
| Main | 482.8005 | 100-YR | 848.37 | 684.71 | 1417.70 | 0.25 |
| Main | 482.8005 | Floodway | 677.52 | 684.71 | 1313.92 | 0.27 |
| | | | | | | |
| Main | 35.46111 | 100-YR | 769.39 | 684.70 | 1919.79 | 0.19 |
| Main | 35.46111 | Floodway | 623.00 | 684.70 | 1762.01 | 0.20 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 10-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | 10-YR | 42.00 | 696.40 | 698.88 | 698.00 | 698.95 | 0.001999 | 2.07 | 20.33 | 17.16 | 0.33 |
| Main | 16983.37 | 10-YR | 42.00 | 696.00 | 698.58 | | 698.76 | 0.007732 | 3.36 | 12.50 | 13.29 | 0.61 |
| Main | 16899.4* | 10-YR | 42.00 | 695.54 | 697.95 | | 698.11 | 0.007641 | 3.30 | 12.74 | 14.12 | 0.61 |
| Main | 16815.4* | 10-YR | 42.00 | 695.08 | 697.30 | | 697.47 | 0.007715 | 3.26 | 12.88 | 14.87 | 0.62 |
| Main | 16731.5* | 10-YR | 42.00 | 694.62 | 696.65 | | 696.81 | 0.007751 | 3.23 | 13.02 | 15.56 | 0.62 |
| Main | 16647.5* | 10-YR | 42.00 | 694.16 | 696.01 | | 696.17 | 0.007623 | 3.18 | 13.22 | 16.15 | 0.62 |
| Main | 16563.6* | 10-YR | 42.00 | 693.70 | 695.33 | | 695.50 | 0.008508 | 3.27 | 12.83 | 16.38 | 0.65 |
| Main | 16479.65 | 10-YR | 42.00 | 693.24 | 694.96 | | 695.05 | 0.003322 | 2.40 | 17.48 | 17.52 | 0.42 |
| Main | 16403.7* | 10-YR | 42.00 | 693.01 | 694.75 | | 694.82 | 0.002787 | 2.12 | 19.79 | 21.14 | 0.39 |
| Main | 16327.7* | 10-YR | 42.00 | 692.78 | 694.56 | | 694.62 | 0.002295 | 1.90 | 22.15 | 24.30 | 0.35 |
| Main | 16251.7* | 10-YR | 42.00 | 692.54 | 694.43 | | 694.47 | 0.001619 | 1.65 | 25.51 | 26.66 | 0.30 |
| Main | 16175.84 | 10-YR | 49.00 | 692.31 | 694.30 | | 694.35 | 0.001600 | 1.68 | 29.19 | 29.37 | 0.30 |
| Main | 16100.* | 10-YR | 49.00 | 692.07 | 694.21 | | 694.24 | 0.001110 | 1.44 | 34.09 | 32.96 | 0.25 |
| Main | 16024.40 | 10-YR | 49.00 | 691.83 | 694.16 | | 694.18 | 0.000577 | 1.09 | 69.43 | 199.59 | 0.18 |
| Main | 15850.19 | 10-YR | 49.00 | 691.30 | 694.04 | | 694.07 | 0.000691 | 1.55 | 88.99 | 281.55 | 0.21 |
| Main | 15434.41 | 10-YR | 49.00 | 690.01 | 693.78 | | 693.81 | 0.000535 | 1.49 | 32.93 | 15.71 | 0.18 |
| Main | 15212.53 | 10-YR | 49.00 | 689.73 | 693.69 | | 693.72 | 0.000354 | 1.28 | 38.33 | 17.10 | 0.15 |
| Main | 14922.76 | 10-YR | 49.00 | 689.36 | 693.63 | | 693.64 | 0.000181 | 0.79 | 74.16 | 188.79 | 0.11 |
| Main | 14774.58 | 10-YR | 78.00 | 689.19 | 693.54 | | 693.58 | 0.000673 | 1.68 | 56.23 | 155.72 | 0.21 |
| Main | 14457.09 | 10-YR | 78.00 | 688.79 | 693.42 | | 693.44 | 0.000292 | 1.13 | 77.91 | 64.02 | 0.14 |
| Main | 14406.13 | 10-YR | 78.00 | 688.73 | 693.42 | 689.63 | 693.43 | 0.000069 | 0.80 | 133.03 | 88.47 | 0.07 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | 10-YR | 81.00 | 688.38 | 693.39 | 689.31 | 693.40 | 0.000042 | 0.73 | 110.49 | 29.42 | 0.06 |
| Main | 13949.59 | 10-YR | 81.00 | 688.37 | 693.38 | 690.00 | 693.40 | 0.000069 | 0.86 | 93.95 | 307.92 | 0.08 |
| Main | 13839.56 | 10-YR | 81.00 | 688.25 | 693.38 | 689.91 | 693.39 | 0.000058 | 0.85 | 98.25 | 328.23 | 0.08 |
| Main | 13732.13 | 10-YR | 81.00 | 688.19 | 693.37 | 689.92 | 693.38 | 0.000069 | 0.92 | 95.62 | 313.87 | 0.08 |
| Main | 13662.15 | 10-YR | 81.00 | 688.17 | 693.36 | 689.95 | 693.38 | 0.000078 | 0.96 | 95.59 | 55.44 | 0.09 |
| Main | 13628.36 | 10-YR | 81.00 | 688.12 | 693.36 | 689.59 | 693.37 | 0.000048 | 0.80 | 113.40 | 45.57 | 0.07 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | 10-YR | 93.00 | 688.72 | 693.32 | 689.71 | 693.33 | 0.000237 | 0.82 | 114.64 | 98.98 | 0.08 |
| Main | 13414.20 | 10-YR | 93.00 | 689.00 | 693.31 | 690.29 | 693.32 | 0.000259 | 0.79 | 118.45 | 61.37 | 0.08 |
| Main | 13217.08 | 10-YR | 93.00 | 688.99 | 693.21 | | 693.24 | 0.000733 | 1.29 | 71.85 | 24.63 | 0.13 |
| Main | 13001.02 | 10-YR | 93.00 | 688.98 | 692.97 | | 693.02 | 0.001521 | 1.72 | 54.19 | 20.79 | 0.19 |
| Main | 12615.85 | 10-YR | 93.00 | 688.85 | 692.44 | | 692.47 | 0.001293 | 1.57 | 59.23 | 23.51 | 0.17 |
| Main | 12216.99 | 10-YR | 93.00 | 688.69 | 692.18 | | 692.20 | 0.000405 | 1.29 | 72.30 | 30.85 | 0.15 |
| Main | 12019.91 | 10-YR | 93.00 | 688.59 | 692.01 | | 692.08 | 0.001134 | 2.05 | 45.26 | 19.81 | 0.24 |
| Main | 12001.15 | 10-YR | 93.00 | 688.06 | 692.02 | 689.03 | 692.04 | 0.000261 | 1.16 | 80.23 | 25.97 | 0.12 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | 10-YR | 93.00 | 687.94 | 691.97 | 688.92 | 691.99 | 0.000137 | 0.97 | 100.31 | 38.30 | 0.09 |
| Main | 11831.40 | 10-YR | 93.00 | 688.77 | 691.93 | 689.98 | 691.97 | 0.000576 | 1.56 | 59.79 | 23.86 | 0.17 |
| Main | 11746.9* | 10-YR | 93.00 | 688.77 | 691.87 | | 691.91 | 0.000832 | 1.63 | 57.27 | 31.77 | 0.19 |
| Main | 11662.5* | 10-YR | 93.00 | 688.77 | 691.78 | | 691.83 | 0.001166 | 1.69 | 56.24 | 45.55 | 0.20 |
| Main | 11578.0* | 10-YR | 93.00 | 688.76 | 691.67 | | 691.72 | 0.001473 | 1.69 | 63.08 | 98.45 | 0.20 |
| Main | 11493.63 | 10-YR | 93.00 | 688.76 | 691.60 | | 691.62 | 0.000811 | 1.19 | 216.99 | 546.55 | 0.14 |
| Main | 11398.6* | 10-YR | 93.00 | 688.76 | 691.51 | | 691.53 | 0.001002 | 1.29 | 149.59 | 313.40 | 0.15 |
| Main | 11303.5* | 10-YR | 93.00 | 688.76 | 691.41 | | 691.43 | 0.000980 | 1.23 | 143.73 | 270.70 | 0.15 |
| Main | 11208.5* | 10-YR | 93.00 | 688.75 | 691.32 | | 691.34 | 0.000869 | 1.12 | 153.82 | 223.94 | 0.14 |
| Main | 11113.5* | 10-YR | 93.00 | 688.75 | 691.25 | | 691.26 | 0.000726 | 0.98 | 179.19 | 229.04 | 0.13 |
| Main | 11018.49 | 10-YR | 92.00 | 688.75 | 691.19 | | 691.20 | 0.000554 | 0.83 | 221.80 | 280.11 | 0.11 |
| Main | 10922.5* | 10-YR | 92.00 | 688.75 | 691.13 | | 691.14 | 0.000465 | 0.75 | 211.57 | 161.44 | 0.10 |
| Main | 10826.6* | 10-YR | 92.00 | 688.75 | 691.09 | | 691.09 | 0.000354 | 0.64 | 230.70 | 168.74 | 0.09 |
| Main | 10730.67 | 10-YR | 92.00 | 688.75 | 691.05 | | 691.06 | 0.000236 | 0.51 | 265.46 | 190.23 | 0.07 |
| Main | 10638.0* | 10-YR | 92.00 | 688.74 | 691.04 | | 691.04 | 0.000180 | 0.44 | 300.48 | 293.80 | 0.06 |
| Main | 10545.5* | 10-YR | 92.00 | 688.73 | 691.03 | | 691.03 | 0.000107 | 0.33 | 415.17 | 419.51 | 0.05 |
| Main | 10452.9* | 10-YR | 92.00 | 688.72 | 691.03 | | 691.03 | 0.000043 | 0.21 | 649.97 | 552.15 | 0.03 |
| Main | 10360.3* | 10-YR | 92.00 | 688.71 | 691.03 | | 691.03 | 0.000011 | 0.11 | 1017.98 | 645.29 | 0.02 |
| Main | 10267.74 | 10-YR | 92.00 | 688.70 | 691.02 | | 691.03 | 0.000134 | 0.39 | 207.89 | 695.75 | 0.05 |
| Main | 10182.4* | 10-YR | 92.00 | 688.69 | 691.02 | | 691.02 | 0.000015 | 0.13 | 1386.05 | 689.80 | 0.02 |
| Main | 10097.1* | 10-YR | 92.00 | 688.68 | 691.02 | | 691.02 | 0.000011 | 0.12 | 1327.18 | 667.51 | 0.02 |
| Main | 10011.8* | 10-YR | 92.00 | 688.67 | 691.02 | | 691.02 | 0.000007 | 0.10 | 1284.42 | 621.65 | 0.01 |
| Main | 9926.510 | 10-YR | 92.00 | 688.66 | 691.01 | | 691.02 | 0.000196 | 0.52 | 162.87 | 595.58 | 0.07 |
| Main | 9491.793 | 10-YR | 92.00 | 688.61 | 690.96 | 689.24 | 690.96 | 0.000211 | 0.45 | 171.43 | 327.42 | 0.07 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | 10-YR | 92.00 | 688.30 | 690.95 | | 690.95 | 0.000241 | 0.50 | 232.70 | 270.96 | 0.07 |
| Main | 8784.397 | 10-YR | 92.00 | 688.22 | 690.85 | | 690.88 | 0.001637 | 1.50 | 103.09 | 409.74 | 0.19 |
| Main | 8722.829 | 10-YR | 92.00 | 688.12 | 690.67 | 689.44 | 690.71 | 0.002924 | 1.75 | 129.18 | 309.16 | 0.25 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | 10-YR | 92.00 | 687.48 | 690.66 | 688.72 | 690.68 | 0.000651 | 1.11 | 145.75 | 384.90 | 0.13 |
| Main | 8631.519 | 10-YR | 92.00 | 687.41 | 690.63 | 688.67 | 690.64 | 0.000828 | 1.12 | 192.31 | 344.44 | 0.14 |
| Main | 8345.665 | 10-YR | 92.00 | 687.28 | 690.54 | | 690.54 | 0.000209 | 0.57 | 312.29 | 684.60 | 0.07 |
| Main | 8047.118 | 10-YR | 80.00 | 687.10 | 690.46 | | 690.47 | 0.000293 | 0.67 | 197.91 | 581.44 | 0.08 |
| Main | 7739.449 | 10-YR | 80.00 | 686.99 | 690.44 | | 690.44 | 0.000044 | 0.35 | 347.90 | 689.55 | 0.03 |
| Main | 7515.565 | 10-YR | 80.00 | 686.79 | 690.43 | | 690.43 | 0.000064 | 0.37 | 255.56 | 240.18 | 0.04 |
| Main | 7272.821 | 10-YR | 80.00 | 686.67 | 690.41 | | 690.41 | 0.000091 | 0.52 | 248.12 | 455.87 | 0.05 |
| Main | 7255.385 | 10-YR | 80.00 | 686.00 | 690.39 | 687.90 | 690.40 | 0.000661 | 1.09 | 223.59 | 626.92 | 0.13 |
| Main | 7226.812 | | Culvert | | | | | | | | | |
| Main | 7193.714 | 10-YR | 80.00 | 685.90 | 690.38 | 687.83 | 690.39 | 0.000044 | 0.35 | 816.64 | 608.23 | 0.03 |
| Main | 7141.580 | 10-YR | 80.00 | 686.28 | 690.38 | 687.19 | 690.38 | 0.000101 | 0.35 | 375.40 | 430.28 | 0.04 |
| Main | 7071.87* | 10-YR | 80.00 | 686.28 | 690.37 | | 690.37 | 0.000081 | 0.35 | 428.93 | 485.01 | 0.04 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 10-YR (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7002.16* | 10-YR | 80.00 | 686.27 | 690.37 | | 690.37 | 0.000067 | 0.38 | 473.25 | 467.79 | 0.04 |
| Main | 6932.458 | 10-YR | 80.00 | 686.27 | 690.36 | | 690.36 | 0.000058 | 0.41 | 505.38 | 443.23 | 0.04 |
| Main | 6846.57* | 10-YR | 80.00 | 686.27 | 690.35 | | 690.35 | 0.000097 | 0.54 | 277.86 | 248.95 | 0.05 |
| Main | 6760.7* | 10-YR | 80.00 | 686.27 | 690.34 | | 690.35 | 0.000121 | 0.60 | 196.77 | 154.18 | 0.06 |
| Main | 6674.82* | 10-YR | 80.00 | 686.26 | 690.33 | | 690.33 | 0.000133 | 0.63 | 173.90 | 106.16 | 0.06 |
| Main | 6588.943 | 10-YR | 80.00 | 686.26 | 690.32 | | 690.32 | 0.000094 | 0.53 | 373.78 | 345.34 | 0.05 |
| Main | 6495.53* | 10-YR | 80.00 | 686.26 | 690.32 | | 690.32 | 0.000048 | 0.38 | 514.24 | 515.16 | 0.04 |
| Main | 6402.13* | 10-YR | 80.00 | 686.26 | 690.31 | | 690.31 | 0.000034 | 0.32 | 659.26 | 714.47 | 0.03 |
| Main | 6308.73* | 10-YR | 80.00 | 686.27 | 690.31 | 687.21 | 690.31 | 0.000026 | 0.27 | 728.18 | 907.37 | 0.03 |
| Main | 6215.32* | 10-YR | 80.00 | 686.27 | 690.31 | 687.16 | 690.31 | 0.000018 | 0.23 | 783.88 | 1082.10 | 0.02 |
| Main | 6121.924 | 10-YR | 80.00 | 686.27 | 690.30 | 687.12 | 690.31 | 0.000017 | 0.22 | 732.71 | 1236.08 | 0.02 |
| Main | 6035.96* | 10-YR | 80.00 | 686.27 | 690.30 | 687.16 | 690.30 | 0.000018 | 0.23 | 731.67 | 1260.63 | 0.02 |
| Main | 5950.01* | 10-YR | 80.00 | 686.27 | 690.30 | 687.22 | 690.30 | 0.000023 | 0.25 | 657.79 | 1281.47 | 0.03 |
| Main | 5864.05* | 10-YR | 80.00 | 686.27 | 690.30 | 687.29 | 690.30 | 0.000031 | 0.29 | 565.48 | 1282.12 | 0.03 |
| Main | 5778.104 | 10-YR | 80.00 | 686.27 | 690.29 | 687.44 | 690.30 | 0.000046 | 0.34 | 457.86 | 1280.11 | 0.03 |
| Main | 5687.63* | 10-YR | 80.00 | 686.28 | 690.28 | 687.69 | 690.29 | 0.000112 | 0.56 | 250.69 | 1034.58 | 0.06 |
| Main | 5597.166 | 10-YR | 80.00 | 686.28 | 690.26 | | 690.27 | 0.000277 | 0.92 | 107.95 | 620.52 | 0.10 |
| Main | 5556.618 | 10-YR | 80.00 | 686.43 | 690.23 | 687.42 | 690.25 | 0.000319 | 1.08 | 76.07 | 374.12 | 0.11 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | 10-YR | 70.00 | 685.19 | 690.17 | 686.15 | 690.18 | 0.000111 | 0.75 | 93.40 | 28.76 | 0.06 |
| Main | 5437.667 | 10-YR | 70.00 | 685.35 | 690.17 | 686.10 | 690.17 | 0.000032 | 0.39 | 180.81 | 428.18 | 0.04 |
| Main | 5357.86* | 10-YR | 70.00 | 685.35 | 690.16 | 686.25 | 690.17 | 0.000051 | 0.48 | 145.61 | 353.76 | 0.04 |
| Main | 5278.05* | 10-YR | 70.00 | 685.34 | 690.16 | 686.44 | 690.16 | 0.000086 | 0.61 | 115.40 | 254.40 | 0.06 |
| Main | 5198.254 | 10-YR | 70.00 | 685.34 | 690.14 | | 690.15 | 0.000164 | 0.80 | 87.86 | 212.77 | 0.08 |
| Main | 5121.63* | 10-YR | 70.00 | 685.34 | 690.13 | 686.71 | 690.14 | 0.000149 | 0.75 | 93.17 | 188.88 | 0.07 |
| Main | 5045.01* | 10-YR | 70.00 | 685.34 | 690.12 | 686.71 | 690.13 | 0.000132 | 0.70 | 100.36 | 221.34 | 0.07 |
| Main | 4968.39* | 10-YR | 70.00 | 685.33 | 690.11 | 686.71 | 690.12 | 0.000114 | 0.63 | 111.08 | 246.88 | 0.07 |
| Main | 4891.776 | 10-YR | 70.00 | 685.33 | 690.11 | | 690.11 | 0.000086 | 0.53 | 144.57 | 276.83 | 0.06 |
| Main | 4810.20* | 10-YR | 70.00 | 685.33 | 690.10 | 686.78 | 690.10 | 0.000118 | 0.60 | 120.07 | 57.13 | 0.07 |
| Main | 4728.63* | 10-YR | 70.00 | 685.33 | 690.08 | 686.84 | 690.09 | 0.000155 | 0.67 | 108.12 | 52.80 | 0.07 |
| Main | 4647.06* | 10-YR | 70.00 | 685.32 | 690.07 | 686.87 | 690.08 | 0.000189 | 0.75 | 98.45 | 48.18 | 0.08 |
| Main | 4565.488 | 10-YR | 70.00 | 685.32 | 690.05 | | 690.06 | 0.000232 | 0.83 | 90.85 | 45.31 | 0.09 |
| Main | 4504.263 | 10-YR | 70.00 | 685.32 | 690.03 | 687.04 | 690.05 | 0.000208 | 0.84 | 82.96 | 27.74 | 0.09 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | 10-YR | 70.00 | 684.72 | 689.93 | 686.52 | 689.94 | 0.000170 | 0.96 | 74.31 | 25.03 | 0.08 |
| Main | 4346.582 | 10-YR | 70.00 | 685.50 | 689.91 | 686.66 | 689.92 | 0.000225 | 0.89 | 78.77 | 25.67 | 0.09 |
| Main | 4194.408 | 10-YR | 70.00 | 685.49 | 689.87 | | 689.88 | 0.000286 | 0.97 | 71.93 | 24.43 | 0.10 |
| Main | 3788.373 | 10-YR | 70.00 | 685.36 | 689.85 | | 689.85 | 0.000034 | 0.36 | 242.49 | 167.55 | 0.04 |
| Main | 3395.646 | 10-YR | 70.00 | 685.01 | 689.84 | | 689.84 | 0.000022 | 0.43 | 273.23 | 140.45 | 0.04 |
| Main | 3331.113 | 10-YR | 70.00 | 685.09 | 689.83 | 686.37 | 689.84 | 0.000065 | 0.65 | 109.54 | 35.53 | 0.06 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | 10-YR | 70.00 | 683.69 | 687.70 | 685.71 | 687.76 | 0.000764 | 1.98 | 39.25 | 18.72 | 0.20 |
| Main | 3141.921 | 10-YR | 70.00 | 683.98 | 687.65 | | 687.71 | 0.000972 | 1.91 | 36.63 | 14.99 | 0.22 |
| Main | 3004.055 | 10-YR | 70.00 | 683.97 | 687.60 | | 687.62 | 0.000381 | 1.30 | 53.91 | 20.25 | 0.14 |
| Main | 2734.719 | 10-YR | 70.00 | 683.96 | 687.43 | | 687.48 | 0.000802 | 1.70 | 41.16 | 18.39 | 0.20 |
| Main | 2688.915 | 10-YR | 70.00 | 683.95 | 687.38 | 685.63 | 687.43 | 0.001083 | 1.89 | 37.13 | 17.72 | 0.23 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | 10-YR | 70.00 | 683.44 | 686.53 | 685.10 | 686.67 | 0.002942 | 3.00 | 23.35 | 9.59 | 0.34 |
| Main | 2582.291 | 10-YR | 70.00 | 683.33 | 686.42 | 685.12 | 686.54 | 0.002434 | 2.72 | 25.76 | 12.13 | 0.33 |
| Main | 2218.895 | 10-YR | 70.00 | 682.33 | 686.34 | | 686.35 | 0.000172 | 0.90 | 78.11 | 29.71 | 0.10 |
| Main | 2049.666 | 10-YR | 70.00 | 681.91 | 686.31 | | 686.32 | 0.000176 | 0.92 | 76.03 | 28.16 | 0.10 |
| Main | 1853.478 | 10-YR | 157.00 | 681.42 | 686.20 | | 686.24 | 0.000575 | 1.76 | 89.16 | 30.27 | 0.18 |
| Main | 1799.666 | 10-YR | 157.00 | 681.24 | 686.15 | 683.19 | 686.21 | 0.000793 | 1.86 | 84.62 | 30.53 | 0.20 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | 10-YR | 157.00 | 681.24 | 685.94 | 683.20 | 686.01 | 0.000991 | 2.18 | 76.81 | 32.89 | 0.22 |
| Main | 1606.765 | 10-YR | 157.00 | 681.22 | 685.90 | 684.19 | 685.94 | 0.000800 | 1.59 | 105.22 | 126.64 | 0.20 |
| Main | 1475.852 | 10-YR | 157.00 | 681.21 | 685.64 | | 685.76 | 0.002734 | 2.76 | 56.97 | 32.14 | 0.36 |
| Main | 1134.554 | 10-YR | 157.00 | 681.17 | 685.05 | | 685.12 | 0.001295 | 2.21 | 70.97 | 32.32 | 0.26 |
| Main | 792.3003 | 10-YR | 157.00 | 681.12 | 684.19 | | 684.36 | 0.004439 | 3.37 | 53.78 | 78.00 | 0.46 |
| Main | 482.8005 | 10-YR | 183.00 | 680.38 | 684.20 | | 684.21 | 0.000124 | 0.78 | 1018.38 | 752.16 | 0.08 |
| Main | 35.46111 | 10-YR | 183.00 | 680.10 | 684.20 | 680.43 | 684.20 | 0.000005 | 0.21 | 1550.93 | 711.37 | 0.02 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 50-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | 50-YR | 60.00 | 696.40 | 699.18 | 698.25 | 699.26 | 0.002185 | 2.33 | 25.79 | 19.47 | 0.36 |
| Main | 16983.37 | 50-YR | 60.00 | 696.00 | 698.85 | | 699.06 | 0.007881 | 3.65 | 16.42 | 15.78 | 0.63 |
| Main | 16899.4* | 50-YR | 60.00 | 695.54 | 698.20 | | 698.40 | 0.007819 | 3.61 | 16.63 | 16.47 | 0.63 |
| Main | 16815.4* | 50-YR | 60.00 | 695.08 | 697.54 | | 697.74 | 0.007890 | 3.59 | 16.70 | 16.98 | 0.64 |
| Main | 16731.5* | 50-YR | 60.00 | 694.62 | 696.89 | | 697.08 | 0.007800 | 3.56 | 16.86 | 17.47 | 0.64 |
| Main | 16647.5* | 50-YR | 60.00 | 694.16 | 696.22 | | 696.42 | 0.008007 | 3.56 | 16.85 | 17.95 | 0.65 |
| Main | 16563.6* | 50-YR | 60.00 | 693.70 | 695.60 | | 695.78 | 0.007185 | 3.44 | 17.47 | 18.23 | 0.62 |
| Main | 16479.65 | 50-YR | 60.00 | 693.24 | 695.29 | | 695.39 | 0.002913 | 2.54 | 23.60 | 19.63 | 0.41 |
| Main | 16403.7* | 50-YR | 60.00 | 693.01 | 695.13 | | 695.20 | 0.002063 | 2.10 | 28.58 | 24.74 | 0.34 |
| Main | 16327.7* | 50-YR | 60.00 | 692.78 | 695.01 | | 695.06 | 0.001447 | 1.75 | 34.37 | 30.22 | 0.29 |
| Main | 16251.7* | 50-YR | 60.00 | 692.54 | 694.93 | | 694.97 | 0.000991 | 1.45 | 41.71 | 47.17 | 0.24 |
| Main | 16175.84 | 50-YR | 75.00 | 692.31 | 694.85 | | 694.89 | 0.001117 | 1.52 | 57.81 | 99.89 | 0.25 |
| Main | 16100.* | 50-YR | 75.00 | 692.07 | 694.79 | | 694.82 | 0.000708 | 1.33 | 59.33 | 64.51 | 0.21 |
| Main | 16024.40 | 50-YR | 75.00 | 691.83 | 694.77 | | 694.78 | 0.000169 | 0.71 | 235.00 | 417.29 | 0.10 |
| Main | 15850.19 | 50-YR | 75.00 | 691.30 | 694.75 | | 694.75 | 0.000118 | 0.81 | 362.80 | 545.40 | 0.09 |
| Main | 15434.41 | 50-YR | 75.00 | 690.01 | 694.62 | | 694.66 | 0.000469 | 1.58 | 47.42 | 18.60 | 0.17 |
| Main | 15212.53 | 50-YR | 75.00 | 689.73 | 694.54 | | 694.57 | 0.000326 | 1.39 | 54.15 | 19.94 | 0.15 |
| Main | 14922.76 | 50-YR | 75.00 | 689.36 | 694.52 | | 694.52 | 0.000084 | 0.70 | 165.13 | 389.22 | 0.08 |
| Main | 14774.58 | 50-YR | 123.00 | 689.19 | 694.48 | | 694.50 | 0.000268 | 1.37 | 188.01 | 297.80 | 0.14 |
| Main | 14457.09 | 50-YR | 123.00 | 688.79 | 694.41 | | 694.43 | 0.000159 | 1.09 | 174.29 | 200.79 | 0.11 |
| Main | 14406.13 | 50-YR | 123.00 | 688.73 | 694.41 | 689.95 | 694.42 | 0.000070 | 0.93 | 197.60 | 121.03 | 0.07 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | 50-YR | 129.00 | 688.38 | 694.35 | 689.65 | 694.37 | 0.000054 | 0.94 | 137.03 | 31.83 | 0.08 |
| Main | 13949.59 | 50-YR | 129.00 | 688.37 | 694.35 | 690.32 | 694.36 | 0.000085 | 1.05 | 122.79 | 320.22 | 0.09 |
| Main | 13839.56 | 50-YR | 129.00 | 688.25 | 694.34 | 690.23 | 694.35 | 0.000070 | 1.06 | 132.00 | 343.78 | 0.09 |
| Main | 13732.13 | 50-YR | 129.00 | 688.19 | 694.34 | 690.26 | 694.35 | 0.000045 | 0.84 | 247.88 | 362.93 | 0.07 |
| Main | 13662.15 | 50-YR | 129.00 | 688.17 | 694.32 | 690.29 | 694.34 | 0.000081 | 1.11 | 161.01 | 117.04 | 0.09 |
| Main | 13628.36 | 50-YR | 129.00 | 688.12 | 694.32 | 689.92 | 694.34 | 0.000055 | 0.98 | 158.84 | 91.01 | 0.08 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | 50-YR | 150.00 | 688.72 | 694.22 | 690.13 | 694.23 | 0.000287 | 1.04 | 150.09 | 274.68 | 0.09 |
| Main | 13414.20 | 50-YR | 150.00 | 689.00 | 694.21 | 690.58 | 694.22 | 0.000286 | 0.95 | 168.07 | 282.12 | 0.09 |
| Main | 13217.08 | 50-YR | 150.00 | 688.99 | 694.09 | | 694.12 | 0.000880 | 1.58 | 99.10 | 105.78 | 0.15 |
| Main | 13001.02 | 50-YR | 150.00 | 688.98 | 693.79 | | 693.86 | 0.001767 | 2.08 | 72.22 | 22.98 | 0.21 |
| Main | 12615.85 | 50-YR | 150.00 | 688.85 | 693.15 | | 693.21 | 0.001612 | 1.95 | 76.74 | 25.61 | 0.20 |
| Main | 12216.99 | 50-YR | 150.00 | 688.69 | 692.83 | | 692.87 | 0.000510 | 1.61 | 93.34 | 33.77 | 0.17 |
| Main | 12019.91 | 50-YR | 150.00 | 688.59 | 692.60 | | 692.70 | 0.001538 | 2.61 | 57.51 | 22.02 | 0.28 |
| Main | 12001.15 | 50-YR | 150.00 | 688.06 | 692.62 | 689.40 | 692.65 | 0.000407 | 1.56 | 96.20 | 27.85 | 0.15 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | 50-YR | 150.00 | 687.94 | 692.51 | 689.27 | 692.54 | 0.000222 | 1.36 | 115.87 | 39.83 | 0.12 |
| Main | 11831.40 | 50-YR | 150.00 | 688.77 | 692.44 | 690.31 | 692.51 | 0.000859 | 2.08 | 72.24 | 78.71 | 0.22 |
| Main | 11746.9* | 50-YR | 150.00 | 688.77 | 692.36 | | 692.42 | 0.001136 | 2.07 | 89.43 | 98.78 | 0.22 |
| Main | 11662.5* | 50-YR | 150.00 | 688.77 | 692.25 | | 692.31 | 0.001509 | 2.10 | 102.52 | 162.59 | 0.23 |
| Main | 11578.0* | 50-YR | 150.00 | 688.76 | 692.12 | | 692.17 | 0.001639 | 1.95 | 160.31 | 355.16 | 0.22 |
| Main | 11493.63 | 50-YR | 150.00 | 688.76 | 692.09 | | 692.09 | 0.000437 | 0.97 | 558.88 | 781.19 | 0.10 |
| Main | 11398.6* | 50-YR | 150.00 | 688.76 | 692.03 | | 692.04 | 0.000601 | 1.13 | 457.53 | 756.69 | 0.12 |
| Main | 11303.5* | 50-YR | 150.00 | 688.76 | 691.97 | | 691.98 | 0.000642 | 1.15 | 409.51 | 679.44 | 0.13 |
| Main | 11208.5* | 50-YR | 150.00 | 688.75 | 691.91 | | 691.92 | 0.000574 | 1.07 | 410.81 | 626.80 | 0.12 |
| Main | 11113.5* | 50-YR | 150.00 | 688.75 | 691.86 | | 691.87 | 0.000463 | 0.95 | 444.76 | 592.20 | 0.11 |
| Main | 11018.49 | 50-YR | 153.00 | 688.75 | 691.82 | | 691.83 | 0.000369 | 0.84 | 497.47 | 585.00 | 0.10 |
| Main | 10922.5* | 50-YR | 153.00 | 688.75 | 691.78 | | 691.78 | 0.000365 | 0.82 | 406.12 | 459.84 | 0.10 |
| Main | 10826.6* | 50-YR | 153.00 | 688.75 | 691.74 | | 691.75 | 0.000275 | 0.70 | 414.74 | 423.50 | 0.08 |
| Main | 10730.67 | 50-YR | 153.00 | 688.75 | 691.72 | | 691.72 | 0.000192 | 0.58 | 443.12 | 409.08 | 0.07 |
| Main | 10638.0* | 50-YR | 153.00 | 688.74 | 691.71 | | 691.71 | 0.000134 | 0.47 | 548.43 | 459.20 | 0.06 |
| Main | 10545.5* | 50-YR | 153.00 | 688.73 | 691.70 | | 691.70 | 0.000075 | 0.34 | 752.58 | 573.31 | 0.04 |
| Main | 10452.9* | 50-YR | 153.00 | 688.72 | 691.70 | | 691.70 | 0.000032 | 0.22 | 1058.19 | 671.57 | 0.03 |
| Main | 10360.3* | 50-YR | 153.00 | 688.71 | 691.70 | | 691.70 | 0.000010 | 0.12 | 1464.66 | 705.86 | 0.02 |
| Main | 10267.74 | 50-YR | 153.00 | 688.70 | 691.69 | | 691.69 | 0.000149 | 0.46 | 287.57 | 776.07 | 0.06 |
| Main | 10182.4* | 50-YR | 153.00 | 688.69 | 691.69 | | 691.69 | 0.000016 | 0.16 | 1857.83 | 733.36 | 0.02 |
| Main | 10097.1* | 50-YR | 153.00 | 688.68 | 691.69 | | 691.69 | 0.000012 | 0.15 | 1786.02 | 722.89 | 0.02 |
| Main | 10011.8* | 50-YR | 153.00 | 688.67 | 691.69 | | 691.69 | 0.000008 | 0.12 | 1716.13 | 716.91 | 0.01 |
| Main | 9926.510 | 50-YR | 153.00 | 688.66 | 691.68 | | 691.69 | 0.000210 | 0.62 | 264.68 | 803.92 | 0.07 |
| Main | 9491.793 | 50-YR | 153.00 | 688.61 | 691.62 | 689.42 | 691.63 | 0.000212 | 0.55 | 236.93 | 374.26 | 0.07 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | 50-YR | 153.00 | 688.30 | 691.61 | | 691.61 | 0.000196 | 0.49 | 524.41 | 667.17 | 0.07 |
| Main | 8784.397 | 50-YR | 153.00 | 688.22 | 691.55 | | 691.57 | 0.000993 | 1.37 | 303.54 | 737.44 | 0.15 |
| Main | 8722.829 | 50-YR | 153.00 | 688.12 | 691.43 | 689.90 | 691.44 | 0.001251 | 1.26 | 317.47 | 506.42 | 0.16 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | 50-YR | 153.00 | 687.48 | 691.43 | 689.08 | 691.44 | 0.000446 | 1.01 | 372.50 | 562.86 | 0.11 |
| Main | 8631.519 | 50-YR | 153.00 | 687.41 | 691.41 | 689.07 | 691.42 | 0.000508 | 1.01 | 386.37 | 485.11 | 0.11 |
| Main | 8345.665 | 50-YR | 153.00 | 687.28 | 691.38 | | 691.39 | 0.000058 | 0.38 | 1125.87 | 1144.01 | 0.04 |
| Main | 8047.118 | 50-YR | 107.00 | 687.10 | 691.37 | | 691.37 | 0.000041 | 0.31 | 786.98 | 722.72 | 0.03 |
| Main | 7739.449 | 50-YR | 107.00 | 686.99 | 691.36 | | 691.36 | 0.000017 | 0.26 | 897.04 | 1370.68 | 0.02 |
| Main | 7515.565 | 50-YR | 107.00 | 686.79 | 691.36 | | 691.36 | 0.000035 | 0.34 | 424.65 | 314.69 | 0.03 |
| Main | 7272.821 | 50-YR | 107.00 | 686.67 | 691.35 | | 691.35 | 0.000041 | 0.41 | 776.56 | 827.11 | 0.04 |
| Main | 7255.385 | 50-YR | 107.00 | 686.00 | 691.35 | 688.08 | 691.35 | 0.000096 | 0.52 | 864.44 | 777.03 | 0.05 |
| Main | 7226.812 | | Culvert | | | | | | | | | |
| Main | 7193.714 | 50-YR | 107.00 | 685.90 | 691.35 | 688.02 | 691.35 | 0.000020 | 0.28 | 1357.69 | 658.22 | 0.02 |
| Main | 7141.580 | 50-YR | 107.00 | 686.28 | 691.34 | 687.33 | 691.34 | 0.000039 | 0.26 | 864.47 | 587.34 | 0.02 |
| Main | 7071.87* | 50-YR | 107.00 | 686.28 | 691.34 | | 691.34 | 0.000030 | 0.26 | 934.86 | 543.77 | 0.02 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 50-YR (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7002.16* | 50-YR | 107.00 | 686.27 | 691.34 | | 691.34 | 0.000027 | 0.28 | 947.73 | 514.21 | 0.02 |
| Main | 6932.458 | 50-YR | 107.00 | 686.27 | 691.33 | | 691.34 | 0.000025 | 0.32 | 982.03 | 504.57 | 0.03 |
| Main | 6846.57* | 50-YR | 107.00 | 686.27 | 691.33 | | 691.33 | 0.000047 | 0.44 | 596.00 | 386.96 | 0.04 |
| Main | 6760.7* | 50-YR | 107.00 | 686.27 | 691.32 | | 691.33 | 0.000064 | 0.52 | 409.09 | 248.15 | 0.04 |
| Main | 6674.82* | 50-YR | 107.00 | 686.26 | 691.32 | | 691.32 | 0.000075 | 0.56 | 339.17 | 253.18 | 0.05 |
| Main | 6588.943 | 50-YR | 107.00 | 686.26 | 691.31 | | 691.32 | 0.000039 | 0.41 | 781.99 | 467.60 | 0.03 |
| Main | 6495.53* | 50-YR | 107.00 | 686.26 | 691.31 | | 691.31 | 0.000016 | 0.26 | 1122.05 | 695.70 | 0.02 |
| Main | 6402.13* | 50-YR | 107.00 | 686.26 | 691.31 | | 691.31 | 0.000011 | 0.21 | 1481.41 | 888.85 | 0.02 |
| Main | 6308.73* | 50-YR | 107.00 | 686.27 | 691.31 | 687.34 | 691.31 | 0.000009 | 0.19 | 1527.31 | 1088.77 | 0.02 |
| Main | 6215.32* | 50-YR | 107.00 | 686.27 | 691.31 | 687.29 | 691.31 | 0.000008 | 0.18 | 1493.34 | 1382.60 | 0.02 |
| Main | 6121.924 | 50-YR | 107.00 | 686.27 | 691.31 | 687.24 | 691.31 | 0.000007 | 0.17 | 1354.23 | 1775.50 | 0.01 |
| Main | 6035.96* | 50-YR | 107.00 | 686.27 | 691.31 | 687.29 | 691.31 | 0.000008 | 0.18 | 1278.75 | 1724.88 | 0.02 |
| Main | 5950.01* | 50-YR | 107.00 | 686.27 | 691.31 | 687.34 | 691.31 | 0.000011 | 0.21 | 1126.42 | 1682.72 | 0.02 |
| Main | 5864.05* | 50-YR | 107.00 | 686.27 | 691.31 | 687.44 | 691.31 | 0.000014 | 0.23 | 941.52 | 1647.18 | 0.02 |
| Main | 5778.104 | 50-YR | 107.00 | 686.27 | 691.30 | 687.61 | 691.30 | 0.000020 | 0.28 | 735.15 | 1611.92 | 0.02 |
| Main | 5687.63* | 50-YR | 107.00 | 686.28 | 691.30 | 687.89 | 691.30 | 0.000044 | 0.43 | 426.66 | 1137.36 | 0.04 |
| Main | 5597.166 | 50-YR | 107.00 | 686.28 | 691.29 | | 691.29 | 0.000107 | 0.69 | 185.11 | 642.32 | 0.06 |
| Main | 5556.618 | 50-YR | 107.00 | 686.43 | 691.27 | 687.62 | 691.28 | 0.000196 | 1.02 | 112.23 | 500.07 | 0.09 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | 50-YR | 101.00 | 685.19 | 691.19 | 686.49 | 691.20 | 0.000112 | 0.87 | 116.10 | 206.84 | 0.07 |
| Main | 5437.667 | 50-YR | 101.00 | 685.35 | 691.19 | 686.29 | 691.19 | 0.000031 | 0.43 | 233.25 | 459.13 | 0.04 |
| Main | 5357.86* | 50-YR | 101.00 | 685.35 | 691.19 | 686.44 | 691.19 | 0.000050 | 0.53 | 188.97 | 393.44 | 0.05 |
| Main | 5278.05* | 50-YR | 101.00 | 685.34 | 691.18 | 686.64 | 691.19 | 0.000084 | 0.67 | 150.83 | 333.21 | 0.06 |
| Main | 5198.254 | 50-YR | 101.00 | 685.34 | 691.16 | | 691.18 | 0.000156 | 0.87 | 116.26 | 269.16 | 0.08 |
| Main | 5121.63* | 50-YR | 101.00 | 685.34 | 691.15 | 686.94 | 691.16 | 0.000138 | 0.81 | 124.59 | 289.76 | 0.07 |
| Main | 5045.01* | 50-YR | 101.00 | 685.34 | 691.15 | 686.94 | 691.15 | 0.000119 | 0.74 | 136.01 | 303.26 | 0.07 |
| Main | 4968.39* | 50-YR | 101.00 | 685.33 | 691.14 | 686.94 | 691.15 | 0.000097 | 0.65 | 160.90 | 315.67 | 0.06 |
| Main | 4891.776 | 50-YR | 101.00 | 685.33 | 691.13 | | 691.14 | 0.000056 | 0.52 | 235.45 | 348.44 | 0.05 |
| Main | 4810.20* | 50-YR | 101.00 | 685.33 | 691.13 | 687.02 | 691.13 | 0.000080 | 0.59 | 202.82 | 229.71 | 0.06 |
| Main | 4728.63* | 50-YR | 101.00 | 685.33 | 691.12 | 687.09 | 691.13 | 0.000108 | 0.65 | 178.59 | 129.05 | 0.06 |
| Main | 4647.06* | 50-YR | 101.00 | 685.32 | 691.11 | 687.14 | 691.12 | 0.000138 | 0.71 | 167.52 | 143.45 | 0.07 |
| Main | 4565.488 | 50-YR | 101.00 | 685.32 | 691.09 | | 691.10 | 0.000176 | 0.78 | 158.64 | 182.17 | 0.08 |
| Main | 4504.263 | 50-YR | 101.00 | 685.32 | 691.08 | 687.29 | 691.09 | 0.000207 | 0.85 | 118.84 | 61.86 | 0.09 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | 50-YR | 101.00 | 684.72 | 690.88 | 686.76 | 690.90 | 0.000176 | 1.12 | 91.66 | 27.44 | 0.09 |
| Main | 4346.582 | 50-YR | 101.00 | 685.50 | 690.87 | 686.93 | 690.88 | 0.000213 | 0.96 | 104.96 | 28.90 | 0.09 |
| Main | 4194.408 | 50-YR | 101.00 | 685.49 | 690.83 | | 690.85 | 0.000266 | 1.04 | 97.31 | 28.32 | 0.10 |
| Main | 3788.373 | 50-YR | 101.00 | 685.36 | 690.82 | | 690.82 | 0.000024 | 0.35 | 460.50 | 256.16 | 0.03 |
| Main | 3395.646 | 50-YR | 101.00 | 685.01 | 690.81 | | 690.81 | 0.000018 | 0.45 | 424.93 | 210.15 | 0.04 |
| Main | 3331.113 | 50-YR | 101.00 | 685.09 | 690.80 | 686.58 | 690.81 | 0.000057 | 0.72 | 143.29 | 69.09 | 0.06 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | 50-YR | 102.00 | 683.69 | 688.51 | 686.06 | 688.59 | 0.000709 | 2.24 | 50.86 | 20.49 | 0.20 |
| Main | 3141.921 | 50-YR | 102.00 | 683.98 | 688.47 | | 688.54 | 0.000896 | 2.05 | 49.69 | 16.91 | 0.21 |
| Main | 3004.055 | 50-YR | 102.00 | 683.97 | 688.42 | | 688.45 | 0.000365 | 1.43 | 71.41 | 22.15 | 0.14 |
| Main | 2734.719 | 50-YR | 102.00 | 683.96 | 688.27 | | 688.32 | 0.000667 | 1.77 | 57.70 | 20.91 | 0.19 |
| Main | 2688.915 | 50-YR | 102.00 | 683.95 | 688.23 | 685.99 | 688.28 | 0.000848 | 1.90 | 53.57 | 20.81 | 0.21 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | 50-YR | 102.00 | 683.44 | 687.36 | 685.49 | 687.52 | 0.002714 | 3.22 | 31.68 | 10.47 | 0.33 |
| Main | 2582.291 | 50-YR | 102.00 | 683.33 | 687.28 | 685.47 | 687.40 | 0.001920 | 2.77 | 36.77 | 13.60 | 0.30 |
| Main | 2218.895 | 50-YR | 102.00 | 682.33 | 687.22 | | 687.23 | 0.000154 | 0.97 | 105.46 | 32.50 | 0.09 |
| Main | 2049.666 | 50-YR | 102.00 | 681.91 | 687.19 | | 687.20 | 0.000159 | 0.98 | 117.55 | 65.11 | 0.10 |
| Main | 1853.478 | 50-YR | 244.00 | 681.42 | 687.05 | | 687.12 | 0.000663 | 2.10 | 116.41 | 33.63 | 0.20 |
| Main | 1799.666 | 50-YR | 244.00 | 681.24 | 687.01 | 684.20 | 687.08 | 0.000871 | 2.17 | 112.53 | 34.85 | 0.21 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | 50-YR | 244.00 | 681.24 | 686.59 | 684.01 | 686.70 | 0.001225 | 2.76 | 94.59 | 35.82 | 0.25 |
| Main | 1606.765 | 50-YR | 244.00 | 681.22 | 686.56 | 684.65 | 686.61 | 0.000686 | 1.77 | 147.63 | 130.93 | 0.20 |
| Main | 1475.852 | 50-YR | 244.00 | 681.21 | 686.28 | | 686.43 | 0.002656 | 3.08 | 79.28 | 37.13 | 0.37 |
| Main | 1134.554 | 50-YR | 244.00 | 681.17 | 685.62 | | 685.73 | 0.001594 | 2.70 | 90.26 | 35.48 | 0.30 |
| Main | 792.3003 | 50-YR | 244.00 | 681.12 | 684.46 | | 684.75 | 0.006135 | 4.38 | 82.91 | 144.50 | 0.55 |
| Main | 482.8005 | 50-YR | 288.00 | 680.38 | 684.51 | | 684.51 | 0.000178 | 1.01 | 1252.57 | 792.53 | 0.10 |
| Main | 35.46111 | 50-YR | 288.00 | 680.10 | 684.50 | 680.54 | 684.50 | 0.000009 | 0.29 | 1767.93 | 743.10 | 0.02 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 100-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | 100-YR | 69.00 | 696.40 | 699.31 | 698.36 | 699.40 | 0.002268 | 2.44 | 28.27 | 20.44 | 0.37 |
| Main | 16983.37 | 100-YR | 69.00 | 696.00 | 698.96 | | 699.19 | 0.007931 | 3.78 | 18.26 | 16.81 | 0.64 |
| Main | 16899.4* | 100-YR | 69.00 | 695.54 | 698.31 | | 698.53 | 0.007827 | 3.73 | 18.49 | 17.45 | 0.64 |
| Main | 16815.4* | 100-YR | 69.00 | 695.08 | 697.65 | | 697.86 | 0.007922 | 3.72 | 18.53 | 17.95 | 0.65 |
| Main | 16731.5* | 100-YR | 69.00 | 694.62 | 696.99 | | 697.20 | 0.007773 | 3.68 | 18.77 | 18.49 | 0.64 |
| Main | 16647.5* | 100-YR | 69.00 | 694.16 | 696.32 | | 696.53 | 0.008157 | 3.71 | 18.60 | 18.90 | 0.66 |
| Main | 16563.6* | 100-YR | 69.00 | 693.70 | 695.74 | | 695.92 | 0.006350 | 3.43 | 20.13 | 19.20 | 0.59 |
| Main | 16479.65 | 100-YR | 69.00 | 693.24 | 695.48 | | 695.58 | 0.002535 | 2.52 | 27.42 | 20.84 | 0.39 |
| Main | 16403.7* | 100-YR | 69.00 | 693.01 | 695.35 | | 695.41 | 0.001655 | 2.01 | 34.31 | 26.84 | 0.31 |
| Main | 16327.7* | 100-YR | 69.00 | 692.78 | 695.26 | | 695.31 | 0.001096 | 1.63 | 42.54 | 39.63 | 0.26 |
| Main | 16251.7* | 100-YR | 69.00 | 692.54 | 695.21 | | 695.24 | 0.000694 | 1.30 | 63.41 | 122.38 | 0.20 |
| Main | 16175.84 | 100-YR | 86.00 | 692.31 | 695.16 | | 695.18 | 0.000673 | 1.29 | 102.23 | 192.14 | 0.20 |
| Main | 16100.* | 100-YR | 86.00 | 692.07 | 695.12 | | 695.14 | 0.000448 | 1.18 | 92.52 | 143.40 | 0.17 |
| Main | 16024.40 | 100-YR | 86.00 | 691.83 | 695.12 | | 695.12 | 0.000083 | 0.56 | 365.86 | 595.71 | 0.07 |
| Main | 15850.19 | 100-YR | 86.00 | 691.30 | 695.11 | | 695.11 | 0.000061 | 0.64 | 545.03 | 700.51 | 0.07 |
| Main | 15434.41 | 100-YR | 86.00 | 690.01 | 695.01 | | 695.05 | 0.000417 | 1.57 | 54.88 | 19.93 | 0.17 |
| Main | 15212.53 | 100-YR | 86.00 | 689.73 | 694.94 | | 694.97 | 0.000293 | 1.38 | 62.31 | 21.26 | 0.14 |
| Main | 14922.76 | 100-YR | 86.00 | 689.36 | 694.92 | | 694.93 | 0.000061 | 0.66 | 212.96 | 432.27 | 0.07 |
| Main | 14774.58 | 100-YR | 145.00 | 689.19 | 694.89 | | 694.91 | 0.000184 | 1.23 | 262.80 | 325.76 | 0.12 |
| Main | 14457.09 | 100-YR | 145.00 | 688.79 | 694.85 | | 694.86 | 0.000126 | 1.06 | 227.27 | 219.32 | 0.10 |
| Main | 14406.13 | 100-YR | 145.00 | 688.73 | 694.84 | 690.09 | 694.86 | 0.000070 | 0.99 | 225.97 | 140.46 | 0.07 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | 100-YR | 153.00 | 688.38 | 694.76 | 689.80 | 694.77 | 0.000060 | 1.03 | 148.43 | 32.88 | 0.08 |
| Main | 13949.59 | 100-YR | 153.00 | 688.37 | 694.75 | 690.47 | 694.77 | 0.000089 | 1.12 | 136.14 | 325.68 | 0.10 |
| Main | 13839.56 | 100-YR | 153.00 | 688.25 | 694.74 | 690.37 | 694.76 | 0.000074 | 1.14 | 148.01 | 351.53 | 0.09 |
| Main | 13732.13 | 100-YR | 153.00 | 688.19 | 694.75 | 690.40 | 694.75 | 0.000019 | 0.57 | 397.65 | 365.00 | 0.05 |
| Main | 13662.15 | 100-YR | 153.00 | 688.17 | 694.73 | 690.44 | 694.75 | 0.000079 | 1.15 | 192.23 | 261.68 | 0.09 |
| Main | 13628.36 | 100-YR | 153.00 | 688.12 | 694.73 | 690.06 | 694.74 | 0.000057 | 1.06 | 178.52 | 205.13 | 0.08 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | 100-YR | 179.00 | 688.72 | 694.57 | 690.27 | 694.59 | 0.000311 | 1.15 | 165.04 | 333.16 | 0.09 |
| Main | 13414.20 | 100-YR | 179.00 | 689.00 | 694.56 | 690.73 | 694.58 | 0.000290 | 1.01 | 193.17 | 346.75 | 0.09 |
| Main | 13217.08 | 100-YR | 179.00 | 688.99 | 694.44 | | 694.48 | 0.000881 | 1.66 | 135.34 | 174.43 | 0.15 |
| Main | 13001.02 | 100-YR | 179.00 | 688.98 | 694.13 | | 694.21 | 0.001883 | 2.23 | 80.14 | 23.89 | 0.21 |
| Main | 12615.85 | 100-YR | 179.00 | 688.85 | 693.43 | | 693.50 | 0.001772 | 2.13 | 84.13 | 26.44 | 0.21 |
| Main | 12216.99 | 100-YR | 179.00 | 688.69 | 693.08 | | 693.13 | 0.000564 | 1.76 | 101.96 | 34.73 | 0.18 |
| Main | 12019.91 | 100-YR | 179.00 | 688.59 | 692.81 | | 692.94 | 0.001774 | 2.87 | 62.36 | 23.02 | 0.31 |
| Main | 12001.15 | 100-YR | 179.00 | 688.06 | 692.84 | 689.58 | 692.88 | 0.000487 | 1.75 | 102.38 | 28.52 | 0.16 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | 100-YR | 179.00 | 687.94 | 692.70 | 689.56 | 692.73 | 0.000272 | 1.55 | 121.21 | 40.35 | 0.13 |
| Main | 11831.40 | 100-YR | 179.00 | 688.77 | 692.61 | 690.48 | 692.69 | 0.001038 | 2.34 | 76.44 | 94.42 | 0.24 |
| Main | 11746.9* | 100-YR | 179.00 | 688.77 | 692.52 | | 692.59 | 0.001259 | 2.24 | 107.78 | 128.19 | 0.23 |
| Main | 11662.5* | 100-YR | 179.00 | 688.77 | 692.40 | | 692.47 | 0.001626 | 2.24 | 132.20 | 219.12 | 0.24 |
| Main | 11578.0* | 100-YR | 179.00 | 688.76 | 692.28 | | 692.33 | 0.001600 | 1.99 | 221.17 | 449.36 | 0.22 |
| Main | 11493.63 | 100-YR | 179.00 | 688.76 | 692.24 | | 692.25 | 0.000401 | 0.96 | 683.14 | 808.64 | 0.10 |
| Main | 11398.6* | 100-YR | 179.00 | 688.76 | 692.19 | | 692.20 | 0.000545 | 1.11 | 583.66 | 801.35 | 0.12 |
| Main | 11303.5* | 100-YR | 179.00 | 688.76 | 692.13 | | 692.15 | 0.000620 | 1.18 | 529.62 | 795.41 | 0.13 |
| Main | 11208.5* | 100-YR | 179.00 | 688.75 | 692.07 | | 692.09 | 0.000569 | 1.11 | 521.27 | 714.98 | 0.12 |
| Main | 11113.5* | 100-YR | 179.00 | 688.75 | 692.02 | | 692.03 | 0.000475 | 1.00 | 547.72 | 662.36 | 0.11 |
| Main | 11018.49 | 100-YR | 131.00 | 688.75 | 692.00 | | 692.00 | 0.000194 | 0.64 | 605.90 | 648.72 | 0.07 |
| Main | 10922.5* | 100-YR | 131.00 | 688.75 | 691.97 | | 691.98 | 0.000182 | 0.61 | 506.63 | 566.51 | 0.07 |
| Main | 10826.6* | 100-YR | 131.00 | 688.75 | 691.96 | | 691.96 | 0.000137 | 0.53 | 519.77 | 525.08 | 0.06 |
| Main | 10730.67 | 100-YR | 131.00 | 688.75 | 691.94 | | 691.95 | 0.000094 | 0.44 | 547.90 | 501.77 | 0.05 |
| Main | 10638.0* | 100-YR | 131.00 | 688.74 | 691.94 | | 691.94 | 0.000065 | 0.35 | 665.50 | 553.90 | 0.04 |
| Main | 10545.5* | 100-YR | 131.00 | 688.73 | 691.94 | | 691.94 | 0.000036 | 0.26 | 894.09 | 617.16 | 0.03 |
| Main | 10452.9* | 100-YR | 131.00 | 688.72 | 691.93 | | 691.93 | 0.000016 | 0.17 | 1222.49 | 710.06 | 0.02 |
| Main | 10360.3* | 100-YR | 131.00 | 688.71 | 691.93 | | 691.93 | 0.000005 | 0.10 | 1636.75 | 740.01 | 0.01 |
| Main | 10267.74 | 100-YR | 131.00 | 688.70 | 691.93 | | 691.93 | 0.000079 | 0.36 | 325.23 | 815.73 | 0.04 |
| Main | 10182.4* | 100-YR | 131.00 | 688.69 | 691.93 | | 691.93 | 0.000009 | 0.13 | 2038.32 | 768.42 | 0.01 |
| Main | 10097.1* | 100-YR | 131.00 | 688.68 | 691.93 | | 691.93 | 0.000006 | 0.11 | 1965.85 | 765.46 | 0.01 |
| Main | 10011.8* | 100-YR | 131.00 | 688.67 | 691.93 | | 691.93 | 0.000004 | 0.09 | 1901.31 | 790.61 | 0.01 |
| Main | 9926.510 | 100-YR | 131.00 | 688.66 | 691.93 | | 691.93 | 0.000108 | 0.47 | 337.01 | 881.45 | 0.05 |
| Main | 9491.793 | 100-YR | 131.00 | 688.61 | 691.89 | 689.36 | 691.90 | 0.000110 | 0.42 | 268.05 | 436.45 | 0.05 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | 100-YR | 131.00 | 688.30 | 691.89 | | 691.89 | 0.000086 | 0.34 | 732.20 | 847.33 | 0.04 |
| Main | 8784.397 | 100-YR | 131.00 | 688.22 | 691.86 | | 691.87 | 0.000400 | 0.92 | 435.45 | 885.21 | 0.10 |
| Main | 8722.829 | 100-YR | 131.00 | 688.12 | 691.81 | 689.74 | 691.82 | 0.000420 | 0.81 | 439.62 | 594.57 | 0.10 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | 100-YR | 131.00 | 687.48 | 691.81 | 688.96 | 691.82 | 0.000167 | 0.67 | 521.52 | 659.81 | 0.07 |
| Main | 8631.519 | 100-YR | 131.00 | 687.41 | 691.81 | 688.93 | 691.81 | 0.000194 | 0.68 | 511.30 | 612.68 | 0.07 |
| Main | 8345.665 | 100-YR | 131.00 | 687.28 | 691.80 | | 691.80 | 0.000017 | 0.23 | 1622.88 | 1240.99 | 0.02 |
| Main | 8047.118 | 100-YR | 117.00 | 687.10 | 691.79 | | 691.79 | 0.000020 | 0.23 | 1098.06 | 746.24 | 0.02 |
| Main | 7739.449 | 100-YR | 117.00 | 686.99 | 691.79 | | 691.79 | 0.000010 | 0.21 | 1181.74 | 1501.85 | 0.02 |
| Main | 7515.565 | 100-YR | 117.00 | 686.79 | 691.79 | | 691.79 | 0.000027 | 0.32 | 512.50 | 332.20 | 0.03 |
| Main | 7272.821 | 100-YR | 117.00 | 686.67 | 691.78 | | 691.78 | 0.000027 | 0.36 | 1107.21 | 909.38 | 0.03 |
| Main | 7255.385 | 100-YR | 117.00 | 686.00 | 691.78 | 688.14 | 691.78 | 0.000051 | 0.41 | 1171.85 | 811.72 | 0.04 |
| Main | 7226.812 | | Culvert | | | | | | | | | |
| Main | 7193.714 | 100-YR | 117.00 | 685.90 | 691.78 | 688.09 | 691.78 | 0.000014 | 0.26 | 1609.04 | 667.23 | 0.02 |
| Main | 7141.580 | 100-YR | 117.00 | 686.28 | 691.78 | 687.38 | 691.78 | 0.000025 | 0.23 | 1107.45 | 609.82 | 0.02 |
| Main | 7071.87* | 100-YR | 117.00 | 686.28 | 691.77 | | 691.77 | 0.000021 | 0.23 | 1173.94 | 558.56 | 0.02 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 100-YR (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7002.16* | 100-YR | 117.00 | 686.27 | 691.77 | | 691.77 | 0.000019 | 0.25 | 1181.38 | 547.70 | 0.02 |
| Main | 6932.458 | 100-YR | 117.00 | 686.27 | 691.77 | | 691.77 | 0.000018 | 0.29 | 1203.73 | 513.27 | 0.02 |
| Main | 6846.57* | 100-YR | 117.00 | 686.27 | 691.77 | | 691.77 | 0.000034 | 0.40 | 779.47 | 444.15 | 0.03 |
| Main | 6760.7* | 100-YR | 117.00 | 686.27 | 691.76 | | 691.76 | 0.000048 | 0.48 | 536.42 | 313.07 | 0.04 |
| Main | 6674.82* | 100-YR | 117.00 | 686.26 | 691.76 | | 691.76 | 0.000055 | 0.51 | 470.26 | 349.69 | 0.04 |
| Main | 6588.943 | 100-YR | 117.00 | 686.26 | 691.76 | | 691.76 | 0.000027 | 0.36 | 1002.16 | 526.88 | 0.03 |
| Main | 6495.53* | 100-YR | 117.00 | 686.26 | 691.75 | | 691.75 | 0.000010 | 0.22 | 1432.96 | 712.80 | 0.02 |
| Main | 6402.13* | 100-YR | 117.00 | 686.26 | 691.75 | | 691.75 | 0.000007 | 0.18 | 1878.17 | 906.49 | 0.01 |
| Main | 6308.73* | 100-YR | 117.00 | 686.27 | 691.75 | 687.39 | 691.75 | 0.000006 | 0.17 | 1897.59 | 1141.81 | 0.01 |
| Main | 6215.32* | 100-YR | 117.00 | 686.27 | 691.75 | 687.33 | 691.75 | 0.000005 | 0.16 | 1816.34 | 1485.95 | 0.01 |
| Main | 6121.924 | 100-YR | 117.00 | 686.27 | 691.75 | 687.29 | 691.75 | 0.000005 | 0.16 | 1635.49 | 1805.53 | 0.01 |
| Main | 6035.96* | 100-YR | 117.00 | 686.27 | 691.75 | 687.33 | 691.75 | 0.000006 | 0.17 | 1526.06 | 1748.64 | 0.01 |
| Main | 5950.01* | 100-YR | 117.00 | 686.27 | 691.75 | 687.39 | 691.75 | 0.000008 | 0.19 | 1337.92 | 1703.48 | 0.02 |
| Main | 5864.05* | 100-YR | 117.00 | 686.27 | 691.75 | 687.50 | 691.75 | 0.000010 | 0.22 | 1114.09 | 1677.45 | 0.02 |
| Main | 5778.104 | 100-YR | 117.00 | 686.27 | 691.75 | 687.67 | 691.75 | 0.000015 | 0.26 | 862.49 | 1651.33 | 0.02 |
| Main | 5687.63* | 100-YR | 117.00 | 686.28 | 691.74 | 687.95 | 691.75 | 0.000032 | 0.39 | 504.24 | 1144.72 | 0.03 |
| Main | 5597.166 | 100-YR | 117.00 | 686.28 | 691.73 | | 691.74 | 0.000075 | 0.63 | 220.46 | 647.62 | 0.06 |
| Main | 5556.618 | 100-YR | 117.00 | 686.43 | 691.72 | 687.69 | 691.73 | 0.000158 | 0.98 | 127.99 | 534.54 | 0.08 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | 100-YR | 113.00 | 685.19 | 691.63 | 686.57 | 691.65 | 0.000107 | 0.90 | 125.95 | 375.60 | 0.07 |
| Main | 5437.667 | 100-YR | 113.00 | 685.35 | 691.64 | 686.34 | 691.64 | 0.000029 | 0.44 | 257.09 | 474.11 | 0.04 |
| Main | 5357.86* | 100-YR | 113.00 | 685.35 | 691.63 | 686.50 | 691.64 | 0.000047 | 0.54 | 208.94 | 408.08 | 0.04 |
| Main | 5278.05* | 100-YR | 113.00 | 685.34 | 691.62 | 686.72 | 691.63 | 0.000079 | 0.68 | 167.23 | 347.05 | 0.06 |
| Main | 5198.254 | 100-YR | 113.00 | 685.34 | 691.61 | | 691.62 | 0.000145 | 0.87 | 129.51 | 283.19 | 0.07 |
| Main | 5121.63* | 100-YR | 113.00 | 685.34 | 691.60 | 687.02 | 691.61 | 0.000127 | 0.81 | 139.39 | 311.87 | 0.07 |
| Main | 5045.01* | 100-YR | 113.00 | 685.34 | 691.59 | 687.02 | 691.60 | 0.000108 | 0.74 | 152.96 | 321.91 | 0.07 |
| Main | 4968.39* | 100-YR | 113.00 | 685.33 | 691.59 | 687.02 | 691.59 | 0.000087 | 0.64 | 190.36 | 343.05 | 0.06 |
| Main | 4891.776 | 100-YR | 113.00 | 685.33 | 691.58 | | 691.59 | 0.000045 | 0.51 | 315.21 | 531.24 | 0.04 |
| Main | 4810.20* | 100-YR | 113.00 | 685.33 | 691.58 | 687.10 | 691.58 | 0.000060 | 0.55 | 295.62 | 452.48 | 0.05 |
| Main | 4728.63* | 100-YR | 113.00 | 685.33 | 691.57 | 687.19 | 691.58 | 0.000079 | 0.60 | 278.18 | 296.53 | 0.06 |
| Main | 4647.06* | 100-YR | 113.00 | 685.32 | 691.56 | 687.24 | 691.57 | 0.000098 | 0.64 | 274.52 | 278.97 | 0.06 |
| Main | 4565.488 | 100-YR | 113.00 | 685.32 | 691.55 | | 691.56 | 0.000127 | 0.71 | 219.87 | 260.73 | 0.07 |
| Main | 4504.263 | 100-YR | 113.00 | 685.32 | 691.54 | 687.37 | 691.55 | 0.000165 | 0.82 | 139.90 | 69.61 | 0.08 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | 100-YR | 113.00 | 684.72 | 691.29 | 686.85 | 691.32 | 0.000170 | 1.16 | 99.08 | 28.57 | 0.09 |
| Main | 4346.582 | 100-YR | 113.00 | 685.50 | 691.28 | 687.01 | 691.30 | 0.000197 | 0.96 | 117.13 | 30.16 | 0.09 |
| Main | 4194.408 | 100-YR | 113.00 | 685.49 | 691.25 | | 691.26 | 0.000244 | 1.03 | 109.41 | 30.00 | 0.10 |
| Main | 3788.373 | 100-YR | 113.00 | 685.36 | 691.24 | | 691.24 | 0.000019 | 0.34 | 575.05 | 283.09 | 0.03 |
| Main | 3395.646 | 100-YR | 113.00 | 685.01 | 691.23 | | 691.23 | 0.000016 | 0.44 | 493.65 | 218.85 | 0.03 |
| Main | 3331.113 | 100-YR | 113.00 | 685.09 | 691.22 | 686.65 | 691.23 | 0.000053 | 0.74 | 157.85 | 91.03 | 0.06 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | 100-YR | 100.00 | 683.69 | 688.68 | 686.04 | 688.74 | 0.000589 | 2.10 | 53.22 | 20.85 | 0.19 |
| Main | 3141.921 | 100-YR | 100.00 | 683.98 | 688.65 | | 688.70 | 0.000736 | 1.90 | 52.66 | 17.34 | 0.19 |
| Main | 3004.055 | 100-YR | 100.00 | 683.97 | 688.60 | | 688.63 | 0.000300 | 1.32 | 75.51 | 22.57 | 0.13 |
| Main | 2734.719 | 100-YR | 100.00 | 683.96 | 688.49 | | 688.53 | 0.000521 | 1.61 | 62.22 | 21.54 | 0.17 |
| Main | 2688.915 | 100-YR | 100.00 | 683.95 | 688.45 | 685.97 | 688.50 | 0.000648 | 1.72 | 58.31 | 21.62 | 0.18 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | 100-YR | 100.00 | 683.44 | 687.84 | 685.47 | 687.95 | 0.001769 | 2.71 | 36.90 | 11.41 | 0.27 |
| Main | 2582.291 | 100-YR | 100.00 | 683.33 | 687.79 | 685.45 | 687.87 | 0.001129 | 2.27 | 43.97 | 14.48 | 0.23 |
| Main | 2218.895 | 100-YR | 100.00 | 682.33 | 687.76 | | 687.77 | 0.000094 | 0.81 | 123.53 | 34.14 | 0.08 |
| Main | 2049.666 | 100-YR | 100.00 | 681.91 | 687.74 | | 687.75 | 0.000092 | 0.80 | 158.02 | 81.10 | 0.07 |
| Main | 1853.478 | 100-YR | 304.00 | 681.42 | 687.60 | | 687.68 | 0.000713 | 2.24 | 135.87 | 37.65 | 0.21 |
| Main | 1799.666 | 100-YR | 304.00 | 681.24 | 687.55 | 684.48 | 687.63 | 0.000867 | 2.30 | 132.27 | 37.60 | 0.22 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | 100-YR | 304.00 | 681.24 | 686.97 | 684.40 | 687.11 | 0.001352 | 3.09 | 105.08 | 37.57 | 0.27 |
| Main | 1606.765 | 100-YR | 304.00 | 681.22 | 686.96 | 684.90 | 687.01 | 0.000636 | 1.88 | 173.68 | 426.71 | 0.19 |
| Main | 1475.852 | 100-YR | 304.00 | 681.21 | 686.64 | | 686.80 | 0.002630 | 3.27 | 94.39 | 54.44 | 0.38 |
| Main | 1134.554 | 100-YR | 304.00 | 681.17 | 685.92 | | 686.06 | 0.001793 | 3.00 | 101.35 | 37.17 | 0.32 |
| Main | 792.3003 | 100-YR | 304.00 | 681.12 | 684.65 | | 684.99 | 0.006496 | 4.80 | 115.08 | 194.29 | 0.58 |
| Main | 482.8005 | 100-YR | 361.00 | 680.38 | 684.71 | | 684.72 | 0.000202 | 1.13 | 1417.70 | 848.37 | 0.11 |
| Main | 35.46111 | 100-YR | 361.00 | 680.10 | 684.70 | 680.61 | 684.70 | 0.000011 | 0.35 | 1919.79 | 769.39 | 0.03 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 500-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | 500-YR | 162.00 | 696.40 | 700.15 | 699.15 | 700.34 | 0.002575 | 3.52 | 46.37 | 26.99 | 0.42 |
| Main | 16983.37 | 500-YR | 162.00 | 696.00 | 699.77 | | 700.11 | 0.008133 | 4.66 | 34.79 | 24.21 | 0.68 |
| Main | 16899.4* | 500-YR | 162.00 | 695.54 | 699.09 | | 699.43 | 0.008079 | 4.62 | 35.06 | 24.86 | 0.69 |
| Main | 16815.4* | 500-YR | 162.00 | 695.08 | 698.41 | | 698.74 | 0.008141 | 4.62 | 35.04 | 25.22 | 0.69 |
| Main | 16731.5* | 500-YR | 162.00 | 694.62 | 697.73 | | 698.07 | 0.007958 | 4.62 | 35.10 | 25.09 | 0.69 |
| Main | 16647.5* | 500-YR | 162.00 | 694.16 | 697.08 | | 697.41 | 0.007605 | 4.59 | 35.27 | 24.68 | 0.68 |
| Main | 16563.6* | 500-YR | 162.00 | 693.70 | 696.54 | | 696.83 | 0.006038 | 4.29 | 38.02 | 31.52 | 0.61 |
| Main | 16479.65 | 500-YR | 162.00 | 693.24 | 696.47 | | 696.55 | 0.001441 | 2.60 | 138.44 | 221.31 | 0.32 |
| Main | 16403.7* | 500-YR | 162.00 | 693.01 | 696.41 | | 696.46 | 0.000824 | 2.02 | 197.63 | 257.50 | 0.24 |
| Main | 16327.7* | 500-YR | 162.00 | 692.78 | 696.38 | | 696.41 | 0.000446 | 1.53 | 271.75 | 282.17 | 0.18 |
| Main | 16251.7* | 500-YR | 162.00 | 692.54 | 696.37 | | 696.38 | 0.000251 | 1.18 | 357.35 | 308.93 | 0.14 |
| Main | 16175.84 | 500-YR | 161.00 | 692.31 | 696.36 | | 696.37 | 0.000146 | 0.93 | 454.20 | 337.80 | 0.10 |
| Main | 16100.* | 500-YR | 161.00 | 692.07 | 696.35 | | 696.36 | 0.000087 | 0.71 | 675.32 | 652.37 | 0.08 |
| Main | 16024.40 | 500-YR | 161.00 | 691.83 | 696.35 | | 696.35 | 0.000024 | 0.42 | 1108.29 | 1154.01 | 0.04 |
| Main | 15850.19 | 500-YR | 161.00 | 691.30 | 696.35 | | 696.35 | 0.000023 | 0.50 | 1315.24 | 1142.18 | 0.04 |
| Main | 15434.41 | 500-YR | 161.00 | 690.01 | 696.25 | | 696.31 | 0.000482 | 1.96 | 82.64 | 30.77 | 0.19 |
| Main | 15212.53 | 500-YR | 161.00 | 689.73 | 696.17 | | 696.22 | 0.000372 | 1.77 | 90.94 | 25.36 | 0.16 |
| Main | 14922.76 | 500-YR | 161.00 | 689.36 | 696.17 | | 696.17 | 0.000051 | 0.76 | 388.64 | 645.23 | 0.07 |
| Main | 14774.58 | 500-YR | 227.00 | 689.19 | 696.15 | | 696.16 | 0.000088 | 1.05 | 502.92 | 393.69 | 0.09 |
| Main | 14457.09 | 500-YR | 227.00 | 688.79 | 696.12 | | 696.13 | 0.000084 | 1.07 | 391.02 | 270.14 | 0.09 |
| Main | 14406.13 | 500-YR | 227.00 | 688.73 | 696.11 | 690.57 | 696.13 | 0.000074 | 1.17 | 309.44 | 254.00 | 0.08 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | 500-YR | 235.00 | 688.38 | 695.88 | 690.32 | 695.91 | 0.000077 | 1.30 | 180.98 | 209.47 | 0.09 |
| Main | 13949.59 | 500-YR | 235.00 | 688.37 | 695.88 | 690.89 | 695.90 | 0.000097 | 1.35 | 177.35 | 341.88 | 0.11 |
| Main | 13839.56 | 500-YR | 235.00 | 688.25 | 695.88 | 690.80 | 695.89 | 0.000049 | 1.03 | 324.39 | 378.01 | 0.08 |
| Main | 13732.13 | 500-YR | 235.00 | 688.19 | 695.89 | 690.86 | 695.89 | 0.000005 | 0.32 | 817.69 | 377.29 | 0.02 |
| Main | 13662.15 | 500-YR | 235.00 | 688.17 | 695.87 | 690.91 | 695.89 | 0.000077 | 1.26 | 280.07 | 340.91 | 0.09 |
| Main | 13628.36 | 500-YR | 235.00 | 688.12 | 695.86 | 690.58 | 695.88 | 0.000065 | 1.28 | 234.61 | 215.17 | 0.09 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | 500-YR | 255.00 | 688.72 | 695.48 | 690.62 | 695.51 | 0.000342 | 1.35 | 203.23 | 387.42 | 0.10 |
| Main | 13414.20 | 500-YR | 255.00 | 689.00 | 695.47 | 691.05 | 695.49 | 0.000271 | 1.12 | 261.04 | 472.25 | 0.09 |
| Main | 13217.08 | 500-YR | 255.00 | 688.99 | 695.38 | | 695.41 | 0.000602 | 1.54 | 279.94 | 372.83 | 0.13 |
| Main | 13001.02 | 500-YR | 255.00 | 688.98 | 695.08 | | 695.18 | 0.001855 | 2.45 | 104.12 | 26.42 | 0.22 |
| Main | 12615.85 | 500-YR | 255.00 | 688.85 | 694.42 | | 694.50 | 0.001641 | 2.28 | 111.79 | 29.63 | 0.21 |
| Main | 12216.99 | 500-YR | 255.00 | 688.69 | 694.13 | | 694.18 | 0.000453 | 1.81 | 140.91 | 41.25 | 0.17 |
| Main | 12019.91 | 500-YR | 255.00 | 688.59 | 693.91 | | 694.03 | 0.001298 | 2.82 | 91.57 | 32.20 | 0.27 |
| Main | 12001.15 | 500-YR | 255.00 | 688.06 | 693.93 | 689.99 | 693.99 | 0.000441 | 1.89 | 136.56 | 37.63 | 0.16 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | 500-YR | 255.00 | 687.94 | 693.73 | 689.88 | 693.78 | 0.000267 | 1.76 | 151.21 | 43.29 | 0.13 |
| Main | 11831.40 | 500-YR | 255.00 | 688.77 | 693.65 | 690.85 | 693.74 | 0.000867 | 2.45 | 104.02 | 232.03 | 0.22 |
| Main | 11746.9* | 500-YR | 255.00 | 688.77 | 693.65 | | 693.67 | 0.000423 | 1.51 | 386.03 | 384.21 | 0.14 |
| Main | 11662.5* | 500-YR | 255.00 | 688.77 | 693.62 | | 693.63 | 0.000345 | 1.22 | 643.40 | 645.39 | 0.11 |
| Main | 11578.0* | 500-YR | 255.00 | 688.76 | 693.61 | | 693.61 | 0.000154 | 0.78 | 1172.61 | 819.77 | 0.07 |
| Main | 11493.63 | 500-YR | 255.00 | 688.76 | 693.60 | | 693.60 | 0.000052 | 0.44 | 1873.38 | 910.91 | 0.04 |
| Main | 11398.6* | 500-YR | 255.00 | 688.76 | 693.60 | | 693.60 | 0.000061 | 0.49 | 1809.52 | 922.99 | 0.04 |
| Main | 11303.5* | 500-YR | 255.00 | 688.76 | 693.59 | | 693.59 | 0.000061 | 0.49 | 1805.36 | 939.80 | 0.04 |
| Main | 11208.5* | 500-YR | 255.00 | 688.75 | 693.59 | | 693.59 | 0.000057 | 0.48 | 1839.29 | 946.08 | 0.04 |
| Main | 11113.5* | 500-YR | 255.00 | 688.75 | 693.58 | | 693.58 | 0.000051 | 0.45 | 1910.39 | 976.40 | 0.04 |
| Main | 11018.49 | 500-YR | 159.00 | 688.75 | 693.58 | | 693.58 | 0.000017 | 0.26 | 2008.13 | 1017.75 | 0.02 |
| Main | 10922.5* | 500-YR | 159.00 | 688.75 | 693.57 | | 693.58 | 0.000018 | 0.27 | 1682.67 | 871.74 | 0.02 |
| Main | 10826.6* | 500-YR | 159.00 | 688.75 | 693.57 | | 693.57 | 0.000016 | 0.26 | 1634.17 | 790.39 | 0.02 |
| Main | 10730.67 | 500-YR | 159.00 | 688.75 | 693.57 | | 693.57 | 0.000014 | 0.23 | 1614.29 | 759.28 | 0.02 |
| Main | 10638.0* | 500-YR | 159.00 | 688.74 | 693.57 | | 693.57 | 0.000010 | 0.19 | 1794.52 | 796.05 | 0.02 |
| Main | 10545.5* | 500-YR | 159.00 | 688.73 | 693.57 | | 693.57 | 0.000006 | 0.15 | 2115.93 | 846.68 | 0.01 |
| Main | 10452.9* | 500-YR | 159.00 | 688.72 | 693.57 | | 693.57 | 0.000003 | 0.10 | 2539.06 | 899.72 | 0.01 |
| Main | 10360.3* | 500-YR | 159.00 | 688.71 | 693.57 | | 693.57 | 0.000001 | 0.07 | 3058.69 | 965.15 | 0.01 |
| Main | 10267.74 | 500-YR | 159.00 | 688.70 | 693.57 | | 693.57 | 0.000006 | 0.14 | 1894.19 | 1110.58 | 0.01 |
| Main | 10182.4* | 500-YR | 159.00 | 688.69 | 693.57 | | 693.57 | 0.000002 | 0.09 | 3501.41 | 1001.83 | 0.01 |
| Main | 10097.1* | 500-YR | 159.00 | 688.68 | 693.57 | | 693.57 | 0.000002 | 0.08 | 3419.85 | 1012.16 | 0.01 |
| Main | 10011.8* | 500-YR | 159.00 | 688.67 | 693.57 | | 693.57 | 0.000001 | 0.06 | 3410.35 | 1018.53 | 0.01 |
| Main | 9926.510 | 500-YR | 159.00 | 688.66 | 693.57 | | 693.57 | 0.000007 | 0.15 | 2052.03 | 1212.48 | 0.01 |
| Main | 9491.793 | 500-YR | 159.00 | 688.61 | 693.57 | 689.43 | 693.57 | 0.000014 | 0.21 | 1219.05 | 725.97 | 0.02 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | 500-YR | 159.00 | 688.30 | 693.56 | | 693.56 | 0.000008 | 0.16 | 2616.31 | 1293.89 | 0.02 |
| Main | 8784.397 | 500-YR | 159.00 | 688.22 | 693.56 | | 693.56 | 0.000040 | 0.37 | 1347.42 | 1178.11 | 0.03 |
| Main | 8722.829 | 500-YR | 159.00 | 688.12 | 693.55 | 690.31 | 693.55 | 0.000051 | 0.39 | 1266.45 | 975.93 | 0.04 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | 500-YR | 159.00 | 687.48 | 693.55 | 689.12 | 693.55 | 0.000024 | 0.34 | 1452.32 | 986.33 | 0.03 |
| Main | 8631.519 | 500-YR | 159.00 | 687.41 | 693.55 | 689.10 | 693.55 | 0.000029 | 0.36 | 1410.69 | 985.88 | 0.03 |
| Main | 8345.665 | 500-YR | 159.00 | 687.28 | 693.55 | | 693.55 | 0.000002 | 0.11 | 3942.61 | 1382.51 | 0.01 |
| Main | 8047.118 | 500-YR | 145.00 | 687.10 | 693.55 | | 693.55 | 0.000003 | 0.11 | 2477.88 | 837.64 | 0.01 |
| Main | 7739.449 | 500-YR | 145.00 | 686.99 | 693.55 | | 693.55 | 0.000002 | 0.12 | 2365.71 | 1594.50 | 0.01 |
| Main | 7515.565 | 500-YR | 145.00 | 686.79 | 693.54 | | 693.55 | 0.000009 | 0.24 | 916.53 | 411.57 | 0.02 |
| Main | 7272.821 | 500-YR | 145.00 | 686.67 | 693.54 | | 693.54 | 0.000006 | 0.20 | 2793.83 | 1012.44 | 0.01 |
| Main | 7255.385 | 500-YR | 145.00 | 686.00 | 693.54 | 688.32 | 693.54 | 0.000009 | 0.22 | 2711.15 | 966.95 | 0.02 |
| Main | 7226.812 | | Culvert | | | | | | | | | |
| Main | 7193.714 | 500-YR | 145.00 | 685.90 | 693.54 | 688.28 | 693.54 | 0.000004 | 0.17 | 3039.51 | 834.45 | 0.01 |
| Main | 7141.580 | 500-YR | 145.00 | 686.28 | 693.54 | 687.49 | 693.54 | 0.000006 | 0.13 | 2304.20 | 675.12 | 0.01 |
| Main | 7071.87* | 500-YR | 145.00 | 686.28 | 693.54 | | 693.54 | 0.000006 | 0.15 | 2236.60 | 641.81 | 0.01 |

HEC-RAS Plan: LOMR Steady River: Spring Creek Reach: Main Profile: 500-YR (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7002.16* | 500-YR | 145.00 | 686.27 | 693.54 | | 693.54 | 0.000006 | 0.17 | 2186.52 | 587.56 | 0.01 |
| Main | 6932.458 | 500-YR | 145.00 | 686.27 | 693.54 | | 693.54 | 0.000006 | 0.20 | 2143.25 | 562.50 | 0.01 |
| Main | 6846.57* | 500-YR | 145.00 | 686.27 | 693.54 | | 693.54 | 0.000009 | 0.26 | 1660.30 | 516.41 | 0.02 |
| Main | 6760.7* | 500-YR | 145.00 | 686.27 | 693.54 | | 693.54 | 0.000014 | 0.32 | 1276.80 | 576.10 | 0.02 |
| Main | 6674.82* | 500-YR | 145.00 | 686.26 | 693.54 | | 693.54 | 0.000014 | 0.32 | 1374.95 | 608.64 | 0.02 |
| Main | 6588.943 | 500-YR | 145.00 | 686.26 | 693.54 | | 693.54 | 0.000007 | 0.23 | 2010.35 | 629.09 | 0.02 |
| Main | 6495.53* | 500-YR | 145.00 | 686.26 | 693.53 | | 693.54 | 0.000003 | 0.14 | 2780.55 | 831.45 | 0.01 |
| Main | 6402.13* | 500-YR | 145.00 | 686.26 | 693.53 | | 693.53 | 0.000002 | 0.12 | 3611.66 | 1049.78 | 0.01 |
| Main | 6308.73* | 500-YR | 145.00 | 686.27 | 693.53 | 687.48 | 693.53 | 0.000002 | 0.11 | 3421.87 | 1336.60 | 0.01 |
| Main | 6215.32* | 500-YR | 145.00 | 686.27 | 693.53 | 687.44 | 693.53 | 0.000002 | 0.11 | 3144.21 | 1612.74 | 0.01 |
| Main | 6121.924 | 500-YR | 145.00 | 686.27 | 693.53 | 687.39 | 693.53 | 0.000002 | 0.11 | 2790.65 | 1883.41 | 0.01 |
| Main | 6035.96* | 500-YR | 145.00 | 686.27 | 693.53 | 687.45 | 693.53 | 0.000002 | 0.13 | 2548.96 | 1836.51 | 0.01 |
| Main | 5950.01* | 500-YR | 145.00 | 686.27 | 693.53 | 687.51 | 693.53 | 0.000003 | 0.14 | 2229.77 | 1785.38 | 0.01 |
| Main | 5864.05* | 500-YR | 145.00 | 686.27 | 693.53 | 687.62 | 693.53 | 0.000004 | 0.16 | 1831.71 | 1745.16 | 0.01 |
| Main | 5778.104 | 500-YR | 145.00 | 686.27 | 693.53 | 687.84 | 693.53 | 0.000005 | 0.19 | 1394.90 | 1702.18 | 0.01 |
| Main | 5687.63* | 500-YR | 145.00 | 686.28 | 693.53 | 688.12 | 693.53 | 0.000011 | 0.29 | 838.01 | 1202.20 | 0.02 |
| Main | 5597.166 | 500-YR | 145.00 | 686.28 | 693.53 | | 693.53 | 0.000024 | 0.45 | 363.14 | 669.70 | 0.03 |
| Main | 5556.618 | 500-YR | 145.00 | 686.43 | 693.52 | 687.87 | 693.53 | 0.000069 | 0.81 | 190.95 | 637.29 | 0.06 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | 500-YR | 142.00 | 685.19 | 693.40 | 686.75 | 693.41 | 0.000069 | 0.86 | 165.22 | 548.24 | 0.06 |
| Main | 5437.667 | 500-YR | 142.00 | 685.35 | 693.41 | 686.49 | 693.41 | 0.000016 | 0.40 | 358.57 | 539.52 | 0.03 |
| Main | 5357.86* | 500-YR | 142.00 | 685.35 | 693.40 | 686.65 | 693.41 | 0.000027 | 0.48 | 295.58 | 471.20 | 0.04 |
| Main | 5278.05* | 500-YR | 142.00 | 685.34 | 693.40 | 686.87 | 693.40 | 0.000046 | 0.59 | 238.71 | 404.59 | 0.04 |
| Main | 5198.254 | 500-YR | 142.00 | 685.34 | 693.39 | | 693.40 | 0.000082 | 0.76 | 187.92 | 341.64 | 0.06 |
| Main | 5121.63* | 500-YR | 142.00 | 685.34 | 693.38 | 687.21 | 693.39 | 0.000069 | 0.69 | 205.55 | 361.35 | 0.05 |
| Main | 5045.01* | 500-YR | 142.00 | 685.34 | 693.38 | 687.20 | 693.39 | 0.000054 | 0.60 | 289.62 | 532.72 | 0.05 |
| Main | 4968.39* | 500-YR | 142.00 | 685.33 | 693.38 | 687.19 | 693.38 | 0.000027 | 0.47 | 590.31 | 688.23 | 0.04 |
| Main | 4891.776 | 500-YR | 142.00 | 685.33 | 693.38 | | 693.38 | 0.000013 | 0.34 | 1045.92 | 784.24 | 0.02 |
| Main | 4810.20* | 500-YR | 142.00 | 685.33 | 693.38 | 687.29 | 693.38 | 0.000013 | 0.34 | 1027.13 | 783.77 | 0.02 |
| Main | 4728.63* | 500-YR | 142.00 | 685.33 | 693.38 | 687.38 | 693.38 | 0.000015 | 0.35 | 989.15 | 683.57 | 0.03 |
| Main | 4647.06* | 500-YR | 142.00 | 685.32 | 693.38 | 687.45 | 693.38 | 0.000016 | 0.34 | 940.79 | 445.21 | 0.03 |
| Main | 4565.488 | 500-YR | 142.00 | 685.32 | 693.37 | | 693.37 | 0.000032 | 0.47 | 480.09 | 411.98 | 0.04 |
| Main | 4504.263 | 500-YR | 142.00 | 685.32 | 693.36 | 687.54 | 693.37 | 0.000062 | 0.65 | 227.86 | 79.10 | 0.05 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | 500-YR | 142.00 | 684.72 | 692.97 | 687.02 | 692.99 | 0.000110 | 1.11 | 129.34 | 35.01 | 0.07 |
| Main | 4346.582 | 500-YR | 142.00 | 685.50 | 692.96 | 687.22 | 692.97 | 0.000108 | 0.83 | 171.78 | 34.94 | 0.07 |
| Main | 4194.408 | 500-YR | 142.00 | 685.49 | 692.94 | | 692.95 | 0.000127 | 0.85 | 166.11 | 36.87 | 0.07 |
| Main | 3788.373 | 500-YR | 142.00 | 685.36 | 692.94 | | 692.94 | 0.000007 | 0.25 | 1105.69 | 336.92 | 0.02 |
| Main | 3395.646 | 500-YR | 142.00 | 685.01 | 692.94 | | 692.94 | 0.000008 | 0.37 | 773.15 | 260.38 | 0.02 |
| Main | 3331.113 | 500-YR | 142.00 | 685.09 | 692.93 | 686.82 | 692.94 | 0.000029 | 0.68 | 217.19 | 148.47 | 0.05 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | 500-YR | 113.00 | 683.69 | 689.83 | 686.16 | 689.88 | 0.000315 | 1.83 | 69.67 | 23.36 | 0.14 |
| Main | 3141.921 | 500-YR | 113.00 | 683.98 | 689.82 | | 689.85 | 0.000368 | 1.51 | 74.68 | 20.31 | 0.14 |
| Main | 3004.055 | 500-YR | 113.00 | 683.97 | 689.80 | | 689.81 | 0.000157 | 1.09 | 104.03 | 25.31 | 0.09 |
| Main | 2734.719 | 500-YR | 113.00 | 683.96 | 689.74 | | 689.76 | 0.000231 | 1.23 | 91.57 | 25.29 | 0.11 |
| Main | 2688.915 | 500-YR | 113.00 | 683.95 | 689.73 | 686.08 | 689.75 | 0.000264 | 1.27 | 88.77 | 26.00 | 0.12 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | 500-YR | 113.00 | 683.44 | 689.24 | 685.62 | 689.31 | 0.000814 | 2.06 | 54.94 | 14.22 | 0.18 |
| Main | 2582.291 | 500-YR | 113.00 | 683.33 | 689.23 | 685.58 | 689.27 | 0.000468 | 1.70 | 66.54 | 16.94 | 0.15 |
| Main | 2218.895 | 500-YR | 113.00 | 682.33 | 689.22 | | 689.23 | 0.000040 | 0.64 | 176.81 | 39.83 | 0.05 |
| Main | 2049.666 | 500-YR | 113.00 | 681.91 | 689.22 | | 689.22 | 0.000033 | 0.57 | 293.90 | 106.89 | 0.05 |
| Main | 1853.478 | 500-YR | 484.00 | 681.42 | 689.07 | | 689.16 | 0.000697 | 2.43 | 199.15 | 48.16 | 0.21 |
| Main | 1799.666 | 500-YR | 484.00 | 681.24 | 689.02 | 685.14 | 689.12 | 0.000747 | 2.51 | 193.68 | 46.94 | 0.21 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | 500-YR | 484.00 | 681.24 | 687.85 | 685.30 | 688.09 | 0.001731 | 3.99 | 129.56 | 60.63 | 0.32 |
| Main | 1606.765 | 500-YR | 484.00 | 681.22 | 687.88 | 685.50 | 687.95 | 0.000580 | 2.16 | 237.77 | 443.18 | 0.19 |
| Main | 1475.852 | 500-YR | 484.00 | 681.21 | 687.41 | | 687.61 | 0.002340 | 3.67 | 157.83 | 96.96 | 0.37 |
| Main | 1134.554 | 500-YR | 484.00 | 681.17 | 686.55 | | 686.78 | 0.002512 | 3.85 | 125.63 | 40.66 | 0.39 |
| Main | 792.3003 | 500-YR | 484.00 | 681.12 | 685.20 | | 685.53 | 0.005573 | 5.17 | 260.15 | 355.38 | 0.56 |
| Main | 482.8005 | 500-YR | 585.00 | 680.38 | 685.22 | | 685.22 | 0.000259 | 1.41 | 1860.57 | 894.69 | 0.13 |
| Main | 35.46111 | 500-YR | 585.00 | 680.10 | 685.20 | 680.80 | 685.20 | 0.000020 | 0.49 | 2312.92 | 803.77 | 0.04 |

# Floodway Calculation Table

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total | Floodway Top Width | Floodway WSEL | Floodway Area | Floodway Velocity | Storage Percentage | Change in Velocity | WSEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (sq ft) | (ft/s) | (ft) | (ft) | (sq ft) | (ft/s) | | | |
| Main | 17035.08 | 100-YR | 20.44 | 699.31 | 28.27 | 2.44 | 20.44 | 699.31 | 28.27 | 2.44 | 1.00 | 0.00 | 0 |
| Main | 16983.37 | 100-YR | 16.81 | 698.96 | 18.26 | 3.78 | 16.81 | 698.96 | 18.26 | 3.78 | 1.00 | 0.00 | 0 |
| Main | 16899.4* | 100-YR | 17.45 | 698.31 | 18.49 | 3.73 | 17.45 | 698.31 | 18.49 | 3.73 | 1.00 | 0.00 | 0 |
| Main | 16815.4* | 100-YR | 17.95 | 697.65 | 18.53 | 3.72 | 17.95 | 697.65 | 18.53 | 3.72 | 1.00 | 0.00 | 0 |
| Main | 16731.5* | 100-YR | 18.49 | 696.99 | 18.77 | 3.68 | 18.49 | 696.99 | 18.77 | 3.68 | 1.00 | 0.00 | 0 |
| Main | 16647.5* | 100-YR | 18.9 | 696.32 | 18.6 | 3.71 | 18.9 | 696.32 | 18.6 | 3.71 | 1.00 | 0.00 | 0 |
| Main | 16563.6* | 100-YR | 19.2 | 695.74 | 20.13 | 3.43 | 19.21 | 695.74 | 20.15 | 3.42 | 1.00 | 0.00 | 0 |
| Main | 16479.65 | 100-YR | 20.84 | 695.48 | 27.42 | 2.52 | 20.86 | 695.48 | 27.45 | 2.51 | 1.00 | 0.00 | 0 |
| Main | 16403.7* | 100-YR | 26.84 | 695.35 | 34.31 | 2.01 | 26.86 | 695.35 | 34.37 | 2.01 | 1.00 | 0.00 | 0 |
| Main | 16327.7* | 100-YR | 39.63 | 695.26 | 42.54 | 1.62 | 33.68 | 695.27 | 42.51 | 1.62 | 1.00 | 0.00 | 0.01 |
| Main | 16251.7* | 100-YR | 122.38 | 695.21 | 63.41 | 1.09 | 98.29 | 695.21 | 59.46 | 1.16 | 0.94 | 0.06 | 0 |
| Main | 16175.84 | 100-YR | 192.14 | 695.16 | 102.23 | 0.84 | 166.39 | 695.16 | 94.68 | 0.91 | 0.93 | 0.08 | 0 |
| Main | 16100.* | 100-YR | 143.4 | 695.12 | 92.52 | 0.93 | 126.81 | 695.12 | 87.86 | 0.98 | 0.95 | 0.05 | 0 |
| Main | 16024.4 | 100-YR | 595.71 | 695.12 | 420.15 | 0.24 | 464.99 | 695.12 | 400.85 | 0.25 | 0.95 | 0.04 | 0 |
| Main | 15850.19 | 100-YR | 700.51 | 695.11 | 622.51 | 0.16 | 540 | 695.11 | 583.13 | 0.17 | 0.94 | 0.06 | 0 |
| Main | 15434.41 | 100-YR | 19.93 | 695.01 | 54.88 | 1.57 | 19.93 | 695.01 | 54.92 | 1.57 | 1.00 | 0.00 | 0 |
| Main | 15212.53 | 100-YR | 21.26 | 694.94 | 62.31 | 1.38 | 21.27 | 694.94 | 62.35 | 1.38 | 1.00 | 0.00 | 0 |
| Main | 14922.76 | 100-YR | 432.27 | 694.92 | 502.15 | 0.4 | 337.78 | 694.93 | 459.11 | 0.4 | 0.91 | 0.00 | 0.01 |
| Main | 14774.58 | 100-YR | 325.76 | 694.89 | 418.9 | 0.55 | 266.56 | 694.9 | 382.77 | 0.55 | 0.91 | 0.00 | 0.01 |
| Main | 14457.09 | 100-YR | 219.32 | 694.85 | 316.04 | 0.64 | 175.72 | 694.85 | 290.76 | 0.64 | 0.92 | 0.00 | 0 |
| Main | 14406.13 | 100-YR | 140.46 | 694.84 | 301.17 | 0.64 | 100.46 | 694.84 | 273.88 | 0.64 | 0.91 | 0.00 | 0 |
| Main | 14204.08 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 13981.41 | 100-YR | 32.88 | 694.76 | 154.62 | 1.03 | 32.89 | 694.76 | 154.69 | 1.03 | 1.00 | 0.00 | 0 |
| Main | 13949.59 | 100-YR | 325.68 | 694.75 | 1370.05 | 1.12 | 287.37 | 694.75 | 1241.85 | 1.12 | 0.91 | 0.00 | 0 |
| Main | 13839.56 | 100-YR | 351.53 | 694.74 | 1466.9 | 1.03 | 313.35 | 694.74 | 1329.57 | 1.03 | 0.91 | 0.00 | 0 |
| Main | 13732.13 | 100-YR | 365 | 694.75 | 1188.71 | 0.38 | 331.88 | 694.75 | 1075.03 | 0.41 | 0.90 | 0.08 | 0 |
| Main | 13662.15 | 100-YR | 261.68 | 694.73 | 239.07 | 0.8 | 222.09 | 694.73 | 217.55 | 0.8 | 0.91 | 0.00 | 0 |
| Main | 13628.36 | 100-YR | 205.13 | 694.73 | 238.97 | 0.86 | 145.69 | 694.73 | 220.38 | 0.86 | 0.92 | 0.00 | 0 |
| Main | 13536.36 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 13453.85 | 100-YR | 333.16 | 694.57 | 399.7 | 1.08 | 272.58 | 694.58 | 360.29 | 1.08 | 0.90 | 0.00 | 0.01 |
| Main | 13414.2 | 100-YR | 346.75 | 694.56 | 377.63 | 0.93 | 274 | 694.57 | 348.71 | 0.93 | 0.92 | 0.00 | 0.01 |
| Main | 13217.08 | 100-YR | 174.43 | 694.44 | 169 | 1.32 | 150.54 | 694.44 | 155.5 | 1.32 | 0.92 | 0.00 | 0 |
| Main | 13001.02 | 100-YR | 23.89 | 694.13 | 80.14 | 2.23 | 23.89 | 694.13 | 80.21 | 2.23 | 1.00 | 0.00 | 0 |
| Main | 12615.85 | 100-YR | 26.44 | 693.43 | 84.13 | 2.13 | 26.46 | 693.44 | 84.28 | 2.12 | 1.00 | 0.00 | 0.01 |
| Main | 12216.99 | 100-YR | 34.73 | 693.08 | 101.96 | 1.76 | 34.76 | 693.09 | 102.23 | 1.75 | 1.00 | -0.01 | 0.01 |
| Main | 12019.91 | 100-YR | 23.02 | 692.81 | 62.36 | 2.87 | 23 | 692.82 | 62.6 | 2.86 | 1.00 | 0.00 | 0.01 |
| Main | 12001.15 | 100-YR | 28.52 | 692.84 | 102.38 | 1.75 | 28.49 | 692.85 | 102.67 | 1.74 | 1.00 | -0.01 | 0.01 |
| Main | 11937.42 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 11882.28 | 100-YR | 40.35 | 692.7 | 143.14 | 1.48 | 33.85 | 692.71 | 129.64 | 1.49 | 0.91 | 0.01 | 0.01 |
| Main | 11831.4 | 100-YR | 94.42 | 692.61 | 100.95 | 2.34 | 68.6 | 692.62 | 91.95 | 2.33 | 0.91 | 0.00 | 0.01 |
| Main | 11746.9* | 100-YR | 128.19 | 692.52 | 107.78 | 1.66 | 90.08 | 692.53 | 102.03 | 1.75 | 0.95 | 0.05 | 0.01 |
| Main | 11662.5* | 100-YR | 219.12 | 692.4 | 132.2 | 1.35 | 141.02 | 692.42 | 120.05 | 1.49 | 0.91 | 0.10 | 0.02 |
| Main | 11578.0* | 100-YR | 449.36 | 692.28 | 221.17 | 0.81 | 362.2 | 692.29 | 200.98 | 0.89 | 0.91 | 0.10 | 0.01 |

# Floodway Calculation Table

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total | Floodway Top Width | Floodway WSEL | Floodway Area | Floodway Velocity | Storage Percentage | Change in Velocity | WSEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Main | 11493.63 | 100-YR | 808.64 | 692.24 | 683.14 | 0.26 | 709.04 | 692.26 | 633.46 | 0.28 | 0.93 | 0.08 | 0.02 |
| Main | 11398.6* | 100-YR | 801.35 | 692.19 | 583.66 | 0.31 | 627.99 | 692.21 | 523.81 | 0.34 | 0.90 | 0.10 | 0.02 |
| Main | 11303.5* | 100-YR | 795.41 | 692.13 | 529.62 | 0.34 | 610.08 | 692.14 | 475.69 | 0.38 | 0.90 | 0.12 | 0.01 |
| Main | 11208.5* | 100-YR | 714.98 | 692.07 | 521.27 | 0.34 | 576.29 | 692.08 | 467.59 | 0.38 | 0.90 | 0.12 | 0.01 |
| Main | 11113.5* | 100-YR | 662.36 | 692.02 | 547.72 | 0.33 | 528.12 | 692.03 | 494.29 | 0.36 | 0.90 | 0.09 | 0.01 |
| Main | 11018.49 | 100-YR | 648.72 | 692 | 605.9 | 0.22 | 533.79 | 692.01 | 553.44 | 0.24 | 0.91 | 0.09 | 0.01 |
| Main | 10922.5* | 100-YR | 566.51 | 691.97 | 506.63 | 0.26 | 424.96 | 691.98 | 467.01 | 0.28 | 0.92 | 0.08 | 0.01 |
| Main | 10826.6* | 100-YR | 525.08 | 691.96 | 519.77 | 0.25 | 410.55 | 691.96 | 484.08 | 0.27 | 0.93 | 0.08 | 0 |
| Main | 10730.67 | 100-YR | 501.77 | 691.94 | 547.9 | 0.24 | 402.18 | 691.95 | 513.2 | 0.26 | 0.94 | 0.08 | 0.01 |
| Main | 10638.0* | 100-YR | 553.9 | 691.94 | 665.5 | 0.2 | 382.33 | 691.95 | 604.58 | 0.22 | 0.91 | 0.10 | 0.01 |
| Main | 10545.5* | 100-YR | 617.16 | 691.94 | 894.09 | 0.15 | 459.42 | 691.94 | 808.14 | 0.16 | 0.90 | 0.07 | 0 |
| Main | 10452.9* | 100-YR | 710.06 | 691.93 | 1222.49 | 0.11 | 551.22 | 691.94 | 1100.28 | 0.12 | 0.90 | 0.09 | 0.01 |
| Main | 10360.3* | 100-YR | 740.01 | 691.93 | 1636.75 | 0.08 | 634.48 | 691.94 | 1492.99 | 0.09 | 0.91 | 0.13 | 0.01 |
| Main | 10267.74 | 100-YR | 815.73 | 691.93 | 2125.62 | 0.4 | 708.47 | 691.94 | 1983.21 | 0.41 | 0.93 | 0.02 | 0.01 |
| Main | 10182.4* | 100-YR | 768.42 | 691.93 | 2038.32 | 0.06 | 673.29 | 691.94 | 1853.78 | 0.07 | 0.91 | 0.17 | 0.01 |
| Main | 10097.1* | 100-YR | 765.46 | 691.93 | 1965.85 | 0.07 | 678.75 | 691.94 | 1797.19 | 0.07 | 0.91 | 0.00 | 0.01 |
| Main | 10011.8* | 100-YR | 790.61 | 691.93 | 1901.31 | 0.07 | 707.39 | 691.94 | 1733.4 | 0.08 | 0.91 | 0.14 | 0.01 |
| Main | 9926.51 | 100-YR | 881.45 | 691.93 | 1918.46 | 0.39 | 793.18 | 691.93 | 1720.7 | 0.39 | 0.90 | 0.00 | 0 |
| Main | 9491.793 | 100-YR | 436.45 | 691.89 | 967.13 | 0.49 | 380.34 | 691.9 | 878.70 | 0.49 | 0.91 | 0.00 | 0.01 |
| Main | 9382.78 | | Inl Struct | | | | Inl Struct | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 8939.248 | 100-YR | 847.33 | 691.89 | 743.79 | 0.18 | 646.47 | 691.89 | 678.25 | 0.2 | 0.91 | 0.11 | 0 |
| Main | 8784.397 | 100-YR | 885.21 | 691.86 | 906.16 | 0.3 | 713.96 | 691.87 | 821.41 | 0.31 | 0.91 | 0.03 | 0.01 |
| Main | 8722.829 | 100-YR | 594.57 | 691.81 | 749.82 | 0.3 | 513.55 | 691.82 | 677.28 | 0.33 | 0.90 | 0.10 | 0.01 |
| Main | 8695.034 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 8674.268 | 100-YR | 659.81 | 691.81 | 830.5 | 0.25 | 567.19 | 691.82 | 747.13 | 0.26 | 0.90 | 0.04 | 0.01 |
| Main | 8631.519 | 100-YR | 612.68 | 691.81 | 796.76 | 0.26 | 487.74 | 691.81 | 713.98 | 0.26 | 0.90 | 0.00 | 0 |
| Main | 8345.665 | 100-YR | 1240.99 | 691.8 | 1780.23 | 0.08 | 1047.74 | 691.8 | 1601.29 | 0.09 | 0.90 | 0.13 | 0 |
| Main | 8047.118 | 100-YR | 746.24 | 691.79 | 1631.94 | 0.11 | 615 | 691.8 | 1469.77 | 0.12 | 0.90 | 0.09 | 0.01 |
| Main | 7739.449 | 100-YR | 1501.85 | 691.79 | 2501.67 | 0.1 | 1153 | 691.79 | 2241.54 | 0.11 | 0.90 | 0.10 | 0 |
| Main | 7515.565 | 100-YR | 332.2 | 691.79 | 747.61 | 0.23 | 288.42 | 691.79 | 677.4 | 0.23 | 0.91 | 0.00 | 0 |
| Main | 7272.821 | 100-YR | 909.38 | 691.78 | 1444.37 | 0.11 | 680 | 691.78 | 1299.06 | 0.12 | 0.90 | 0.09 | 0 |
| Main | 7255.385 | 100-YR | 811.72 | 691.78 | 2077.96 | 0.1 | 620 | 691.78 | 1893.19 | 0.11 | 0.91 | 0.10 | 0 |
| Main | 7226.812 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 7193.714 | 100-YR | 667.23 | 691.78 | 1769.09 | 0.07 | 535 | 691.78 | 1593.66 | 0.08 | 0.90 | 0.14 | 0 |
| Main | 7141.58 | 100-YR | 609.82 | 691.78 | 1175.11 | 0.11 | 515 | 691.78 | 1052.1 | 0.11 | 0.90 | 0.00 | 0 |
| Main | 7071.87* | 100-YR | 558.56 | 691.77 | 1173.94 | 0.1 | 463 | 691.78 | 1053.05 | 0.11 | 0.90 | 0.10 | 0.01 |
| Main | 7002.16* | 100-YR | 547.7 | 691.77 | 1181.38 | 0.1 | 430 | 691.77 | 1063.98 | 0.11 | 0.90 | 0.10 | 0 |
| Main | 6932.458 | 100-YR | 513.27 | 691.77 | 1203.73 | 0.1 | 418 | 691.77 | 1088.43 | 0.11 | 0.90 | 0.10 | 0 |
| Main | 6846.57* | 100-YR | 444.15 | 691.77 | 779.47 | 0.15 | 332 | 691.77 | 731.46 | 0.16 | 0.94 | 0.07 | 0 |
| Main | 6760.7* | 100-YR | 313.07 | 691.76 | 536.42 | 0.22 | 215 | 691.76 | 483.08 | 0.24 | 0.90 | 0.09 | 0 |
| Main | 6674.82* | 100-YR | 349.69 | 691.76 | 470.26 | 0.25 | 221.45 | 691.76 | 431.11 | 0.27 | 0.92 | 0.08 | 0 |
| Main | 6588.943 | 100-YR | 526.88 | 691.76 | 1002.16 | 0.12 | 476.59 | 691.76 | 903.15 | 0.13 | 0.90 | 0.08 | 0 |
| Main | 6495.53* | 100-YR | 712.8 | 691.75 | 1432.96 | 0.08 | 631.44 | 691.76 | 1287.4 | 0.09 | 0.90 | 0.13 | 0.01 |
| Main | 6402.13* | 100-YR | 906.49 | 691.75 | 1878.17 | 0.06 | 789.38 | 691.75 | 1689.07 | 0.07 | 0.90 | 0.17 | 0 |

# Floodway Calculation Table

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total | Floodway Top Width | Floodway WSEL | Floodway Area | Floodway Velocity | Storage Percentage | Change in Velocity | WSEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Main | 6308.73* | 100-YR | 1141.81 | 691.75 | 2345.54 | 0.06 | 956.08 | 691.75 | 2116.43 | 0.06 | 0.90 | 0.00 | 0 |
| Main | 6215.32* | 100-YR | 1485.95 | 691.75 | 2900.12 | 0.06 | 1153.92 | 691.75 | 2628.16 | 0.06 | 0.91 | 0.00 | 0 |
| Main | 6121.924 | 100-YR | 1805.53 | 691.75 | 3649.23 | 0.07 | 1522.04 | 691.75 | 3327.81 | 0.07 | 0.91 | 0.00 | 0 |
| Main | 6035.96* | 100-YR | 1748.64 | 691.75 | 3579.73 | 0.08 | 1446.54 | 691.75 | 3242.9 | 0.08 | 0.91 | 0.00 | 0 |
| Main | 5950.01* | 100-YR | 1703.48 | 691.75 | 3556.17 | 0.09 | 1417.91 | 691.75 | 3246.43 | 0.09 | 0.91 | 0.00 | 0 |
| Main | 5864.05* | 100-YR | 1677.45 | 691.75 | 3569.02 | 0.11 | 1358.99 | 691.75 | 3218.99 | 0.1 | 0.90 | -0.09 | 0 |
| Main | 5778.104 | 100-YR | 1651.33 | 691.75 | 3599.88 | 0.14 | 1364.84 | 691.75 | 3293.75 | 0.14 | 0.91 | 0.00 | 0 |
| Main | 5687.63* | 100-YR | 1144.72 | 691.74 | 2724.66 | 0.23 | 1018.52 | 691.75 | 2554.39 | 0.23 | 0.94 | 0.00 | 0.01 |
| Main | 5597.166 | 100-YR | 647.62 | 691.73 | 1655.24 | 0.53 | 573.61 | 691.74 | 1503.24 | 0.53 | 0.91 | 0.00 | 0.01 |
| Main | 5556.618 | 100-YR | 534.54 | 691.72 | 1041.92 | 0.91 | 426.28 | 691.72 | 950.96 | 0.91 | 0.91 | 0.00 | 0 |
| Main | 5525.006 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 5490.413 | 100-YR | 375.6 | 691.63 | 334.72 | 0.9 | 329.52 | 691.63 | 304.8 | 0.9 | 0.91 | 0.00 | 0 |
| Main | 5437.667 | 100-YR | 474.11 | 691.64 | 1131.93 | 0.44 | 400.73 | 691.64 | 1025.33 | 0.44 | 0.91 | 0.00 | 0 |
| Main | 5357.86* | 100-YR | 408.08 | 691.63 | 926.63 | 0.54 | 344.74 | 691.63 | 832.76 | 0.54 | 0.90 | 0.00 | 0 |
| Main | 5278.05* | 100-YR | 347.05 | 691.62 | 752.99 | 0.68 | 300.41 | 691.62 | 683.09 | 0.68 | 0.91 | 0.00 | 0 |
| Main | 5198.254 | 100-YR | 283.19 | 691.61 | 605.26 | 0.87 | 249.73 | 691.61 | 551.24 | 0.87 | 0.91 | 0.00 | 0 |
| Main | 5121.63* | 100-YR | 311.87 | 691.6 | 595.5 | 0.81 | 262.34 | 691.6 | 543.37 | 0.81 | 0.91 | 0.00 | 0 |
| Main | 5045.01* | 100-YR | 321.91 | 691.59 | 619.7 | 0.74 | 263.28 | 691.59 | 565.89 | 0.74 | 0.91 | 0.00 | 0 |
| Main | 4968.39* | 100-YR | 343.05 | 691.59 | 695.6 | 0.59 | 279 | 691.59 | 630.29 | 0.59 | 0.91 | 0.00 | 0 |
| Main | 4891.776 | 100-YR | 531.24 | 691.58 | 864.78 | 0.36 | 410 | 691.59 | 790.14 | 0.37 | 0.91 | 0.03 | 0.01 |
| Main | 4810.20* | 100-YR | 452.48 | 691.58 | 410.14 | 0.38 | 322 | 691.58 | 376.24 | 0.4 | 0.92 | 0.05 | 0 |
| Main | 4728.63* | 100-YR | 296.53 | 691.57 | 278.18 | 0.41 | 278.12 | 691.57 | 249.97 | 0.45 | 0.90 | 0.10 | 0 |
| Main | 4647.06* | 100-YR | 278.97 | 691.56 | 274.52 | 0.41 | 263.89 | 691.56 | 248.78 | 0.45 | 0.91 | 0.10 | 0 |
| Main | 4565.488 | 100-YR | 260.73 | 691.55 | 269.96 | 0.51 | 186.61 | 691.55 | 242.82 | 0.51 | 0.90 | 0.00 | 0 |
| Main | 4504.263 | 100-YR | 69.61 | 691.54 | 157.14 | 0.81 | 52.32 | 691.54 | 142.47 | 0.81 | 0.91 | 0.00 | 0 |
| Main | 4461.252 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 4430.212 | 100-YR | 28.57 | 691.29 | 120.83 | 1.14 | 28 | 691.29 | 120.74 | 1.14 | 1.00 | 0.00 | 0 |
| Main | 4346.582 | 100-YR | 30.16 | 691.28 | 117.13 | 0.96 | 30.16 | 691.28 | 117.14 | 0.96 | 1.00 | 0.00 | 0 |
| Main | 4194.408 | 100-YR | 30 | 691.25 | 109.41 | 1.03 | 30 | 691.25 | 109.43 | 1.03 | 1.00 | 0.00 | 0 |
| Main | 3788.373 | 100-YR | 283.09 | 691.24 | 575.05 | 0.2 | 220 | 691.24 | 525.61 | 0.21 | 0.91 | 0.05 | 0 |
| Main | 3395.646 | 100-YR | 218.85 | 691.23 | 533.36 | 0.23 | 160 | 691.23 | 493.01 | 0.23 | 0.92 | 0.00 | 0 |
| Main | 3331.113 | 100-YR | 91.03 | 691.22 | 189.34 | 0.72 | 60 | 691.22 | 179.06 | 0.72 | 0.95 | 0.00 | 0 |
| Main | 3265.168 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 3196.567 | 100-YR | 20.85 | 688.68 | 61.4 | 1.88 | 20.67 | 688.69 | 61.65 | 1.87 | 1.00 | -0.01 | 0.01 |
| Main | 3141.921 | 100-YR | 17.34 | 688.65 | 52.66 | 1.9 | 17.38 | 688.66 | 52.88 | 1.89 | 1.00 | -0.01 | 0.01 |
| Main | 3004.055 | 100-YR | 22.57 | 688.6 | 75.51 | 1.32 | 22.6 | 688.62 | 75.81 | 1.32 | 1.00 | 0.00 | 0.02 |
| Main | 2734.719 | 100-YR | 21.54 | 688.49 | 62.22 | 1.61 | 21.59 | 688.5 | 62.54 | 1.6 | 1.01 | -0.01 | 0.01 |
| Main | 2688.915 | 100-YR | 21.62 | 688.45 | 58.31 | 1.72 | 21.68 | 688.47 | 58.64 | 1.71 | 1.01 | -0.01 | 0.02 |
| Main | 2653.174 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 2626.817 | 100-YR | 11.41 | 687.84 | 36.9 | 2.71 | 11.46 | 687.86 | 37.17 | 2.69 | 1.01 | -0.01 | 0.02 |
| Main | 2582.291 | 100-YR | 14.48 | 687.79 | 43.97 | 2.27 | 14.52 | 687.82 | 44.33 | 2.26 | 1.01 | 0.00 | 0.03 |
| Main | 2218.895 | 100-YR | 34.14 | 687.76 | 123.53 | 0.81 | 34.22 | 687.78 | 124.39 | 0.8 | 1.01 | -0.01 | 0.02 |
| Main | 2049.666 | 100-YR | 81.1 | 687.74 | 158.02 | 0.63 | 76.61 | 687.77 | 158.54 | 0.63 | 1.00 | 0.00 | 0.03 |
| Main | 1853.478 | 100-YR | 37.65 | 687.6 | 135.87 | 2.24 | 37.86 | 687.63 | 136.94 | 2.22 | 1.01 | -0.01 | 0.03 |

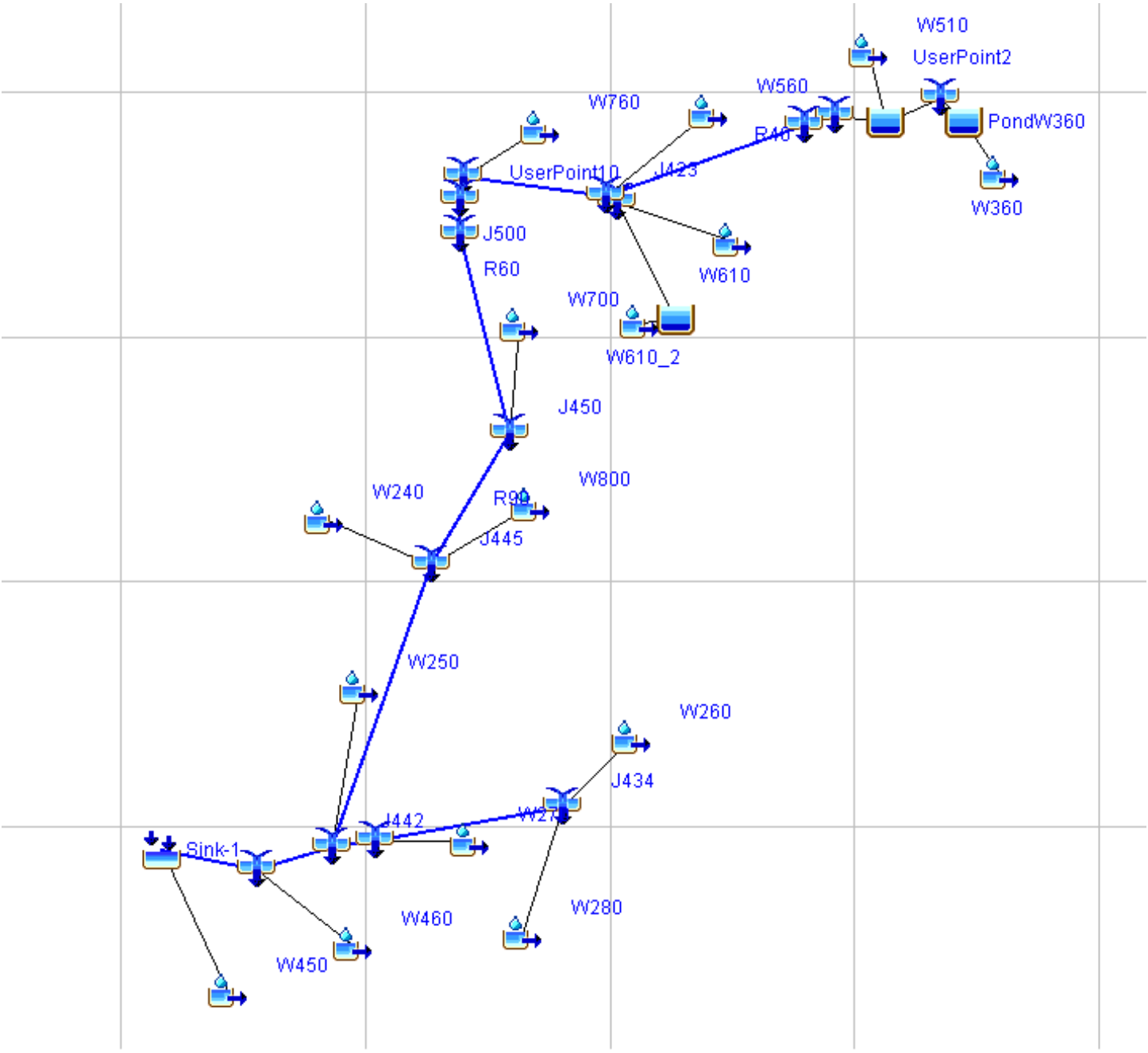
# Floodway Calculation Table

| Reach | River Sta | Profile | Top Width | W.S. Elev | Area | Vel Total | Floodway Top Width | Floodway WSEL | Floodway Area | Floodway Velocity | Storage Percentage | Change in Velocity | WSEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Main | 1799.666 | 100-YR | 37.6 | 687.55 | 132.27 | 2.3 | 33 | 687.58 | 131.03 | 2.32 | 0.99 | 0.01 | 0.03 |
| Main | 1727.858 | | Culvert | | | | Culvert | | | | #DIV/0! | #DIV/0! | 0 |
| Main | 1670.018 | 100-YR | 37.57 | 686.97 | 115.43 | 2.89 | 29.07 | 687 | 108.04 | 2.87 | 0.94 | -0.01 | 0.03 |
| Main | 1606.765 | 100-YR | 426.71 | 686.96 | 395.62 | 1.75 | 126.26 | 686.99 | 357.5 | 1.72 | 0.90 | -0.02 | 0.03 |
| Main | 1475.852 | 100-YR | 54.44 | 686.64 | 94.39 | 3.22 | 32 | 686.66 | 88.09 | 3.45 | 0.93 | 0.07 | 0.02 |
| Main | 1134.554 | 100-YR | 37.17 | 685.92 | 101.35 | 3 | 27 | 685.92 | 91.99 | 3.3 | 0.91 | 0.10 | 0 |
| Main | 792.3003 | 100-YR | 194.29 | 684.65 | 115.08 | 2.64 | 129.58 | 684.65 | 104.55 | 2.91 | 0.91 | 0.10 | 0 |
| Main | 482.8005 | 100-YR | 848.37 | 684.71 | 1417.7 | 0.25 | 677.52 | 684.71 | 1313.92 | 0.27 | 0.93 | 0.08 | 0 |
| Main | 35.46111 | 100-YR | 769.39 | 684.7 | 1919.79 | 0.19 | 623 | 684.7 | 1762.01 | 0.2 | 0.92 | 0.05 | 0 |

# *Appendix 2*

# *Hydrologic Calculations*

# HEC-HMS MODEL SCHEMATIC



LEGEND

Calumet-Sag Curve Numbers

Value

High : 100

Low : 30

N

0 1 2

Miles

DRAFT

Appendix D.1
Calumet-Sag Watershed Curve Number Grid

CH2MHILL

File Path: Q:\Project_Data\GIS\WorkingMaps\Report\Appendices\AppendixC_FigureC.1.mxd, Date: October 15, 2008 1:26:27 PM, User: KBUCKVOL

| Data Comparison Table | | | |
|---|---|---|---|
| | | | |
| Location | Area (sq. mi.) | | |
| | FIS | LOMR | StreamStats |
| At 118th Avenue (XS 1799.666) | 2.3 | 2.3 | 2.3 |
| At 159th Street (XS 5556.618) | 1.6 | 1.6 | 1.5 |
| At 151st Street and Wold Road (XS 13628.36) | 0.8 | 0.8 | 0.8 |
| | | | |
| Location | 10-Year Flows (cfs) | | |
| | FIS | LOMR | StreamStats |
| At 118th Avenue (XS 1799.666) | 108 | 157 | 139 |
| At 159th Street (XS 5556.618) | 61 | 80 | 96 |
| At 151st Street and Wold Road (XS 13628.36) | 64 | 81 | 72 |
| | | | |
| Location | 50-Year Flows (cfs) | | |
| | FIS | LOMR | StreamStats |
| At 118th Avenue (XS 1799.666) | 205 | 244 | 210 |
| At 159th Street (XS 5556.618) | 90 | 107 | 146 |
| At 151st Street and Wold Road (XS 13628.36) | 112 | 129 | 113 |
| | | | |
| Location | 100-Year Flows (cfs) | | |
| | FIS | LOMR | StreamStats |
| At 118th Avenue (XS 1799.666) | 259 | 304 | 247 |
| At 159th Street (XS 5556.618) | 97 | 117 | 172 |
| At 151st Street and Wold Road (XS 13628.36) | 139 | 153 | 135 |
| | | | |
| Location | 500-Year Flows (cfs) | | |
| | FIS | LOMR | StreamStats |
| At 118th Avenue (XS 1799.666) | 396 | 484 | 342 |
| At 159th Street (XS 5556.618) | 117 | 145 | 241 |
| At 151st Street and Wold Road (XS 13628.36) | 195 | 235 | 193 |

| FIS XS | CBBEL HEC-RAS Station | Flowrate (cfs) | | | WSEL (ft, NAVD) | | |
|---|---|---|---|---|---|---|---|
| | | FIS | Unsteady Model | Steady Model | FIS | Unsteady Model | Steady Model |
| S | 16983.37 | 67 | 63 | 69 | 700.7 | 698.9 | 698.96 |
| R | 16024.4 | 98 | 73 | 86 | 695.8 | 695.06 | 695.12 |
| Q | 15850.19 | 98 | 75 | 86 | 695.8 | 695.05 | 695.11 |
| P | 15212.53 | 139 | 82 | 86 | 695.3 | 694.87 | 694.94 |
| O | 14457.09 | 139 | 145 | 145 | 694.7 | 694.75 | 694.85 |
| Wolf Road | | | | | | | |
| N | 13981.41 | 148 | 145 | 153 | 693.9 | 694.66 | 694.76 |
| 151st Street (Upstream Crossing) | | | | | | | |
| M | 13453.85 | 183 | 153 | 179 | 693.6 | 694.48 | 694.57 |
| L | 12019.91 | 183 | 176 | 179 | 693.1 | 692.78 | 692.81 |
| 151st Street (Downstream Crossing) | | | | | | | |
| K | 11831.4 | 144 | 177 | 179 | 692.8 | 692.63 | 692.61 |
| J | 8722.829 | 144 | 124 | 131 | 691.4 | 691.83 | 691.81 |
| 155th Street | | | | | | | |
| 157th Street | | | | | | | |
| I | 7193.714 | 97 | 116 | 117 | 691.3 | 691.78 | 691.78 |
| 159th Street | | | | | | | |
| H | 5490.413 | 105 | 113 | 113 | 691.1 | 691.65 | 691.63 |
| Jaunita Drive | | | | | | | |
| G | 4346.582 | 105 | 113 | 113 | 690.9 | 691.3 | 691.28 |
| F | 3331.113 | 105 | 113 | 113 | 690.8 | 691.21 | 691.22 |
| Private Drive | | | | | | | |
| E | 3196.567 | 105 | 83 | 100 | 689.4 | 689.07 | 688.68 |
| Field Access Road | | | | | | | |
| D | 2582.291 | 107 | 90 | 100 | 688.4 | 688.55 | 687.79 |
| C | 1799.666 | 259 | 272 | 304 | 686.7 | 688.34 | 687.55 |
| Will-Cook Road | | | | | | | |
| B | 1670.018 | 259 | 245 | 304 | 685.2 | 688.01 | 686.97 |
| A | 482.8005 | 738 | 361 | 361 | 682.9 | 684.74 | 684.71 |

10-yr

HEC-RAS Plan: 10yrHuff River: Spring Creek Reach: Main Profile: Max WS

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | Max WS | 39.10 | 696.40 | 698.88 | | 698.93 | 0.001758 | 1.93 | 20.22 | 17.10 | 0.31 |
| Main | 16983.37 | Max WS | 39.10 | 696.00 | 698.53 | | 698.70 | 0.007626 | 3.29 | 11.88 | 12.88 | 0.60 |
| Main | 16899.4* | Max WS | 39.46 | 695.54 | 697.91 | | 698.07 | 0.007552 | 3.24 | 12.19 | 13.74 | 0.61 |
| Main | 16815.4* | Max WS | 39.83 | 695.08 | 697.27 | | 697.43 | 0.007719 | 3.22 | 12.36 | 14.52 | 0.62 |
| Main | 16731.5* | Max WS | 40.20 | 694.62 | 696.63 | | 696.78 | 0.007762 | 3.19 | 12.60 | 15.34 | 0.62 |
| Main | 16647.5* | Max WS | 40.57 | 694.16 | 695.99 | | 696.14 | 0.007740 | 3.16 | 12.83 | 64.19 | 0.62 |
| Main | 16563.6* | Max WS | 40.93 | 693.70 | 695.35 | | 695.50 | 0.007654 | 3.13 | 13.07 | 126.80 | 0.62 |
| Main | 16479.65 | Max WS | 41.29 | 693.24 | 694.94 | | 695.03 | 0.003389 | 2.41 | 17.15 | 145.61 | 0.43 |
| Main | 16403.7* | Max WS | 41.46 | 693.01 | 694.72 | | 694.79 | 0.002923 | 2.15 | 19.27 | 157.62 | 0.39 |
| Main | 16327.7* | Max WS | 41.83 | 692.78 | 694.52 | | 694.58 | 0.002580 | 1.97 | 21.20 | 172.13 | 0.37 |
| Main | 16251.7* | Max WS | 42.20 | 692.54 | 694.36 | | 694.41 | 0.001984 | 1.77 | 23.82 | 190.72 | 0.33 |
| Main | 16175.84 | Max WS | 42.53 | 692.31 | 694.24 | | 694.28 | 0.001426 | 1.55 | 27.46 | 204.39 | 0.28 |
| Main | 16100.* | Max WS | 43.23 | 692.07 | 694.16 | | 694.19 | 0.000981 | 1.33 | 32.46 | 32.09 | 0.23 |
| Main | 16024.40 | Max WS | 43.96 | 691.83 | 694.10 | | 694.12 | 0.000562 | 1.06 | 58.78 | 182.40 | 0.18 |
| Main | 15850.19 | Max WS | 44.71 | 691.30 | 694.01 | | 694.03 | 0.000650 | 1.49 | 80.72 | 255.46 | 0.20 |
| Main | 15434.41 | Max WS | 46.49 | 690.01 | 693.76 | | 693.79 | 0.000495 | 1.43 | 32.59 | 15.64 | 0.17 |
| Main | 15212.53 | Max WS | 47.71 | 689.73 | 693.67 | | 693.69 | 0.000345 | 1.26 | 37.98 | 17.03 | 0.15 |
| Main | 14922.76 | Max WS | 49.18 | 689.36 | 693.60 | | 693.61 | 0.000192 | 0.81 | 71.84 | 179.94 | 0.11 |
| Main | 14774.58 | Max WS | 75.58 | 689.19 | 693.50 | | 693.54 | 0.000682 | 1.67 | 52.98 | 140.81 | 0.21 |
| Main | 14457.09 | Max WS | 77.47 | 688.79 | 693.36 | | 693.38 | 0.000323 | 1.17 | 73.90 | 60.86 | 0.15 |
| Main | 14406.13 | Max WS | 77.84 | 688.73 | 693.35 | | 693.36 | 0.000073 | 0.81 | 129.07 | 86.03 | 0.07 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | Max WS | 77.84 | 688.38 | 693.33 | | 693.33 | 0.000040 | 0.72 | 108.75 | 29.26 | 0.06 |
| Main | 13949.59 | Max WS | 78.12 | 688.37 | 693.32 | | 693.33 | 0.000068 | 0.85 | 92.17 | 307.17 | 0.08 |
| Main | 13839.56 | Max WS | 78.87 | 688.25 | 693.31 | | 693.33 | 0.000058 | 0.84 | 96.24 | 327.27 | 0.08 |
| Main | 13732.13 | Max WS | 79.64 | 688.19 | 693.31 | | 693.32 | 0.000071 | 0.92 | 93.09 | 310.29 | 0.08 |
| Main | 13662.15 | Max WS | 80.14 | 688.17 | 693.30 | | 693.31 | 0.000081 | 0.97 | 92.12 | 53.68 | 0.09 |
| Main | 13628.36 | Max WS | 81.00 | 688.12 | 693.30 | | 693.31 | 0.000051 | 0.81 | 110.57 | 44.30 | 0.07 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | Max WS | 80.98 | 688.72 | 693.26 | | 693.26 | 0.000191 | 0.73 | 112.21 | 77.47 | 0.07 |
| Main | 13414.20 | Max WS | 81.22 | 689.00 | 693.25 | | 693.26 | 0.000209 | 0.70 | 115.93 | 56.83 | 0.07 |
| Main | 13217.08 | Max WS | 82.93 | 688.99 | 693.15 | | 693.18 | 0.000616 | 1.18 | 70.44 | 24.46 | 0.12 |
| Main | 13001.02 | Max WS | 84.64 | 688.98 | 692.93 | | 692.97 | 0.001319 | 1.59 | 53.31 | 20.68 | 0.17 |
| Main | 12615.85 | Max WS | 87.29 | 688.85 | 692.47 | | 692.50 | 0.001100 | 1.46 | 59.95 | 23.60 | 0.16 |
| Main | 12216.99 | Max WS | 89.85 | 688.69 | 692.18 | | 692.20 | 0.000377 | 1.24 | 72.34 | 30.85 | 0.14 |
| Main | 12019.91 | Max WS | 91.03 | 688.59 | 692.00 | | 692.06 | 0.001106 | 2.02 | 44.98 | 19.75 | 0.24 |
| Main | 12001.15 | Max WS | 91.25 | 688.06 | 692.02 | | 692.04 | 0.000251 | 1.14 | 80.21 | 25.97 | 0.11 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | Max WS | 91.18 | 687.94 | 691.98 | | 691.99 | 0.000131 | 0.95 | 100.53 | 38.33 | 0.09 |
| Main | 11831.40 | Max WS | 91.03 | 688.77 | 691.94 | | 691.98 | 0.000543 | 1.51 | 60.11 | 23.89 | 0.17 |
| Main | 11746.9* | Max WS | 91.64 | 688.77 | 691.88 | | 691.92 | 0.000794 | 1.59 | 57.75 | 34.78 | 0.18 |
| Main | 11662.5* | Max WS | 92.34 | 688.77 | 691.80 | | 691.84 | 0.001127 | 1.67 | 56.93 | 48.00 | 0.19 |
| Main | 11578.0* | Max WS | 92.78 | 688.76 | 691.69 | | 691.73 | 0.001424 | 1.67 | 64.90 | 102.40 | 0.20 |
| Main | 11493.63 | Max WS | 92.92 | 688.76 | 691.61 | | 691.62 | 0.000789 | 1.17 | 221.42 | 553.65 | 0.14 |
| Main | 11398.6* | Max WS | 92.92 | 688.76 | 691.52 | | 691.54 | 0.000970 | 1.27 | 153.59 | 322.63 | 0.15 |
| Main | 11303.5* | Max WS | 92.02 | 688.76 | 691.43 | | 691.45 | 0.000926 | 1.20 | 148.21 | 282.97 | 0.15 |
| Main | 11208.5* | Max WS | 89.07 | 688.75 | 691.35 | | 691.36 | 0.000760 | 1.05 | 159.26 | 239.65 | 0.13 |
| Main | 11113.5* | Max WS | 88.32 | 688.75 | 691.29 | | 691.29 | 0.000608 | 0.91 | 187.56 | 251.03 | 0.12 |
| Main | 11018.49 | Max WS | 88.14 | 688.75 | 691.24 | | 691.24 | 0.000459 | 0.77 | 234.99 | 302.82 | 0.10 |
| Main | 10922.5* | Max WS | 87.87 | 688.75 | 691.19 | | 691.19 | 0.000379 | 0.69 | 221.26 | 185.75 | 0.09 |
| Main | 10826.6* | Max WS | 87.87 | 688.75 | 691.15 | | 691.16 | 0.000284 | 0.59 | 241.90 | 181.99 | 0.08 |
| Main | 10730.67 | Max WS | 87.70 | 688.75 | 691.13 | | 691.13 | 0.000186 | 0.47 | 279.44 | 195.34 | 0.06 |
| Main | 10638.0* | Max WS | 87.66 | 688.74 | 691.11 | | 691.12 | 0.000140 | 0.40 | 323.42 | 319.62 | 0.06 |
| Main | 10545.5* | Max WS | 88.01 | 688.73 | 691.11 | | 691.11 | 0.000082 | 0.29 | 448.11 | 452.01 | 0.04 |
| Main | 10452.9* | Max WS | 87.85 | 688.72 | 691.10 | | 691.10 | 0.000033 | 0.19 | 691.65 | 561.99 | 0.03 |
| Main | 10360.3* | Max WS | 88.47 | 688.71 | 691.10 | | 691.10 | 0.000009 | 0.10 | 1066.04 | 647.68 | 0.01 |
| Main | 10267.74 | Max WS | 88.69 | 688.70 | 691.10 | | 691.10 | 0.000111 | 0.36 | 216.03 | 702.80 | 0.05 |
| Main | 10182.4* | Max WS | 88.92 | 688.69 | 691.09 | | 691.09 | 0.000012 | 0.13 | 1434.49 | 692.86 | 0.02 |
| Main | 10097.1* | Max WS | 89.43 | 688.68 | 691.09 | | 691.09 | 0.000009 | 0.11 | 1374.16 | 670.99 | 0.01 |
| Main | 10011.8* | Max WS | 89.72 | 688.67 | 691.09 | | 691.09 | 0.000006 | 0.09 | 1328.26 | 625.42 | 0.01 |
| Main | 9926.510 | Max WS | 90.08 | 688.66 | 691.08 | | 691.09 | 0.000170 | 0.49 | 168.83 | 602.14 | 0.06 |
| Main | 9491.793 | Max WS | 91.50 | 688.61 | 691.01 | 689.24 | 691.02 | 0.000189 | 0.43 | 176.99 | 328.81 | 0.06 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | Max WS | 91.51 | 688.30 | 691.01 | | 691.01 | 0.000214 | 0.48 | 248.67 | 291.62 | 0.07 |
| Main | 8784.397 | Max WS | 91.67 | 688.22 | 690.91 | | 690.94 | 0.001430 | 1.42 | 115.26 | 436.31 | 0.18 |
| Main | 8722.829 | Max WS | 91.16 | 688.12 | 690.73 | | 690.76 | 0.002358 | 1.61 | 142.96 | 331.09 | 0.22 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | Max WS | 87.61 | 687.48 | 690.69 | | 690.71 | 0.000562 | 1.04 | 152.19 | 399.83 | 0.12 |
| Main | 8631.519 | Max WS | 87.07 | 687.41 | 690.66 | | 690.68 | 0.000696 | 1.03 | 199.67 | 353.34 | 0.13 |
| Main | 8345.665 | Max WS | 79.66 | 687.28 | 690.57 | | 690.57 | 0.000146 | 0.48 | 330.10 | 702.36 | 0.06 |
| Main | 8047.118 | Max WS | 78.92 | 687.10 | 690.51 | | 690.51 | 0.000258 | 0.64 | 212.77 | 596.84 | 0.08 |
| Main | 7739.449 | Max WS | 79.34 | 686.99 | 690.47 | | 690.47 | 0.000041 | 0.34 | 355.30 | 705.77 | 0.03 |
| Main | 7515.565 | Max WS | 79.56 | 686.79 | 690.46 | | 690.46 | 0.000060 | 0.36 | 260.17 | 243.81 | 0.04 |
| Main | 7272.821 | Max WS | 79.79 | 686.67 | 690.44 | | 690.45 | 0.000087 | 0.51 | 262.01 | 473.74 | 0.05 |
| Main | 7255.385 | Max WS | 79.59 | 686.00 | 690.43 | | 690.44 | 0.000582 | 1.04 | 245.59 | 630.31 | 0.12 |
| Main | 7226.812 | | Culvert | | | | | | | | | |

42
49
78
81
93
92
80

HEC-RAS Plan: 10yrHuff River: Spring Creek Reach: Main Profile: Max WS (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7193.714 | Max WS | 76.38 | 685.90 | 690.36 | | 690.36 | 0.000042 | 0.35 | 800.26 | 604.47 | 0.03 |
| Main | 7141.580 | Max WS | 76.39 | 686.28 | 690.35 | | 690.35 | 0.000096 | 0.34 | 363.67 | 421.85 | 0.03 |
| Main | 7071.87* | Max WS | 75.63 | 686.28 | 690.34 | | 690.35 | 0.000076 | 0.34 | 414.99 | 478.56 | 0.03 |
| Main | 7002.16* | Max WS | 75.20 | 686.27 | 690.34 | | 690.34 | 0.000062 | 0.36 | 459.96 | 466.66 | 0.04 |
| Main | 6932.458 | Max WS | 74.93 | 686.27 | 690.33 | | 690.33 | 0.000053 | 0.39 | 493.28 | 433.95 | 0.04 |
| Main | 6846.57* | Max WS | 74.49 | 686.27 | 690.33 | | 690.33 | 0.000088 | 0.51 | 271.49 | 240.33 | 0.05 |
| Main | 6760.7* | Max WS | 73.19 | 686.27 | 690.32 | | 690.32 | 0.000105 | 0.55 | 193.10 | 146.92 | 0.05 |
| Main | 6674.82* | Max WS | 72.46 | 686.26 | 690.31 | | 690.31 | 0.000112 | 0.58 | 171.50 | 104.47 | 0.06 |
| Main | 6588.943 | Max WS | 71.65 | 686.26 | 690.30 | | 690.30 | 0.000078 | 0.48 | 366.24 | 342.47 | 0.05 |
| Main | 6495.53* | Max WS | 71.08 | 686.26 | 690.29 | | 690.29 | 0.000040 | 0.34 | 503.17 | 512.33 | 0.03 |
| Main | 6402.13* | Max WS | 71.07 | 686.26 | 690.29 | | 690.29 | 0.000028 | 0.29 | 644.48 | 705.85 | 0.03 |
| Main | 6308.73* | Max WS | 70.82 | 686.27 | 690.29 | | 690.29 | 0.000021 | 0.24 | 713.69 | 903.29 | 0.02 |
| Main | 6215.32* | Max WS | 71.05 | 686.27 | 690.29 | | 690.29 | 0.000015 | 0.21 | 770.65 | 1068.96 | 0.02 |
| Main | 6121.924 | Max WS | 70.82 | 686.27 | 690.29 | | 690.29 | 0.000014 | 0.20 | 721.28 | 1209.10 | 0.02 |
| Main | 6035.96* | Max WS | 70.36 | 686.27 | 690.28 | | 690.28 | 0.000015 | 0.20 | 721.43 | 1251.83 | 0.02 |
| Main | 5950.01* | Max WS | 70.60 | 686.27 | 690.28 | | 690.28 | 0.000019 | 0.23 | 649.40 | 1259.34 | 0.02 |
| Main | 5864.05* | Max WS | 70.62 | 686.27 | 690.28 | | 690.28 | 0.000025 | 0.26 | 558.96 | 1272.02 | 0.03 |
| Main | 5778.104 | Max WS | 70.34 | 686.27 | 690.28 | | 690.28 | 0.000036 | 0.30 | 453.31 | 1272.65 | 0.03 |
| Main | 5687.63* | Max WS | 70.30 | 686.28 | 690.27 | | 690.27 | 0.000089 | 0.49 | 248.22 | 1028.11 | 0.05 |
| Main | 5597.166 | Max WS | 70.21 | 686.28 | 690.25 | | 690.26 | 0.000216 | 0.81 | 107.42 | 620.42 | 0.09 |
| Main | 5556.618 | Max WS | 70.16 | 686.43 | 690.23 | | 690.25 | 0.000246 | 0.95 | 76.04 | 374.02 | 0.09 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | Max WS | 70.08 | 685.19 | 690.19 | | 690.20 | 0.000110 | 0.75 | 93.85 | 32.44 | 0.06 |
| Main | 5437.667 | Max WS | 70.07 | 685.35 | 690.19 | | 690.19 | 0.000031 | 0.39 | 181.90 | 428.62 | 0.04 |
| Main | 5357.86* | Max WS | 70.05 | 685.35 | 690.18 | | 690.19 | 0.000050 | 0.48 | 146.51 | 355.21 | 0.04 |
| Main | 5278.05* | Max WS | 70.05 | 685.34 | 690.18 | | 690.18 | 0.000085 | 0.60 | 116.13 | 255.34 | 0.06 |
| Main | 5198.254 | Max WS | 70.02 | 685.34 | 690.16 | | 690.17 | 0.000161 | 0.79 | 88.44 | 213.87 | 0.08 |
| Main | 5121.63* | Max WS | 69.99 | 685.34 | 690.15 | | 690.16 | 0.000146 | 0.75 | 93.83 | 193.22 | 0.07 |
| Main | 5045.01* | Max WS | 70.03 | 685.34 | 690.14 | | 690.15 | 0.000130 | 0.69 | 101.12 | 222.98 | 0.07 |
| Main | 4968.39* | Max WS | 70.00 | 685.33 | 690.14 | | 690.14 | 0.000111 | 0.63 | 112.00 | 248.83 | 0.06 |
| Main | 4891.776 | Max WS | 69.98 | 685.33 | 690.13 | | 690.13 | 0.000084 | 0.52 | 146.41 | 280.52 | 0.06 |
| Main | 4810.20* | Max WS | 69.97 | 685.33 | 690.12 | | 690.13 | 0.000115 | 0.60 | 121.48 | 57.72 | 0.06 |
| Main | 4728.63* | Max WS | 69.95 | 685.33 | 690.11 | | 690.12 | 0.000151 | 0.67 | 109.44 | 53.31 | 0.07 |
| Main | 4647.06* | Max WS | 69.96 | 685.32 | 690.09 | | 690.10 | 0.000184 | 0.74 | 99.68 | 48.60 | 0.08 |
| Main | 4565.488 | Max WS | 69.96 | 685.32 | 690.07 | | 690.08 | 0.000225 | 0.82 | 92.02 | 45.68 | 0.09 |
| Main | 4504.263 | Max WS | 69.94 | 685.32 | 690.06 | | 690.07 | 0.000203 | 0.84 | 83.69 | 27.83 | 0.08 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | Max WS | 69.89 | 684.72 | 689.95 | | 689.96 | 0.000166 | 0.95 | 74.74 | 25.09 | 0.08 |
| Main | 4346.582 | Max WS | 69.90 | 685.50 | 689.94 | | 689.95 | 0.000219 | 0.88 | 79.41 | 25.75 | 0.09 |
| Main | 4194.408 | Max WS | 69.84 | 685.49 | 689.90 | | 689.91 | 0.000278 | 0.96 | 72.56 | 24.53 | 0.10 |
| Main | 3788.373 | Max WS | 69.83 | 685.36 | 689.84 | | 689.84 | 0.000034 | 0.36 | 241.20 | 166.34 | 0.04 |
| Main | 3395.646 | Max WS | 69.82 | 685.01 | 689.83 | | 689.83 | 0.000022 | 0.43 | 272.13 | 140.00 | 0.04 |
| Main | 3331.113 | Max WS | 69.82 | 685.09 | 689.82 | | 689.83 | 0.000065 | 0.65 | 109.34 | 35.50 | 0.06 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | Max WS | 68.66 | 683.69 | 687.81 | | 687.87 | 0.000645 | 1.87 | 40.88 | 18.97 | 0.19 |
| Main | 3141.921 | Max WS | 68.83 | 683.98 | 687.77 | | 687.82 | 0.000821 | 1.79 | 38.46 | 15.27 | 0.20 |
| Main | 3004.055 | Max WS | 69.23 | 683.97 | 687.72 | | 687.74 | 0.000327 | 1.23 | 56.47 | 20.54 | 0.13 |
| Main | 2734.719 | Max WS | 69.99 | 683.96 | 687.57 | | 687.61 | 0.000678 | 1.60 | 43.72 | 18.80 | 0.19 |
| Main | 2688.915 | Max WS | 70.15 | 683.95 | 687.52 | | 687.57 | 0.000898 | 1.76 | 39.82 | 18.26 | 0.21 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | Max WS | 52.37 | 683.44 | 687.10 | | 687.15 | 0.000911 | 1.81 | 28.98 | 10.20 | 0.19 |
| Main | 2582.291 | Max WS | 52.85 | 683.33 | 687.08 | | 687.11 | 0.000638 | 1.55 | 34.05 | 13.25 | 0.17 |
| Main | 2218.895 | Max WS | 56.47 | 682.33 | 686.97 | | 686.98 | 0.000059 | 0.58 | 97.64 | 31.76 | 0.06 |
| Main | 2049.666 | Max WS | 56.46 | 681.91 | 686.96 | | 686.97 | 0.000060 | 0.59 | 103.55 | 57.69 | 0.06 |
| Main | 1853.478 | Max WS | 126.93 | 681.42 | 686.90 | | 686.92 | 0.000200 | 1.14 | 111.44 | 32.71 | 0.11 |
| Main | 1799.666 | Max WS | 127.02 | 681.24 | 686.89 | | 686.91 | 0.000261 | 1.17 | 108.50 | 34.26 | 0.12 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | Max WS | 125.77 | 681.24 | 686.78 | | 686.81 | 0.000272 | 1.35 | 99.96 | 36.72 | 0.12 |
| Main | 1606.765 | Max WS | 126.18 | 681.22 | 686.78 | | 686.79 | 0.000136 | 0.84 | 162.23 | 132.64 | 0.09 |
| Main | 1475.852 | Max WS | 151.94 | 681.21 | 685.68 | | 685.79 | 0.002383 | 2.60 | 58.46 | 32.48 | 0.34 |
| Main | 1134.554 | Max WS | 154.06 | 681.17 | 685.12 | | 685.19 | 0.001141 | 2.10 | 73.25 | 32.71 | 0.25 |
| Main | 792.3003 | Max WS | 154.01 | 681.12 | 684.56 | | 684.66 | 0.001996 | 2.58 | 98.20 | 162.25 | 0.32 |
| Main | 482.8005 | Max WS | 179.52 | 680.38 | 684.22 | | 684.23 | 0.000115 | 0.76 | 1032.40 | 754.69 | 0.08 |
| Main | 35.46111 | Max WS | 5.02 | 680.10 | 684.20 | 677.02 | 684.20 | 0.000000 | 0.01 | 1550.93 | 711.37 | 0.00 |

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50-yr

HEC-RAS Plan: 50yrHuff River: Spring Creek Reach: Main Profile: Max WS

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | Max WS | 55.61 | 696.40 | 699.16 | | 699.23 | 0.001958 | 2.19 | 25.38 | 19.31 | 0.34 |
| Main | 16983.37 | Max WS | 55.61 | 696.00 | 698.80 | | 698.99 | 0.007750 | 3.57 | 15.58 | 15.27 | 0.62 |
| Main | 16899.4* | Max WS | 56.07 | 695.54 | 698.15 | | 698.35 | 0.007715 | 3.53 | 15.88 | 16.06 | 0.63 |
| Main | 16815.4* | Max WS | 56.44 | 695.08 | 697.50 | | 697.69 | 0.007821 | 3.53 | 16.00 | 16.63 | 0.63 |
| Main | 16731.5* | Max WS | 57.06 | 694.62 | 696.86 | | 697.05 | 0.007653 | 3.49 | 16.37 | 17.23 | 0.63 |
| Main | 16647.5* | Max WS | 57.67 | 694.16 | 696.20 | | 696.39 | 0.007963 | 3.52 | 16.38 | 92.81 | 0.64 |
| Main | 16563.6* | Max WS | 57.62 | 693.70 | 695.60 | | 695.77 | 0.006674 | 3.31 | 17.42 | 130.04 | 0.60 |
| Main | 16479.65 | Max WS | 58.40 | 693.24 | 695.26 | | 695.36 | 0.003002 | 2.55 | 22.90 | 149.46 | 0.41 |
| Main | 16403.7* | Max WS | 59.12 | 693.01 | 695.08 | | 695.16 | 0.002228 | 2.15 | 27.49 | 164.07 | 0.36 |
| Main | 16327.7* | Max WS | 59.75 | 692.78 | 694.96 | | 695.01 | 0.001641 | 1.83 | 32.68 | 185.59 | 0.31 |
| Main | 16251.7* | Max WS | 60.44 | 692.54 | 694.86 | | 694.90 | 0.001177 | 1.55 | 38.99 | 203.84 | 0.26 |
| Main | 16175.84 | Max WS | 61.20 | 692.31 | 694.80 | | 694.82 | 0.000836 | 1.31 | 52.96 | 265.07 | 0.22 |
| Main | 16100.* | Max WS | 62.63 | 692.07 | 694.75 | | 694.77 | 0.000540 | 1.15 | 56.63 | 61.40 | 0.18 |
| Main | 16024.40 | Max WS | 64.06 | 691.83 | 694.72 | | 694.72 | 0.000146 | 0.65 | 217.81 | 403.56 | 0.10 |
| Main | 15850.19 | Max WS | 65.64 | 691.30 | 694.70 | | 694.70 | 0.000105 | 0.75 | 340.11 | 519.17 | 0.09 |
| Main | 15434.41 | Max WS | 69.76 | 690.01 | 694.57 | | 694.60 | 0.000431 | 1.50 | 46.37 | 18.41 | 0.17 |
| Main | 15212.53 | Max WS | 71.90 | 689.73 | 694.49 | | 694.52 | 0.000316 | 1.36 | 53.04 | 19.76 | 0.15 |
| Main | 14922.76 | Max WS | 74.71 | 689.36 | 694.45 | | 694.45 | 0.000094 | 0.72 | 157.08 | 380.08 | 0.08 |
| Main | 14774.58 | Max WS | 118.89 | 689.19 | 694.40 | | 694.42 | 0.000285 | 1.38 | 175.48 | 288.80 | 0.14 |
| Main | 14457.09 | Max WS | 122.58 | 688.79 | 694.33 | | 694.35 | 0.000178 | 1.13 | 163.87 | 197.11 | 0.12 |
| Main | 14406.13 | Max WS | 123.24 | 688.73 | 694.32 | | 694.34 | 0.000076 | 0.96 | 191.91 | 118.24 | 0.08 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | Max WS | 123.15 | 688.38 | 694.26 | | 694.28 | 0.000052 | 0.92 | 134.54 | 31.60 | 0.07 |
| Main | 13949.59 | Max WS | 123.68 | 688.37 | 694.26 | | 694.27 | 0.000083 | 1.03 | 119.99 | 319.04 | 0.09 |
| Main | 13839.56 | Max WS | 125.12 | 688.25 | 694.25 | | 694.27 | 0.000070 | 1.05 | 128.64 | 342.08 | 0.09 |
| Main | 13732.13 | Max WS | 126.51 | 688.19 | 694.25 | | 694.26 | 0.000057 | 0.94 | 215.21 | 362.47 | 0.08 |
| Main | 13662.15 | Max WS | 127.40 | 688.17 | 694.24 | | 694.25 | 0.000085 | 1.13 | 154.40 | 107.21 | 0.09 |
| Main | 13628.36 | Max WS | 128.94 | 688.12 | 694.23 | | 694.25 | 0.000058 | 1.00 | 154.65 | 73.13 | 0.08 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | Max WS | 128.98 | 688.72 | 694.13 | | 694.14 | 0.000228 | 0.92 | 146.52 | 253.42 | 0.08 |
| Main | 13414.20 | Max WS | 129.37 | 689.00 | 694.12 | | 694.13 | 0.000230 | 0.84 | 162.25 | 265.39 | 0.08 |
| Main | 13217.08 | Max WS | 132.36 | 688.99 | 694.01 | | 694.04 | 0.000734 | 1.43 | 94.80 | 76.32 | 0.14 |
| Main | 13001.02 | Max WS | 135.44 | 688.98 | 693.74 | | 693.79 | 0.001517 | 1.91 | 70.89 | 22.83 | 0.19 |
| Main | 12615.85 | Max WS | 140.34 | 688.85 | 693.18 | | 693.23 | 0.001367 | 1.81 | 77.61 | 25.71 | 0.18 |
| Main | 12216.99 | Max WS | 145.23 | 688.69 | 692.82 | | 692.86 | 0.000481 | 1.56 | 93.17 | 33.74 | 0.17 |
| Main | 12019.91 | Max WS | 147.75 | 688.59 | 692.56 | | 692.66 | 0.001550 | 2.61 | 56.70 | 21.87 | 0.29 |
| Main | 12001.15 | Max WS | 148.08 | 688.06 | 692.60 | | 692.64 | 0.000401 | 1.54 | 95.86 | 27.81 | 0.15 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | Max WS | 148.03 | 687.94 | 692.51 | | 692.54 | 0.000216 | 1.34 | 115.90 | 39.83 | 0.11 |
| Main | 11831.40 | Max WS | 147.98 | 688.77 | 692.45 | | 692.51 | 0.000828 | 2.04 | 72.49 | 79.41 | 0.21 |
| Main | 11746.9* | Max WS | 149.29 | 688.77 | 692.37 | | 692.43 | 0.001106 | 2.05 | 90.56 | 99.27 | 0.22 |
| Main | 11662.5* | Max WS | 149.75 | 688.77 | 692.26 | | 692.32 | 0.001479 | 2.08 | 104.11 | 164.24 | 0.23 |
| Main | 11578.0* | Max WS | 149.61 | 688.76 | 692.13 | | 692.18 | 0.001592 | 1.93 | 164.00 | 360.07 | 0.21 |
| Main | 11493.63 | Max WS | 149.78 | 688.76 | 692.06 | | 692.06 | 0.000480 | 1.02 | 534.36 | 775.72 | 0.11 |
| Main | 11398.6* | Max WS | 150.21 | 688.76 | 692.00 | | 692.01 | 0.000671 | 1.19 | 431.07 | 739.58 | 0.13 |
| Main | 11303.5* | Max WS | 149.92 | 688.76 | 691.93 | | 691.94 | 0.000719 | 1.20 | 381.19 | 662.25 | 0.13 |
| Main | 11208.5* | Max WS | 149.41 | 688.75 | 691.86 | | 691.87 | 0.000643 | 1.12 | 380.57 | 599.57 | 0.13 |
| Main | 11113.5* | Max WS | 147.55 | 688.75 | 691.81 | | 691.82 | 0.000510 | 0.98 | 413.30 | 566.03 | 0.11 |
| Main | 11018.49 | Max WS | 147.06 | 688.75 | 691.76 | | 691.77 | 0.000385 | 0.84 | 464.66 | 557.73 | 0.10 |
| Main | 10922.5* | Max WS | 147.34 | 688.75 | 691.72 | | 691.73 | 0.000379 | 0.82 | 380.29 | 424.84 | 0.10 |
| Main | 10826.6* | Max WS | 147.88 | 688.75 | 691.68 | | 691.69 | 0.000288 | 0.71 | 390.45 | 388.74 | 0.08 |
| Main | 10730.67 | Max WS | 147.96 | 688.75 | 691.65 | | 691.66 | 0.000199 | 0.58 | 419.25 | 374.61 | 0.07 |
| Main | 10638.0* | Max WS | 148.67 | 688.74 | 691.64 | | 691.64 | 0.000142 | 0.48 | 520.14 | 441.33 | 0.06 |
| Main | 10545.5* | Max WS | 148.84 | 688.73 | 691.63 | | 691.64 | 0.000079 | 0.35 | 716.19 | 552.73 | 0.04 |
| Main | 10452.9* | Max WS | 149.70 | 688.72 | 691.63 | | 691.63 | 0.000035 | 0.22 | 1014.33 | 657.62 | 0.03 |
| Main | 10360.3* | Max WS | 150.26 | 688.71 | 691.63 | | 691.63 | 0.000011 | 0.12 | 1417.97 | 696.42 | 0.02 |
| Main | 10267.74 | Max WS | 150.74 | 688.70 | 691.62 | | 691.63 | 0.000158 | 0.46 | 277.79 | 763.34 | 0.06 |
| Main | 10182.4* | Max WS | 151.02 | 688.69 | 691.62 | | 691.62 | 0.000017 | 0.17 | 1803.67 | 723.85 | 0.02 |
| Main | 10097.1* | Max WS | 151.80 | 688.68 | 691.61 | | 691.61 | 0.000013 | 0.15 | 1732.41 | 717.15 | 0.02 |
| Main | 10011.8* | Max WS | 152.44 | 688.67 | 691.61 | | 691.61 | 0.000008 | 0.12 | 1664.51 | 679.95 | 0.01 |
| Main | 9926.510 | Max WS | 152.91 | 688.66 | 691.60 | | 691.61 | 0.000234 | 0.65 | 244.58 | 751.09 | 0.07 |
| Main | 9491.793 | Max WS | 120.62 | 688.61 | 691.53 | 689.33 | 691.53 | 0.000149 | 0.45 | 227.75 | 363.73 | 0.06 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | Max WS | 120.62 | 688.30 | 691.52 | | 691.52 | 0.000145 | 0.42 | 467.35 | 611.99 | 0.06 |
| Main | 8784.397 | Max WS | 119.06 | 688.22 | 691.48 | | 691.49 | 0.000694 | 1.13 | 279.58 | 716.15 | 0.13 |
| Main | 8722.829 | Max WS | 115.36 | 688.12 | 691.41 | | 691.42 | 0.000744 | 0.97 | 311.35 | 500.79 | 0.12 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | Max WS | 114.57 | 687.48 | 691.40 | | 691.41 | 0.000261 | 0.77 | 363.78 | 556.83 | 0.08 |
| Main | 8631.519 | Max WS | 113.82 | 687.41 | 691.39 | | 691.40 | 0.000289 | 0.76 | 381.91 | 483.96 | 0.08 |
| Main | 8345.665 | Max WS | 109.22 | 687.28 | 691.36 | | 691.36 | 0.000032 | 0.28 | 1094.68 | 1137.46 | 0.03 |
| Main | 8047.118 | Max WS | 106.60 | 687.10 | 691.35 | | 691.35 | 0.000043 | 0.32 | 770.49 | 721.39 | 0.03 |
| Main | 7739.449 | Max WS | 106.09 | 686.99 | 691.34 | | 691.34 | 0.000017 | 0.26 | 881.62 | 1363.38 | 0.02 |
| Main | 7515.565 | Max WS | 105.06 | 686.79 | 691.33 | | 691.33 | 0.000035 | 0.33 | 420.15 | 313.76 | 0.03 |
| Main | 7272.821 | Max WS | 104.52 | 686.67 | 691.32 | | 691.33 | 0.000040 | 0.41 | 761.04 | 822.35 | 0.04 |
| Main | 7255.385 | Max WS | 104.50 | 686.00 | 691.32 | | 691.32 | 0.000096 | 0.52 | 848.18 | 776.29 | 0.05 |
| Main | 7226.812 | | Culvert | | | | | | | | | |

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HEC-RAS Plan: 50yrHuff River: Spring Creek Reach: Main Profile: Max WS (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7193.714 | Max WS | 104.14 | 685.90 | 691.32 | | 691.32 | 0.000019 | 0.28 | 1343.99 | 657.73 | 0.02 |
| Main | 7141.580 | Max WS | 104.15 | 686.28 | 691.32 | | 691.32 | 0.000038 | 0.26 | 851.51 | 586.10 | 0.02 |
| Main | 7071.87* | Max WS | 104.02 | 686.28 | 691.32 | | 691.32 | 0.000030 | 0.25 | 922.29 | 542.96 | 0.02 |
| Main | 7002.16* | Max WS | 104.00 | 686.27 | 691.31 | | 691.32 | 0.000026 | 0.28 | 936.04 | 509.88 | 0.02 |
| Main | 6932.458 | Max WS | 103.28 | 686.27 | 691.31 | | 691.31 | 0.000024 | 0.32 | 970.89 | 504.07 | 0.03 |
| Main | 6846.57* | Max WS | 102.78 | 686.27 | 691.31 | | 691.31 | 0.000044 | 0.43 | 587.74 | 384.08 | 0.04 |
| Main | 6760.7* | Max WS | 102.08 | 686.27 | 691.30 | | 691.31 | 0.000059 | 0.50 | 403.98 | 247.24 | 0.04 |
| Main | 6674.82* | Max WS | 102.26 | 686.26 | 691.30 | | 691.30 | 0.000070 | 0.54 | 334.15 | 249.64 | 0.05 |
| Main | 6588.943 | Max WS | 101.93 | 686.26 | 691.29 | | 691.29 | 0.000036 | 0.39 | 772.34 | 465.14 | 0.03 |
| Main | 6495.53* | Max WS | 100.89 | 686.26 | 691.29 | | 691.29 | 0.000015 | 0.25 | 1107.49 | 694.82 | 0.02 |
| Main | 6402.13* | Max WS | 101.52 | 686.26 | 691.29 | | 691.29 | 0.000010 | 0.20 | 1462.87 | 887.99 | 0.02 |
| Main | 6308.73* | Max WS | 101.41 | 686.27 | 691.29 | | 691.29 | 0.000008 | 0.19 | 1510.06 | 1087.65 | 0.02 |
| Main | 6215.32* | Max WS | 101.11 | 686.27 | 691.29 | | 691.29 | 0.000007 | 0.17 | 1478.39 | 1378.06 | 0.01 |
| Main | 6121.924 | Max WS | 101.07 | 686.27 | 691.29 | | 691.29 | 0.000007 | 0.17 | 1341.30 | 1773.98 | 0.01 |
| Main | 6035.96* | Max WS | 101.01 | 686.27 | 691.29 | | 691.29 | 0.000008 | 0.18 | 1267.50 | 1720.88 | 0.02 |
| Main | 5950.01* | Max WS | 100.98 | 686.27 | 691.29 | | 691.29 | 0.000010 | 0.20 | 1116.84 | 1681.84 | 0.02 |
| Main | 5864.05* | Max WS | 100.81 | 686.27 | 691.29 | | 691.29 | 0.000013 | 0.22 | 933.80 | 1645.45 | 0.02 |
| Main | 5778.104 | Max WS | 100.79 | 686.27 | 691.28 | | 691.28 | 0.000019 | 0.26 | 729.60 | 1607.51 | 0.02 |
| Main | 5687.63* | Max WS | 100.80 | 686.28 | 691.28 | | 691.28 | 0.000040 | 0.41 | 423.39 | 1137.05 | 0.04 |
| Main | 5597.166 | Max WS | 100.80 | 686.28 | 691.27 | | 691.27 | 0.000097 | 0.66 | 183.79 | 642.12 | 0.06 |
| Main | 5556.618 | Max WS | 100.68 | 686.43 | 691.26 | | 691.27 | 0.000175 | 0.97 | 111.83 | 499.20 | 0.08 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | Max WS | 100.49 | 685.19 | 691.19 | | 691.20 | 0.000111 | 0.87 | 116.09 | 206.71 | 0.07 |
| Main | 5437.667 | Max WS | 100.52 | 685.35 | 691.19 | | 691.20 | 0.000031 | 0.43 | 233.36 | 459.20 | 0.04 |
| Main | 5357.86* | Max WS | 100.49 | 685.35 | 691.19 | | 691.19 | 0.000050 | 0.53 | 189.06 | 393.49 | 0.05 |
| Main | 5278.05* | Max WS | 100.37 | 685.34 | 691.18 | | 691.19 | 0.000083 | 0.67 | 150.92 | 333.28 | 0.06 |
| Main | 5198.254 | Max WS | 100.47 | 685.34 | 691.17 | | 691.18 | 0.000154 | 0.86 | 116.33 | 269.24 | 0.08 |
| Main | 5121.63* | Max WS | 100.35 | 685.34 | 691.16 | | 691.17 | 0.000136 | 0.80 | 124.69 | 289.94 | 0.07 |
| Main | 5045.01* | Max WS | 100.41 | 685.34 | 691.15 | | 691.16 | 0.000117 | 0.74 | 136.14 | 303.47 | 0.07 |
| Main | 4968.39* | Max WS | 100.34 | 685.33 | 691.14 | | 691.15 | 0.000096 | 0.65 | 161.16 | 315.88 | 0.06 |
| Main | 4891.776 | Max WS | 100.37 | 685.33 | 691.14 | | 691.14 | 0.000055 | 0.52 | 235.93 | 349.13 | 0.05 |
| Main | 4810.20* | Max WS | 100.35 | 685.33 | 691.13 | | 691.14 | 0.000079 | 0.59 | 203.35 | 231.10 | 0.06 |
| Main | 4728.63* | Max WS | 100.32 | 685.33 | 691.12 | | 691.13 | 0.000106 | 0.65 | 179.20 | 133.99 | 0.06 |
| Main | 4647.06* | Max WS | 100.34 | 685.32 | 691.11 | | 691.12 | 0.000135 | 0.71 | 168.21 | 147.48 | 0.07 |
| Main | 4565.488 | Max WS | 100.32 | 685.32 | 691.10 | | 691.11 | 0.000172 | 0.77 | 159.26 | 183.73 | 0.08 |
| Main | 4504.263 | Max WS | 100.33 | 685.32 | 691.08 | | 691.10 | 0.000203 | 0.85 | 119.10 | 62.10 | 0.09 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | Max WS | 100.22 | 684.72 | 690.88 | | 690.90 | 0.000173 | 1.11 | 91.67 | 27.44 | 0.09 |
| Main | 4346.582 | Max WS | 100.18 | 685.50 | 690.87 | | 690.89 | 0.000209 | 0.95 | 105.05 | 28.91 | 0.09 |
| Main | 4194.408 | Max WS | 100.17 | 685.49 | 690.84 | | 690.85 | 0.000261 | 1.03 | 97.42 | 28.34 | 0.10 |
| Main | 3788.373 | Max WS | 100.12 | 685.36 | 690.79 | | 690.79 | 0.000024 | 0.35 | 451.76 | 255.16 | 0.03 |
| Main | 3395.646 | Max WS | 100.12 | 685.01 | 690.78 | | 690.78 | 0.000018 | 0.45 | 419.37 | 208.53 | 0.04 |
| Main | 3331.113 | Max WS | 100.11 | 685.09 | 690.77 | | 690.78 | 0.000058 | 0.72 | 142.21 | 67.52 | 0.06 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | Max WS | 99.10 | 683.69 | 688.65 | | 688.71 | 0.000593 | 2.10 | 52.82 | 20.79 | 0.19 |
| Main | 3141.921 | Max WS | 99.44 | 683.98 | 688.62 | | 688.68 | 0.000746 | 1.91 | 52.19 | 17.28 | 0.19 |
| Main | 3004.055 | Max WS | 100.24 | 683.97 | 688.57 | | 688.60 | 0.000310 | 1.34 | 74.80 | 22.50 | 0.13 |
| Main | 2734.719 | Max WS | 101.77 | 683.96 | 688.44 | | 688.48 | 0.000564 | 1.66 | 61.22 | 21.41 | 0.17 |
| Main | 2688.915 | Max WS | 81.91 | 683.95 | 688.41 | | 688.45 | 0.000451 | 1.42 | 57.51 | 21.49 | 0.15 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | Max WS | 78.19 | 683.44 | 688.03 | | 688.09 | 0.000929 | 2.00 | 39.17 | 11.80 | 0.19 |
| Main | 2582.291 | Max WS | 79.11 | 683.33 | 688.02 | | 688.06 | 0.000580 | 1.67 | 47.26 | 14.86 | 0.17 |
| Main | 2218.895 | Max WS | 85.83 | 682.33 | 687.93 | | 687.93 | 0.000061 | 0.66 | 129.30 | 34.65 | 0.06 |
| Main | 2049.666 | Max WS | 85.86 | 681.91 | 687.92 | | 687.92 | 0.000058 | 0.64 | 172.54 | 86.12 | 0.06 |
| Main | 1853.478 | Max WS | 212.07 | 681.42 | 687.83 | | 687.86 | 0.000298 | 1.47 | 144.66 | 39.33 | 0.13 |
| Main | 1799.666 | Max WS | 212.16 | 681.24 | 687.81 | | 687.84 | 0.000347 | 1.49 | 142.12 | 38.90 | 0.14 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | Max WS | 198.70 | 681.24 | 687.58 | | 687.62 | 0.000355 | 1.74 | 121.98 | 49.68 | 0.14 |
| Main | 1606.765 | Max WS | 199.85 | 681.22 | 687.59 | | 687.61 | 0.000132 | 0.98 | 217.60 | 438.20 | 0.09 |
| Main | 1475.852 | Max WS | 240.68 | 681.21 | 686.30 | | 686.44 | 0.002539 | 3.02 | 79.81 | 37.26 | 0.36 |
| Main | 1134.554 | Max WS | 244.12 | 681.17 | 685.62 | | 685.73 | 0.001592 | 2.70 | 90.34 | 35.49 | 0.30 |
| Main | 792.3003 | Max WS | 244.10 | 681.12 | 684.94 | | 685.07 | 0.002352 | 3.14 | 179.08 | 270.39 | 0.36 |
| Main | 482.8005 | Max WS | 288.48 | 680.38 | 684.53 | | 684.54 | 0.000171 | 1.00 | 1273.57 | 796.00 | 0.10 |
| Main | 35.46111 | Max WS | 4.92 | 680.10 | 684.50 | 677.01 | 684.50 | 0.000000 | 0.01 | 1767.93 | 743.10 | 0.00 |

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100-yr

HEC-RAS Plan: 100yr12hrHuf River: Spring Creek Reach: Main Profile: Max WS

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | Max WS | 63.43 | 696.40 | 699.27 | | 699.36 | 0.002032 | 2.29 | 27.65 | 20.20 | 0.35 |
| Main | 16983.37 | Max WS | 63.41 | 696.00 | 698.90 | | 699.11 | 0.007787 | 3.68 | 17.23 | 16.24 | 0.63 |
| Main | 16899.4* | Max WS | 63.95 | 695.54 | 698.25 | | 698.46 | 0.007777 | 3.66 | 17.49 | 16.92 | 0.63 |
| Main | 16815.4* | Max WS | 64.48 | 695.08 | 697.60 | | 697.81 | 0.007839 | 3.65 | 17.67 | 17.48 | 0.64 |
| Main | 16731.5* | Max WS | 65.02 | 694.62 | 696.95 | | 697.15 | 0.007675 | 3.61 | 18.03 | 18.10 | 0.64 |
| Main | 16647.5* | Max WS | 65.49 | 694.16 | 696.29 | | 696.49 | 0.008019 | 3.64 | 17.99 | 99.52 | 0.65 |
| Main | 16563.6* | Max WS | 65.30 | 693.70 | 695.73 | | 695.90 | 0.005879 | 3.28 | 19.90 | 131.76 | 0.57 |
| Main | 16479.65 | Max WS | 66.31 | 693.24 | 695.44 | | 695.54 | 0.002545 | 2.49 | 26.61 | 152.27 | 0.39 |
| Main | 16403.7* | Max WS | 67.19 | 693.01 | 695.31 | | 695.37 | 0.001716 | 2.02 | 33.20 | 168.72 | 0.32 |
| Main | 16327.7* | Max WS | 68.10 | 692.78 | 695.22 | | 695.26 | 0.001178 | 1.67 | 40.86 | 191.62 | 0.26 |
| Main | 16251.7* | Max WS | 68.95 | 692.54 | 695.16 | | 695.19 | 0.000791 | 1.36 | 57.44 | 274.07 | 0.22 |
| Main | 16175.84 | Max WS | 69.84 | 692.31 | 695.12 | | 695.14 | 0.000495 | 1.09 | 94.53 | 358.85 | 0.17 |
| Main | 16100.* | Max WS | 71.58 | 692.07 | 695.08 | | 695.10 | 0.000340 | 1.01 | 86.86 | 128.49 | 0.15 |
| Main | 16024.40 | Max WS | 73.32 | 691.83 | 695.06 | | 695.07 | 0.000069 | 0.50 | 343.19 | 557.79 | 0.07 |
| Main | 15850.19 | Max WS | 75.28 | 691.30 | 695.05 | | 695.06 | 0.000053 | 0.59 | 517.68 | 680.16 | 0.06 |
| Main | 15434.41 | Max WS | 79.76 | 690.01 | 694.94 | | 694.98 | 0.000383 | 1.49 | 53.56 | 19.70 | 0.16 |
| Main | 15212.53 | Max WS | 82.42 | 689.73 | 694.87 | | 694.90 | 0.000286 | 1.35 | 60.89 | 21.04 | 0.14 |
| Main | 14922.76 | Max WS | 85.93 | 689.36 | 694.84 | | 694.84 | 0.000069 | 0.68 | 202.59 | 423.08 | 0.07 |
| Main | 14774.58 | Max WS | 139.92 | 689.19 | 694.81 | | 694.82 | 0.000197 | 1.26 | 247.11 | 319.14 | 0.12 |
| Main | 14457.09 | Max WS | 144.62 | 688.79 | 694.75 | | 694.77 | 0.000141 | 1.10 | 215.57 | 214.96 | 0.11 |
| Main | 14406.13 | Max WS | 145.45 | 688.73 | 694.75 | | 694.76 | 0.000076 | 1.01 | 219.71 | 135.52 | 0.08 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | Max WS | 145.40 | 688.38 | 694.66 | | 694.67 | 0.000057 | 1.00 | 145.66 | 32.62 | 0.08 |
| Main | 13949.59 | Max WS | 146.02 | 688.37 | 694.65 | | 694.67 | 0.000087 | 1.10 | 132.86 | 324.37 | 0.10 |
| Main | 13839.56 | Max WS | 147.80 | 688.25 | 694.64 | | 694.66 | 0.000074 | 1.13 | 144.04 | 349.65 | 0.09 |
| Main | 13732.13 | Max WS | 149.55 | 688.19 | 694.65 | | 694.65 | 0.000024 | 0.63 | 361.30 | 364.50 | 0.05 |
| Main | 13662.15 | Max WS | 150.69 | 688.17 | 694.64 | | 694.65 | 0.000083 | 1.17 | 184.96 | 199.38 | 0.09 |
| Main | 13628.36 | Max WS | 152.66 | 688.12 | 694.63 | | 694.65 | 0.000061 | 1.08 | 173.84 | 202.09 | 0.08 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | Max WS | 152.66 | 688.72 | 694.48 | | 694.50 | 0.000243 | 1.00 | 161.09 | 321.02 | 0.08 |
| Main | 13414.20 | Max WS | 153.13 | 689.00 | 694.47 | | 694.49 | 0.000232 | 0.89 | 186.75 | 328.85 | 0.08 |
| Main | 13217.08 | Max WS | 157.03 | 688.99 | 694.36 | | 694.39 | 0.000743 | 1.51 | 125.17 | 163.37 | 0.14 |
| Main | 13001.02 | Max WS | 160.80 | 688.98 | 694.07 | | 694.13 | 0.001601 | 2.04 | 78.65 | 23.72 | 0.20 |
| Main | 12615.85 | Max WS | 166.98 | 688.85 | 693.48 | | 693.54 | 0.001485 | 1.96 | 85.26 | 26.57 | 0.19 |
| Main | 12216.99 | Max WS | 173.19 | 688.69 | 693.09 | | 693.13 | 0.000525 | 1.70 | 102.12 | 34.75 | 0.17 |
| Main | 12019.91 | Max WS | 176.39 | 688.59 | 692.78 | | 692.91 | 0.001776 | 2.86 | 61.62 | 22.86 | 0.31 |
| Main | 12001.15 | Max WS | 176.88 | 688.06 | 692.83 | | 692.88 | 0.000477 | 1.73 | 102.32 | 28.52 | 0.16 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | Max WS | 176.80 | 687.94 | 692.71 | | 692.74 | 0.000263 | 1.52 | 121.59 | 40.39 | 0.13 |
| Main | 11831.40 | Max WS | 176.64 | 688.77 | 692.63 | | 692.71 | 0.000986 | 2.29 | 77.09 | 95.93 | 0.23 |
| Main | 11746.9* | Max WS | 178.45 | 688.77 | 692.55 | | 692.62 | 0.001197 | 2.20 | 112.00 | 137.02 | 0.23 |
| Main | 11662.5* | Max WS | 178.69 | 688.77 | 692.44 | | 692.50 | 0.001528 | 2.18 | 140.01 | 226.32 | 0.23 |
| Main | 11578.0* | Max WS | 178.62 | 688.76 | 692.31 | | 692.36 | 0.001452 | 1.91 | 238.60 | 487.48 | 0.21 |
| Main | 11493.63 | Max WS | 179.21 | 688.76 | 692.24 | | 692.25 | 0.000403 | 0.97 | 681.95 | 808.38 | 0.10 |
| Main | 11398.6* | Max WS | 179.36 | 688.76 | 692.19 | | 692.20 | 0.000546 | 1.11 | 584.20 | 801.49 | 0.12 |
| Main | 11303.5* | Max WS | 178.53 | 688.76 | 692.14 | | 692.15 | 0.000609 | 1.17 | 533.12 | 797.56 | 0.12 |
| Main | 11208.5* | Max WS | 171.53 | 688.75 | 692.09 | | 692.10 | 0.000508 | 1.06 | 529.50 | 719.82 | 0.11 |
| Main | 11113.5* | Max WS | 131.78 | 688.75 | 692.04 | | 692.05 | 0.000245 | 0.73 | 560.78 | 671.03 | 0.08 |
| Main | 11018.49 | Max WS | 131.21 | 688.75 | 692.02 | | 692.03 | 0.000184 | 0.62 | 623.54 | 658.71 | 0.07 |
| Main | 10922.5* | Max WS | 130.55 | 688.75 | 692.00 | | 692.01 | 0.000170 | 0.60 | 523.13 | 576.02 | 0.07 |
| Main | 10826.6* | Max WS | 130.06 | 688.75 | 691.99 | | 691.99 | 0.000127 | 0.51 | 535.73 | 531.20 | 0.06 |
| Main | 10730.67 | Max WS | 129.86 | 688.75 | 691.97 | | 691.98 | 0.000088 | 0.42 | 563.68 | 509.85 | 0.05 |
| Main | 10638.0* | Max WS | 129.75 | 688.74 | 691.97 | | 691.97 | 0.000061 | 0.34 | 682.87 | 568.33 | 0.04 |
| Main | 10545.5* | Max WS | 129.29 | 688.73 | 691.97 | | 691.97 | 0.000034 | 0.25 | 912.97 | 622.76 | 0.03 |
| Main | 10452.9* | Max WS | 129.87 | 688.72 | 691.96 | | 691.96 | 0.000015 | 0.16 | 1243.98 | 714.95 | 0.02 |
| Main | 10360.3* | Max WS | 130.08 | 688.71 | 691.96 | | 691.96 | 0.000005 | 0.09 | 1658.99 | 747.43 | 0.01 |
| Main | 10267.74 | Max WS | 129.99 | 688.70 | 691.96 | | 691.96 | 0.000075 | 0.35 | 330.29 | 822.22 | 0.04 |
| Main | 10182.4* | Max WS | 130.21 | 688.69 | 691.96 | | 691.96 | 0.000008 | 0.12 | 2058.13 | 773.65 | 0.01 |
| Main | 10097.1* | Max WS | 130.16 | 688.68 | 691.96 | | 691.96 | 0.000006 | 0.11 | 1985.60 | 767.61 | 0.01 |
| Main | 10011.8* | Max WS | 130.65 | 688.67 | 691.96 | | 691.96 | 0.000004 | 0.09 | 1921.72 | 794.40 | 0.01 |
| Main | 9926.510 | Max WS | 130.63 | 688.66 | 691.95 | | 691.95 | 0.000104 | 0.46 | 344.37 | 887.83 | 0.05 |
| Main | 9491.793 | Max WS | 129.11 | 688.61 | 691.89 | 689.31 | 691.90 | 0.000107 | 0.41 | 267.76 | 435.61 | 0.05 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | Max WS | 129.11 | 688.30 | 691.89 | | 691.89 | 0.000083 | 0.33 | 732.62 | 847.64 | 0.04 |
| Main | 8784.397 | Max WS | 127.85 | 688.22 | 691.86 | | 691.87 | 0.000378 | 0.89 | 437.32 | 886.15 | 0.10 |
| Main | 8722.829 | Max WS | 123.75 | 688.12 | 691.83 | | 691.83 | 0.000379 | 0.77 | 443.88 | 596.76 | 0.09 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | Max WS | 122.46 | 687.48 | 691.83 | | 691.83 | 0.000143 | 0.62 | 526.47 | 661.75 | 0.06 |
| Main | 8631.519 | Max WS | 122.23 | 687.41 | 691.82 | | 691.82 | 0.000166 | 0.63 | 516.20 | 615.57 | 0.06 |
| Main | 8345.665 | Max WS | 118.08 | 687.28 | 691.80 | | 691.80 | 0.000014 | 0.20 | 1622.88 | 1240.99 | 0.02 |
| Main | 8047.118 | Max WS | 117.43 | 687.10 | 691.79 | | 691.79 | 0.000020 | 0.23 | 1098.52 | 746.26 | 0.02 |
| Main | 7739.449 | Max WS | 117.19 | 686.99 | 691.79 | | 691.79 | 0.000010 | 0.21 | 1182.11 | 1501.96 | 0.02 |
| Main | 7515.565 | Max WS | 116.42 | 686.79 | 691.79 | | 691.79 | 0.000026 | 0.31 | 512.72 | 332.24 | 0.03 |
| Main | 7272.821 | Max WS | 115.74 | 686.67 | 691.78 | | 691.78 | 0.000027 | 0.36 | 1108.76 | 909.56 | 0.03 |
| Main | 7255.385 | Max WS | 115.73 | 686.00 | 691.78 | | 691.78 | 0.000049 | 0.41 | 1172.59 | 811.80 | 0.04 |
| Main | 7226.812 | | Culvert | | | | | | | | | |

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86
145
153
179
131
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HEC-RAS Plan: 100yr12hrHuf River: Spring Creek Reach: Main Profile: Max WS (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7193.714 | Max WS | 115.73 | 685.90 | 691.78 | | 691.78 | 0.000014 | 0.25 | 1609.69 | 667.25 | 0.02 |
| Main | 7141.580 | Max WS | 115.92 | 686.28 | 691.78 | | 691.78 | 0.000025 | 0.23 | 1108.11 | 609.87 | 0.02 |
| Main | 7071.87* | Max WS | 115.61 | 686.28 | 691.78 | | 691.78 | 0.000020 | 0.22 | 1174.79 | 558.61 | 0.02 |
| Main | 7002.16* | Max WS | 115.59 | 686.27 | 691.77 | | 691.77 | 0.000018 | 0.25 | 1182.42 | 547.75 | 0.02 |
| Main | 6932.458 | Max WS | 115.28 | 686.27 | 691.77 | | 691.77 | 0.000017 | 0.29 | 1204.96 | 513.31 | 0.02 |
| Main | 6846.57* | Max WS | 114.94 | 686.27 | 691.77 | | 691.77 | 0.000033 | 0.40 | 780.72 | 444.26 | 0.03 |
| Main | 6760.7* | Max WS | 114.76 | 686.27 | 691.77 | | 691.77 | 0.000046 | 0.47 | 537.49 | 313.14 | 0.04 |
| Main | 6674.82* | Max WS | 114.32 | 686.26 | 691.76 | | 691.76 | 0.000052 | 0.50 | 471.65 | 350.63 | 0.04 |
| Main | 6588.943 | Max WS | 114.14 | 686.26 | 691.76 | | 691.76 | 0.000025 | 0.35 | 1003.87 | 526.99 | 0.03 |
| Main | 6495.53* | Max WS | 113.85 | 686.26 | 691.76 | | 691.76 | 0.000010 | 0.22 | 1435.09 | 712.92 | 0.02 |
| Main | 6402.13* | Max WS | 113.82 | 686.26 | 691.76 | | 691.76 | 0.000007 | 0.18 | 1880.99 | 906.63 | 0.01 |
| Main | 6308.73* | Max WS | 113.99 | 686.27 | 691.76 | | 691.76 | 0.000006 | 0.17 | 1900.25 | 1141.92 | 0.01 |
| Main | 6215.32* | Max WS | 113.76 | 686.27 | 691.76 | | 691.76 | 0.000005 | 0.16 | 1818.75 | 1486.22 | 0.01 |
| Main | 6121.924 | Max WS | 113.68 | 686.27 | 691.75 | | 691.75 | 0.000005 | 0.15 | 1637.59 | 1806.30 | 0.01 |
| Main | 6035.96* | Max WS | 113.52 | 686.27 | 691.75 | | 691.75 | 0.000006 | 0.16 | 1527.98 | 1748.82 | 0.01 |
| Main | 5950.01* | Max WS | 113.53 | 686.27 | 691.75 | | 691.75 | 0.000007 | 0.18 | 1339.59 | 1703.71 | 0.02 |
| Main | 5864.05* | Max WS | 113.33 | 686.27 | 691.75 | | 691.75 | 0.000010 | 0.21 | 1115.55 | 1677.57 | 0.02 |
| Main | 5778.104 | Max WS | 113.32 | 686.27 | 691.75 | | 691.75 | 0.000014 | 0.25 | 863.61 | 1651.64 | 0.02 |
| Main | 5687.63* | Max WS | 113.45 | 686.28 | 691.75 | | 691.75 | 0.000030 | 0.38 | 505.01 | 1144.78 | 0.03 |
| Main | 5597.166 | Max WS | 113.39 | 686.28 | 691.74 | | 691.74 | 0.000070 | 0.61 | 220.93 | 647.69 | 0.05 |
| Main | 5556.618 | Max WS | 113.31 | 686.43 | 691.73 | | 691.74 | 0.000147 | 0.95 | 128.34 | 535.36 | 0.08 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | Max WS | 112.92 | 685.19 | 691.65 | | 691.66 | 0.000106 | 0.89 | 126.32 | 381.95 | 0.07 |
| Main | 5437.667 | Max WS | 113.02 | 685.35 | 691.65 | | 691.66 | 0.000029 | 0.44 | 258.13 | 475.20 | 0.04 |
| Main | 5357.86* | Max WS | 113.07 | 685.35 | 691.65 | | 691.65 | 0.000047 | 0.54 | 209.83 | 408.87 | 0.04 |
| Main | 5278.05* | Max WS | 112.81 | 685.34 | 691.64 | | 691.65 | 0.000077 | 0.67 | 167.97 | 347.56 | 0.06 |
| Main | 5198.254 | Max WS | 112.85 | 685.34 | 691.63 | | 691.64 | 0.000142 | 0.87 | 130.12 | 283.87 | 0.07 |
| Main | 5121.63* | Max WS | 112.83 | 685.34 | 691.62 | | 691.63 | 0.000125 | 0.81 | 140.08 | 312.51 | 0.07 |
| Main | 5045.01* | Max WS | 112.87 | 685.34 | 691.61 | | 691.62 | 0.000106 | 0.73 | 153.78 | 322.95 | 0.07 |
| Main | 4968.39* | Max WS | 112.86 | 685.33 | 691.61 | | 691.61 | 0.000085 | 0.64 | 192.02 | 343.59 | 0.06 |
| Main | 4891.776 | Max WS | 112.85 | 685.33 | 691.61 | | 691.61 | 0.000044 | 0.50 | 321.29 | 534.95 | 0.04 |
| Main | 4810.20* | Max WS | 112.81 | 685.33 | 691.60 | | 691.61 | 0.000058 | 0.55 | 301.66 | 460.56 | 0.05 |
| Main | 4728.63* | Max WS | 112.77 | 685.33 | 691.59 | | 691.60 | 0.000077 | 0.60 | 284.72 | 297.29 | 0.06 |
| Main | 4647.06* | Max WS | 112.79 | 685.32 | 691.59 | | 691.59 | 0.000095 | 0.64 | 280.74 | 284.06 | 0.06 |
| Main | 4565.488 | Max WS | 112.80 | 685.32 | 691.58 | | 691.58 | 0.000123 | 0.70 | 222.87 | 263.71 | 0.07 |
| Main | 4504.263 | Max WS | 112.78 | 685.32 | 691.56 | | 691.57 | 0.000161 | 0.82 | 140.99 | 69.72 | 0.08 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | Max WS | 112.69 | 684.72 | 691.31 | | 691.33 | 0.000167 | 1.15 | 99.35 | 28.61 | 0.09 |
| Main | 4346.582 | Max WS | 112.67 | 685.50 | 691.30 | | 691.31 | 0.000193 | 0.96 | 117.67 | 30.21 | 0.09 |
| Main | 4194.408 | Max WS | 112.64 | 685.49 | 691.27 | | 691.28 | 0.000239 | 1.02 | 109.98 | 30.08 | 0.09 |
| Main | 3788.373 | Max WS | 112.59 | 685.36 | 691.22 | | 691.22 | 0.000019 | 0.34 | 569.94 | 282.45 | 0.03 |
| Main | 3395.646 | Max WS | 112.59 | 685.01 | 691.21 | | 691.22 | 0.000016 | 0.44 | 490.75 | 218.52 | 0.03 |
| Main | 3331.113 | Max WS | 112.59 | 685.09 | 691.21 | | 691.21 | 0.000053 | 0.73 | 157.35 | 90.44 | 0.06 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | Max WS | 83.39 | 683.69 | 689.07 | | 689.11 | 0.000296 | 1.59 | 58.88 | 21.71 | 0.13 |
| Main | 3141.921 | Max WS | 84.62 | 683.98 | 689.06 | | 689.09 | 0.000371 | 1.41 | 60.03 | 18.39 | 0.14 |
| Main | 3004.055 | Max WS | 84.27 | 683.97 | 689.03 | | 689.05 | 0.000151 | 0.99 | 85.44 | 23.56 | 0.09 |
| Main | 2734.719 | Max WS | 89.97 | 683.96 | 688.97 | | 688.99 | 0.000273 | 1.23 | 72.91 | 22.98 | 0.12 |
| Main | 2688.915 | Max WS | 91.05 | 683.95 | 688.95 | | 688.98 | 0.000334 | 1.31 | 69.50 | 23.43 | 0.13 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | Max WS | 88.53 | 683.44 | 688.56 | | 688.62 | 0.000804 | 1.94 | 45.68 | 12.85 | 0.18 |
| Main | 2582.291 | Max WS | 89.80 | 683.33 | 688.55 | | 688.59 | 0.000485 | 1.62 | 55.41 | 15.78 | 0.15 |
| Main | 2218.895 | Max WS | 99.88 | 682.33 | 688.47 | | 688.48 | 0.000054 | 0.67 | 148.72 | 36.31 | 0.06 |
| Main | 2049.666 | Max WS | 99.84 | 681.91 | 688.47 | | 688.47 | 0.000047 | 0.63 | 221.52 | 91.62 | 0.05 |
| Main | 1853.478 | Max WS | 272.92 | 681.42 | 688.36 | | 688.40 | 0.000349 | 1.64 | 166.78 | 43.36 | 0.15 |
| Main | 1799.666 | Max WS | 271.73 | 681.24 | 688.34 | | 688.38 | 0.000388 | 1.66 | 163.51 | 41.59 | 0.15 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | Max WS | 244.81 | 681.24 | 688.01 | | 688.07 | 0.000398 | 1.95 | 133.88 | 64.11 | 0.15 |
| Main | 1606.765 | Max WS | 246.35 | 681.22 | 688.03 | | 688.05 | 0.000129 | 1.04 | 248.85 | 445.87 | 0.09 |
| Main | 1475.852 | Max WS | 299.44 | 681.21 | 686.62 | | 686.79 | 0.002598 | 3.24 | 93.63 | 53.30 | 0.37 |
| Main | 1134.554 | Max WS | 303.85 | 681.17 | 685.87 | | 686.02 | 0.001881 | 3.05 | 99.58 | 36.91 | 0.33 |
| Main | 792.3003 | Max WS | 303.77 | 681.12 | 685.15 | | 685.29 | 0.002397 | 3.35 | 244.04 | 334.40 | 0.36 |
| Main | 482.8005 | Max WS | 361.19 | 680.38 | 684.74 | | 684.74 | 0.000198 | 1.12 | 1442.74 | 852.75 | 0.11 |
| Main | 35.46111 | Max WS | 4.93 | 680.10 | 684.70 | 677.01 | 684.70 | 0.000000 | 0.00 | 1919.79 | 769.39 | 0.00 |

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304

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500-yr

HEC-RAS Plan: 500yrHuff River: Spring Creek Reach: Main Profile: Max WS

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 17035.08 | Max WS | 154.25 | 696.40 | 700.14 | | 700.31 | 0.002371 | 3.37 | 46.15 | 26.91 | 0.40 |
| Main | 16983.37 | Max WS | 154.23 | 696.00 | 699.73 | | 700.06 | 0.007850 | 4.54 | 33.96 | 23.90 | 0.67 |
| Main | 16899.4* | Max WS | 156.42 | 695.54 | 699.07 | | 699.39 | 0.007841 | 4.53 | 34.52 | 24.65 | 0.67 |
| Main | 16815.4* | Max WS | 158.62 | 695.08 | 698.41 | | 698.73 | 0.007874 | 4.54 | 34.93 | 25.18 | 0.68 |
| Main | 16731.5* | Max WS | 160.79 | 694.62 | 697.74 | | 698.06 | 0.007727 | 4.56 | 35.29 | 87.10 | 0.68 |
| Main | 16647.5* | Max WS | 162.33 | 694.16 | 697.11 | | 697.42 | 0.007255 | 4.52 | 35.93 | 125.44 | 0.66 |
| Main | 16563.6* | Max WS | 159.13 | 693.70 | 696.60 | | 696.86 | 0.005232 | 4.06 | 39.91 | 153.68 | 0.57 |
| Main | 16479.65 | Max WS | 143.42 | 693.24 | 696.44 | | 696.51 | 0.001207 | 2.36 | 132.33 | 363.30 | 0.29 |
| Main | 16403.7* | Max WS | 139.98 | 693.01 | 696.38 | | 696.42 | 0.000656 | 1.78 | 190.28 | 417.72 | 0.21 |
| Main | 16327.7* | Max WS | 139.10 | 692.78 | 696.35 | | 696.37 | 0.000350 | 1.34 | 263.17 | 451.62 | 0.16 |
| Main | 16251.7* | Max WS | 139.91 | 692.54 | 696.34 | | 696.35 | 0.000199 | 1.04 | 347.74 | 487.78 | 0.12 |
| Main | 16175.84 | Max WS | 140.66 | 692.31 | 696.33 | | 696.33 | 0.000118 | 0.83 | 443.59 | 526.64 | 0.09 |
| Main | 16100.* | Max WS | 142.13 | 692.07 | 696.32 | | 696.32 | 0.000073 | 0.64 | 652.10 | 646.04 | 0.07 |
| Main | 16024.40 | Max WS | 144.13 | 691.83 | 696.31 | | 696.31 | 0.000021 | 0.38 | 1081.63 | 1151.29 | 0.04 |
| Main | 15850.19 | Max WS | 146.33 | 691.30 | 696.31 | | 696.31 | 0.000020 | 0.46 | 1290.75 | 1138.26 | 0.04 |
| Main | 15434.41 | Max WS | 153.22 | 690.01 | 696.19 | | 696.24 | 0.000466 | 1.90 | 80.76 | 26.08 | 0.18 |
| Main | 15212.53 | Max WS | 156.69 | 689.73 | 696.10 | | 696.15 | 0.000370 | 1.76 | 89.26 | 25.13 | 0.16 |
| Main | 14922.76 | Max WS | 160.62 | 689.36 | 696.07 | | 696.07 | 0.000056 | 0.79 | 373.05 | 640.92 | 0.07 |
| Main | 14774.58 | Max WS | 221.44 | 689.19 | 696.05 | | 696.06 | 0.000093 | 1.07 | 482.99 | 389.15 | 0.09 |
| Main | 14457.09 | Max WS | 226.45 | 688.79 | 696.02 | | 696.03 | 0.000091 | 1.10 | 377.61 | 266.97 | 0.09 |
| Main | 14406.13 | Max WS | 227.33 | 688.73 | 696.01 | | 696.03 | 0.000079 | 1.20 | 302.92 | 243.88 | 0.08 |
| Main | 14204.08 | | Culvert | | | | | | | | | |
| Main | 13981.41 | Max WS | 227.29 | 688.38 | 695.77 | | 695.80 | 0.000076 | 1.28 | 177.82 | 158.51 | 0.09 |
| Main | 13949.59 | Max WS | 227.99 | 688.37 | 695.77 | | 695.80 | 0.000098 | 1.34 | 173.16 | 339.96 | 0.11 |
| Main | 13839.56 | Max WS | 229.88 | 688.25 | 695.77 | | 695.79 | 0.000063 | 1.16 | 283.18 | 377.29 | 0.09 |
| Main | 13732.13 | Max WS | 231.72 | 688.19 | 695.78 | | 695.78 | 0.000005 | 0.34 | 776.20 | 375.03 | 0.02 |
| Main | 13662.15 | Max WS | 232.93 | 688.17 | 695.76 | | 695.78 | 0.000081 | 1.29 | 272.01 | 336.97 | 0.10 |
| Main | 13628.36 | Max WS | 235.00 | 688.12 | 695.75 | | 695.78 | 0.000069 | 1.31 | 229.39 | 214.25 | 0.09 |
| Main | 13536.36 | | Culvert | | | | | | | | | |
| Main | 13453.85 | Max WS | 234.98 | 688.72 | 695.38 | | 695.40 | 0.000310 | 1.27 | 198.79 | 385.11 | 0.09 |
| Main | 13414.20 | Max WS | 235.51 | 689.00 | 695.37 | | 695.39 | 0.000250 | 1.06 | 253.12 | 457.88 | 0.09 |
| Main | 13217.08 | Max WS | 239.59 | 688.99 | 695.27 | | 695.30 | 0.000601 | 1.52 | 262.87 | 363.86 | 0.13 |
| Main | 13001.02 | Max WS | 243.46 | 688.98 | 694.94 | | 695.03 | 0.001868 | 2.42 | 100.41 | 26.05 | 0.22 |
| Main | 12615.85 | Max WS | 249.28 | 688.85 | 694.24 | | 694.33 | 0.001790 | 2.34 | 106.50 | 29.01 | 0.22 |
| Main | 12216.99 | Max WS | 254.99 | 688.69 | 693.78 | | 693.85 | 0.000609 | 2.00 | 127.26 | 37.42 | 0.19 |
| Main | 12019.91 | Max WS | 215.97 | 688.59 | 693.47 | | 693.59 | 0.001411 | 2.74 | 78.71 | 26.57 | 0.28 |
| Main | 12001.15 | Max WS | 217.42 | 688.06 | 693.52 | | 693.57 | 0.000430 | 1.77 | 122.49 | 30.06 | 0.15 |
| Main | 11937.42 | | Culvert | | | | | | | | | |
| Main | 11882.28 | Max WS | 209.34 | 687.94 | 693.38 | | 693.41 | 0.000227 | 1.55 | 140.85 | 42.27 | 0.12 |
| Main | 11831.40 | Max WS | 198.12 | 688.77 | 693.31 | | 693.38 | 0.000680 | 2.09 | 94.91 | 188.70 | 0.20 |
| Main | 11746.9* | Max WS | 193.51 | 688.77 | 693.30 | | 693.32 | 0.000417 | 1.44 | 269.78 | 276.94 | 0.14 |
| Main | 11662.5* | Max WS | 183.59 | 688.77 | 693.27 | | 693.28 | 0.000340 | 1.16 | 434.03 | 514.54 | 0.11 |
| Main | 11578.0* | Max WS | 170.72 | 688.76 | 693.25 | | 693.25 | 0.000137 | 0.70 | 884.45 | 791.30 | 0.07 |
| Main | 11493.63 | Max WS | 168.09 | 688.76 | 693.24 | | 693.24 | 0.000039 | 0.37 | 1548.68 | 896.38 | 0.03 |
| Main | 11398.6* | Max WS | 166.37 | 688.76 | 693.24 | | 693.24 | 0.000045 | 0.39 | 1484.40 | 893.74 | 0.04 |
| Main | 11303.5* | Max WS | 164.19 | 688.76 | 693.24 | | 693.24 | 0.000044 | 0.39 | 1478.83 | 902.23 | 0.04 |
| Main | 11208.5* | Max WS | 161.94 | 688.75 | 693.23 | | 693.23 | 0.000039 | 0.37 | 1507.33 | 917.33 | 0.03 |
| Main | 11113.5* | Max WS | 159.48 | 688.75 | 693.23 | | 693.23 | 0.000034 | 0.35 | 1568.65 | 964.68 | 0.03 |
| Main | 11018.49 | Max WS | 158.65 | 688.75 | 693.22 | | 693.23 | 0.000029 | 0.32 | 1651.57 | 998.12 | 0.03 |
| Main | 10922.5* | Max WS | 157.03 | 688.75 | 693.22 | | 693.22 | 0.000029 | 0.32 | 1384.21 | 813.43 | 0.03 |
| Main | 10826.6* | Max WS | 156.24 | 688.75 | 693.22 | | 693.22 | 0.000025 | 0.30 | 1361.11 | 748.57 | 0.03 |
| Main | 10730.67 | Max WS | 155.10 | 688.75 | 693.22 | | 693.22 | 0.000020 | 0.26 | 1349.38 | 730.59 | 0.02 |
| Main | 10638.0* | Max WS | 154.73 | 688.74 | 693.21 | | 693.21 | 0.000014 | 0.22 | 1517.45 | 759.24 | 0.02 |
| Main | 10545.5* | Max WS | 154.32 | 688.73 | 693.21 | | 693.21 | 0.000008 | 0.17 | 1820.00 | 815.66 | 0.02 |
| Main | 10452.9* | Max WS | 153.51 | 688.72 | 693.21 | | 693.21 | 0.000004 | 0.11 | 2227.35 | 844.66 | 0.01 |
| Main | 10360.3* | Max WS | 153.87 | 688.71 | 693.21 | | 693.21 | 0.000002 | 0.07 | 2720.58 | 934.36 | 0.01 |
| Main | 10267.74 | Max WS | 153.19 | 688.70 | 693.21 | | 693.21 | 0.000010 | 0.17 | 1503.87 | 1077.86 | 0.02 |
| Main | 10182.4* | Max WS | 153.80 | 688.69 | 693.21 | | 693.21 | 0.000003 | 0.09 | 3150.51 | 967.44 | 0.01 |
| Main | 10097.1* | Max WS | 153.74 | 688.68 | 693.21 | | 693.21 | 0.000002 | 0.08 | 3065.47 | 955.25 | 0.01 |
| Main | 10011.8* | Max WS | 152.79 | 688.67 | 693.21 | | 693.21 | 0.000002 | 0.07 | 3051.04 | 995.34 | 0.01 |
| Main | 9926.510 | Max WS | 152.75 | 688.66 | 693.21 | | 693.21 | 0.000012 | 0.19 | 1624.64 | 1175.15 | 0.02 |
| Main | 9491.793 | Max WS | 151.17 | 688.61 | 693.20 | 689.40 | 693.21 | 0.000023 | 0.26 | 965.83 | 671.55 | 0.03 |
| Main | 9382.780 | | Inl Struct | | | | | | | | | |
| Main | 8939.248 | Max WS | 150.23 | 688.30 | 693.20 | | 693.20 | 0.000012 | 0.17 | 2170.57 | 1221.82 | 0.02 |
| Main | 8784.397 | Max WS | 149.61 | 688.22 | 693.20 | | 693.20 | 0.000054 | 0.41 | 1121.84 | 1122.96 | 0.04 |
| Main | 8722.829 | Max WS | 147.79 | 688.12 | 693.19 | | 693.19 | 0.000067 | 0.42 | 1058.86 | 905.73 | 0.04 |
| Main | 8695.034 | | Culvert | | | | | | | | | |
| Main | 8674.268 | Max WS | 146.67 | 687.48 | 693.19 | | 693.19 | 0.000031 | 0.36 | 1225.82 | 913.29 | 0.03 |
| Main | 8631.519 | Max WS | 146.65 | 687.41 | 693.19 | | 693.19 | 0.000038 | 0.39 | 1178.05 | 892.80 | 0.03 |
| Main | 8345.665 | Max WS | 146.05 | 687.28 | 693.19 | | 693.19 | 0.000003 | 0.11 | 3445.67 | 1360.46 | 0.01 |
| Main | 8047.118 | Max WS | 145.26 | 687.10 | 693.18 | | 693.18 | 0.000004 | 0.13 | 2179.16 | 804.60 | 0.01 |
| Main | 7739.449 | Max WS | 145.13 | 686.99 | 693.18 | | 693.18 | 0.000003 | 0.14 | 2118.96 | 1571.94 | 0.01 |
| Main | 7515.565 | Max WS | 144.46 | 686.79 | 693.18 | | 693.18 | 0.000012 | 0.26 | 827.59 | 393.42 | 0.02 |
| Main | 7272.821 | Max WS | 144.57 | 686.67 | 693.18 | | 693.18 | 0.000008 | 0.23 | 2427.32 | 1000.42 | 0.02 |
| Main | 7255.385 | Max WS | 144.26 | 686.00 | 693.18 | | 693.18 | 0.000013 | 0.26 | 2361.20 | 954.49 | 0.02 |
| Main | 7226.812 | | Culvert | | | | | | | | | |

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HEC-RAS Plan: 500yrHuff River: Spring Creek Reach: Main Profile: Max WS (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main | 7193.714 | Max WS | 143.95 | 685.90 | 693.18 | | 693.18 | 0.000005 | 0.19 | 2752.24 | 751.89 | 0.01 |
| Main | 7141.580 | Max WS | 143.74 | 686.28 | 693.18 | | 693.18 | 0.000007 | 0.14 | 2062.80 | 654.34 | 0.01 |
| Main | 7071.87* | Max WS | 143.59 | 686.28 | 693.18 | | 693.18 | 0.000007 | 0.16 | 2005.61 | 628.95 | 0.01 |
| Main | 7002.16* | Max WS | 143.57 | 686.27 | 693.18 | | 693.18 | 0.000007 | 0.19 | 1974.31 | 579.78 | 0.01 |
| Main | 6932.458 | Max WS | 143.85 | 686.27 | 693.18 | | 693.18 | 0.000007 | 0.22 | 1943.87 | 540.30 | 0.02 |
| Main | 6846.57* | Max WS | 143.42 | 686.27 | 693.17 | | 693.18 | 0.000012 | 0.29 | 1473.65 | 509.99 | 0.02 |
| Main | 6760.7* | Max WS | 143.83 | 686.27 | 693.17 | | 693.17 | 0.000019 | 0.36 | 1082.81 | 487.35 | 0.03 |
| Main | 6674.82* | Max WS | 143.40 | 686.26 | 693.17 | | 693.17 | 0.000019 | 0.36 | 1156.24 | 591.06 | 0.03 |
| Main | 6588.943 | Max WS | 143.38 | 686.26 | 693.17 | | 693.17 | 0.000009 | 0.25 | 1786.87 | 586.25 | 0.02 |
| Main | 6495.53* | Max WS | 143.35 | 686.26 | 693.17 | | 693.17 | 0.000003 | 0.15 | 2489.00 | 783.12 | 0.01 |
| Main | 6402.13* | Max WS | 143.21 | 686.26 | 693.17 | | 693.17 | 0.000002 | 0.13 | 3235.78 | 1016.16 | 0.01 |
| Main | 6308.73* | Max WS | 143.29 | 686.27 | 693.17 | | 693.17 | 0.000002 | 0.12 | 3103.93 | 1306.15 | 0.01 |
| Main | 6215.32* | Max WS | 143.01 | 686.27 | 693.17 | | 693.17 | 0.000002 | 0.12 | 2867.12 | 1585.12 | 0.01 |
| Main | 6121.924 | Max WS | 143.14 | 686.27 | 693.17 | | 693.17 | 0.000002 | 0.12 | 2550.29 | 1865.59 | 0.01 |
| Main | 6035.96* | Max WS | 143.05 | 686.27 | 693.17 | | 693.17 | 0.000003 | 0.14 | 2336.29 | 1822.73 | 0.01 |
| Main | 5950.01* | Max WS | 142.99 | 686.27 | 693.17 | | 693.17 | 0.000004 | 0.15 | 2042.51 | 1770.92 | 0.01 |
| Main | 5864.05* | Max WS | 142.67 | 686.27 | 693.17 | | 693.17 | 0.000005 | 0.17 | 1679.28 | 1728.72 | 0.01 |
| Main | 5778.104 | Max WS | 142.85 | 686.27 | 693.17 | | 693.17 | 0.000007 | 0.21 | 1284.16 | 1693.12 | 0.02 |
| Main | 5687.63* | Max WS | 142.96 | 686.28 | 693.17 | | 693.17 | 0.000014 | 0.31 | 764.14 | 1186.19 | 0.02 |
| Main | 5597.166 | Max WS | 142.79 | 686.28 | 693.16 | | 693.16 | 0.000030 | 0.49 | 333.86 | 664.88 | 0.04 |
| Main | 5556.618 | Max WS | 142.78 | 686.43 | 693.15 | | 693.16 | 0.000084 | 0.86 | 178.20 | 616.59 | 0.06 |
| Main | 5525.006 | | Culvert | | | | | | | | | |
| Main | 5490.413 | Max WS | 142.02 | 685.19 | 693.04 | | 693.05 | 0.000081 | 0.90 | 157.19 | 530.09 | 0.06 |
| Main | 5437.667 | Max WS | 142.06 | 685.35 | 693.05 | | 693.05 | 0.000019 | 0.43 | 337.14 | 527.79 | 0.03 |
| Main | 5357.86* | Max WS | 141.97 | 685.35 | 693.04 | | 693.05 | 0.000034 | 0.51 | 276.95 | 459.45 | 0.04 |
| Main | 5278.05* | Max WS | 142.01 | 685.34 | 693.04 | | 693.04 | 0.000056 | 0.64 | 223.41 | 394.25 | 0.05 |
| Main | 5198.254 | Max WS | 141.96 | 685.34 | 693.03 | | 693.04 | 0.000099 | 0.81 | 175.35 | 333.47 | 0.06 |
| Main | 5121.63* | Max WS | 141.99 | 685.34 | 693.02 | | 693.03 | 0.000084 | 0.74 | 190.97 | 351.09 | 0.06 |
| Main | 5045.01* | Max WS | 141.89 | 685.34 | 693.02 | | 693.02 | 0.000069 | 0.66 | 229.33 | 431.38 | 0.05 |
| Main | 4968.39* | Max WS | 141.91 | 685.33 | 693.02 | | 693.02 | 0.000038 | 0.53 | 455.87 | 656.91 | 0.04 |
| Main | 4891.776 | Max WS | 141.88 | 685.33 | 693.02 | | 693.02 | 0.000017 | 0.38 | 870.48 | 744.51 | 0.03 |
| Main | 4810.20* | Max WS | 141.86 | 685.33 | 693.01 | | 693.01 | 0.000019 | 0.38 | 854.20 | 743.34 | 0.03 |
| Main | 4728.63* | Max WS | 141.83 | 685.33 | 693.01 | | 693.01 | 0.000022 | 0.40 | 818.76 | 573.10 | 0.03 |
| Main | 4647.06* | Max WS | 141.80 | 685.32 | 693.01 | | 693.01 | 0.000024 | 0.40 | 782.42 | 416.91 | 0.03 |
| Main | 4565.488 | Max WS | 141.86 | 685.32 | 693.00 | | 693.01 | 0.000045 | 0.52 | 426.38 | 394.86 | 0.04 |
| Main | 4504.263 | Max WS | 141.83 | 685.32 | 693.00 | | 693.01 | 0.000080 | 0.71 | 209.61 | 76.46 | 0.06 |
| Main | 4461.252 | | Culvert | | | | | | | | | |
| Main | 4430.212 | Max WS | 141.58 | 684.72 | 692.59 | | 692.61 | 0.000132 | 1.17 | 122.46 | 33.39 | 0.08 |
| Main | 4346.582 | Max WS | 141.59 | 685.50 | 692.58 | | 692.60 | 0.000133 | 0.89 | 158.79 | 33.87 | 0.07 |
| Main | 4194.408 | Max WS | 141.60 | 685.49 | 692.56 | | 692.57 | 0.000159 | 0.93 | 152.32 | 35.32 | 0.08 |
| Main | 3788.373 | Max WS | 141.53 | 685.36 | 692.53 | | 692.53 | 0.000009 | 0.28 | 969.62 | 325.15 | 0.02 |
| Main | 3395.646 | Max WS | 141.55 | 685.01 | 692.53 | | 692.53 | 0.000010 | 0.40 | 705.80 | 245.61 | 0.03 |
| Main | 3331.113 | Max WS | 141.54 | 685.09 | 692.52 | | 692.53 | 0.000036 | 0.72 | 203.00 | 138.50 | 0.05 |
| Main | 3265.168 | | Culvert | | | | | | | | | |
| Main | 3196.567 | Max WS | 69.32 | 683.69 | 690.42 | | 690.43 | 0.000082 | 1.00 | 78.09 | 24.64 | 0.07 |
| Main | 3141.921 | Max WS | 72.12 | 683.98 | 690.41 | | 690.42 | 0.000099 | 0.83 | 87.27 | 21.82 | 0.07 |
| Main | 3004.055 | Max WS | 78.67 | 683.97 | 690.41 | | 690.41 | 0.000052 | 0.66 | 119.89 | 26.71 | 0.05 |
| Main | 2734.719 | Max WS | 91.09 | 683.96 | 690.38 | | 690.39 | 0.000095 | 0.84 | 108.31 | 27.12 | 0.07 |
| Main | 2688.915 | Max WS | 93.51 | 683.95 | 690.37 | | 690.38 | 0.000110 | 0.88 | 106.14 | 27.79 | 0.08 |
| Main | 2653.174 | | Culvert | | | | | | | | | |
| Main | 2626.817 | Max WS | 91.66 | 683.44 | 690.03 | | 690.06 | 0.000324 | 1.37 | 66.68 | 15.78 | 0.12 |
| Main | 2582.291 | Max WS | 94.04 | 683.33 | 690.02 | | 690.04 | 0.000194 | 1.17 | 80.55 | 18.31 | 0.10 |
| Main | 2218.895 | Max WS | 112.85 | 682.33 | 689.99 | | 690.00 | 0.000024 | 0.55 | 210.21 | 46.48 | 0.04 |
| Main | 2049.666 | Max WS | 112.82 | 681.91 | 689.99 | | 689.99 | 0.000018 | 0.46 | 392.57 | 159.83 | 0.04 |
| Main | 1853.478 | Max WS | 426.62 | 681.42 | 689.89 | | 689.94 | 0.000321 | 1.77 | 242.50 | 84.15 | 0.15 |
| Main | 1799.666 | Max WS | 426.91 | 681.24 | 689.87 | | 689.92 | 0.000327 | 1.85 | 236.30 | 54.48 | 0.14 |
| Main | 1727.858 | | Culvert | | | | | | | | | |
| Main | 1670.018 | Max WS | 378.43 | 681.24 | 688.99 | | 689.08 | 0.000521 | 2.51 | 160.82 | 93.35 | 0.18 |
| Main | 1606.765 | Max WS | 382.66 | 681.22 | 689.03 | | 689.05 | 0.000129 | 1.21 | 323.05 | 463.00 | 0.10 |
| Main | 1475.852 | Max WS | 476.44 | 681.21 | 687.39 | | 687.58 | 0.002336 | 3.65 | 155.66 | 96.23 | 0.37 |
| Main | 1134.554 | Max WS | 484.22 | 681.17 | 686.48 | | 686.72 | 0.002672 | 3.94 | 122.88 | 40.28 | 0.40 |
| Main | 792.3003 | Max WS | 484.05 | 681.12 | 685.67 | | 685.82 | 0.002383 | 3.77 | 453.50 | 448.64 | 0.37 |
| Main | 482.8005 | Max WS | 585.41 | 680.38 | 685.25 | | 685.26 | 0.000248 | 1.39 | 1890.53 | 896.97 | 0.13 |
| Main | 35.46111 | Max WS | 4.95 | 680.10 | 685.20 | 677.01 | 685.20 | 0.000000 | 0.00 | 2312.92 | 803.77 | 0.00 |

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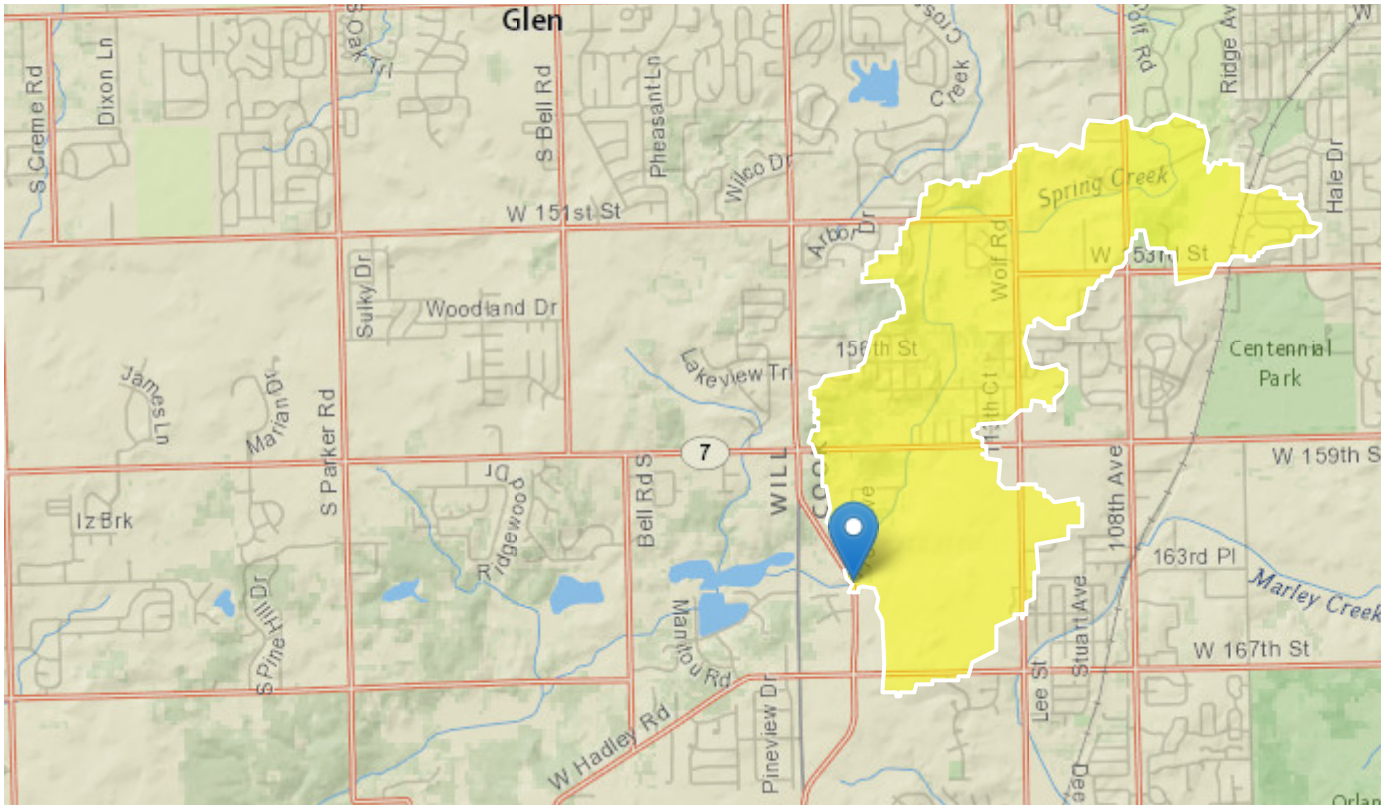
# StreamStats Report

**Region ID:** IL
**Workspace ID:** IL20180620215737951000
**Clicked Point (Latitude, Longitude):** 41.59179, -87.90582
**Time:** 2018-06-20 16:57:52 -0500




Basin Characteristics

| Parameter Code | Parameter Description | Value | Unit |
|---|---|---|---|
| DRNAREA | Area that drains to a point on a stream | 2.31 | square miles |
| FLC11DVLMH | Fraction of drainage area that is in low to high developed land-use classes 22-24 from NLCD 2011 | 0.509 | decimal fraction |
| FSSURGDC78 | Fraction of land area that is in very poorly drained and unknown likely water drainage classes 7 and 8 from SSURGO | 0.173 | decimal fraction |
| RELRELF | Basin relief divided by basin perimeter | 5.84 | feet per mi |

Peak-Flow Statistics Parameters [Region 2 Peak Rural and Urban 2016 5050]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 2.31 | square miles | 0.078 | 1351 |
| FLC11DVLMH | Frac_Lo_Med_Hi_Developed_from_NLCD2011 | 0.509 | decimal fraction | 0.0022 | 0.979 |
| FSSURGDC78 | Fraction_SSURGO_Drainage_Classes_7_and_8 | 0.173 | decimal fraction | 0 | 0.256 |
| RELRELF | Relative Relief | 5.84 | feet per mi | 0.821 | 37.3 |

Peak-Flow Statistics Flow Report [Region 2 Peak Rural and Urban 2016 5050]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

| Statistic | Value | Unit | PII | PIu | SEp |
|---|---|---|---|---|---|
| Urban 2 Year Peak Flood | 75.3 | ft^3/s | 35.8 | 158 | 46 |
| Urban 5 Year Peak Flood | 111 | ft^3/s | 52.1 | 238 | 47.1 |
| Urban 10 Year Peak Flood | 139 | ft^3/s | 63 | 305 | 49.6 |
| Urban 25 Year Peak Flood | 178 | ft^3/s | 76.7 | 413 | 52.9 |
| Urban 50 Year Peak Flood | 210 | ft^3/s | 86.9 | 510 | 55.9 |
| Urban 100 Year Peak Flood | 247 | ft^3/s | 97.1 | 626 | 59.4 |
| Urban 500 Year Peak Flood | 342 | ft^3/s | 122 | 961 | 66.9 |

*Peak-Flow Statistics Citations*

**Over, T.M. , Saito, R.J., Veilleux, A.G., Sharpe, J.B., Soong, D.T., and Ishii, A.L.,2016, Estimation of peak discharge quantiles for selected annual exceedance probabilities in northeastern Illinois: U.S. Geological Survey Scientific Investigations Report 2016-5050, 50 p. (http://dx.doi.org/10.3133/sir20165050)**

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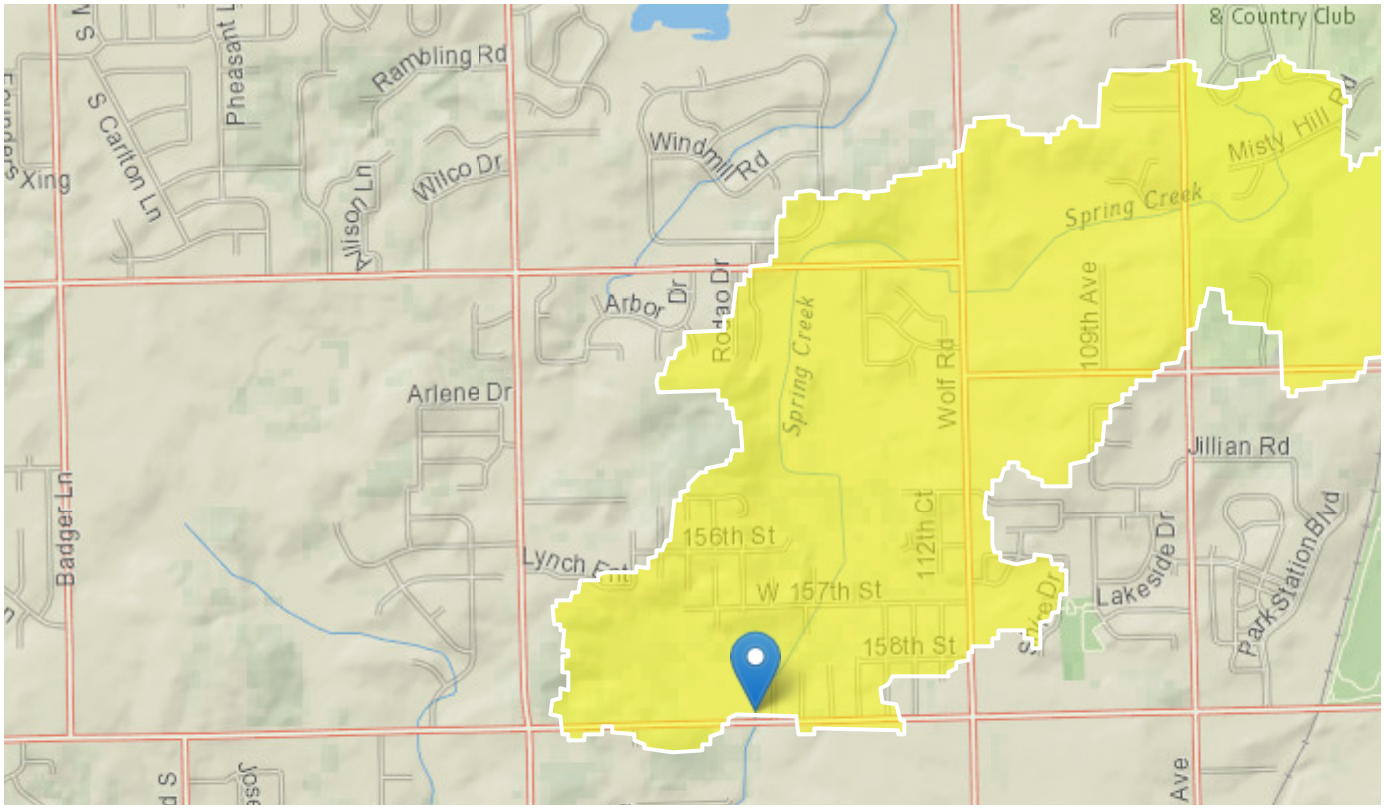
Application Version: 4.2.1

# StreamStats Report

**Region ID:** IL
**Workspace ID:** IL20180620233548735000
**Clicked Point (Latitude, Longitude):** 41.60075, -87.90075
**Time:** 2018-06-20 18:36:04 -0500




Basin Characteristics

| Parameter Code | Parameter Description | Value | Unit |
|---|---|---|---|
| DRNAREA | Area that drains to a point on a stream | 1.54 | square miles |
| FLC11DVLMH | Fraction of drainage area that is in low to high developed land-use classes 22-24 from NLCD 2011 | 0.625 | decimal fraction |
| FSSURGDC78 | Fraction of land area that is in very poorly drained and unknown likely water drainage classes 7 and 8 from SSURGO | 0.249 | decimal fraction |
| RELRELF | Basin relief divided by basin perimeter | 7.15 | feet per mi |

Peak-Flow Statistics Parameters [Region 2 Peak Rural and Urban 2016 5050]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.54 | square miles | 0.078 | 1351 |
| FLC11DVLMH | Frac_Lo_Med_Hi_Developed_from_NLCD2011 | 0.625 | decimal fraction | 0.0022 | 0.979 |
| FSSURGDC78 | Fraction_SSURGO_Drainage_Classes_7_and_8 | 0.249 | decimal fraction | 0 | 0.256 |
| RELRELF | Relative Relief | 7.15 | feet per mi | 0.821 | 37.3 |

Peak-Flow Statistics Flow Report [Region 2 Peak Rural and Urban 2016 5050]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

| Statistic | Value | Unit | PII | PIu | SEp |
|---|---|---|---|---|---|
| Urban 2 Year Peak Flood | 52.5 | ft^3/s | 24.7 | 112 | 46 |
| Urban 5 Year Peak Flood | 76.8 | ft^3/s | 35.4 | 166 | 47.1 |
| Urban 10 Year Peak Flood | 95.6 | ft^3/s | 42.8 | 214 | 49.6 |
| Urban 25 Year Peak Flood | 123 | ft^3/s | 52.1 | 290 | 52.9 |
| Urban 50 Year Peak Flood | 146 | ft^3/s | 59.1 | 360 | 55.9 |
| Urban 100 Year Peak Flood | 172 | ft^3/s | 66.2 | 445 | 59.4 |
| Urban 500 Year Peak Flood | 241 | ft^3/s | 83.9 | 692 | 66.9 |

*Peak-Flow Statistics Citations*

**Over, T.M. , Saito, R.J., Veilleux, A.G., Sharpe, J.B., Soong, D.T., and Ishii, A.L.,2016, Estimation of peak discharge quantiles for selected annual exceedance probabilities in northeastern Illinois: U.S. Geological Survey Scientific Investigations Report 2016-5050, 50 p. (http://dx.doi.org/10.3133/sir20165050)**

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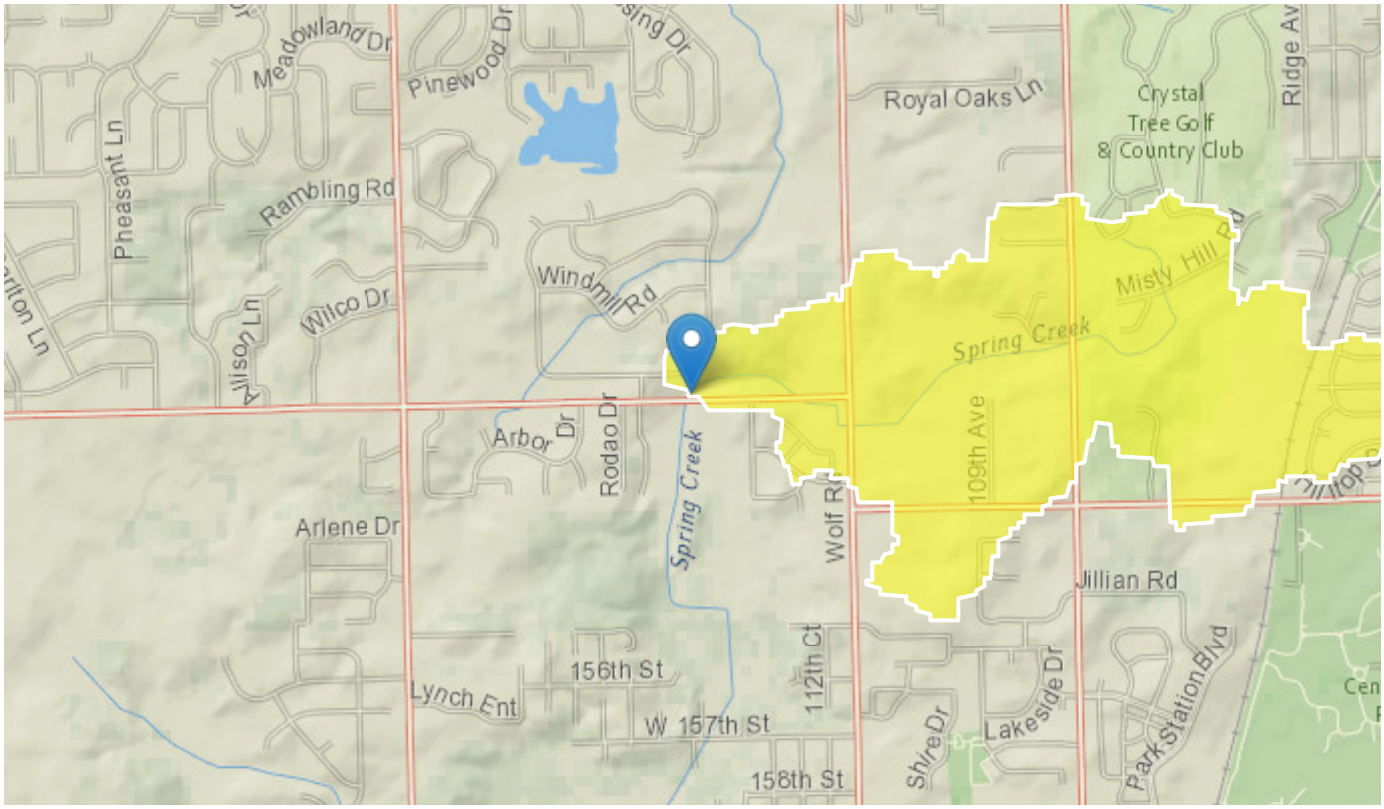
Application Version: 4.2.1

# StreamStats Report

**Region ID:** IL
**Workspace ID:** IL20180620231051877000
**Clicked Point (Latitude, Longitude):** 41.61528, -87.89874
**Time:** 2018-06-20 18:11:08 -0500




Basin Characteristics

| Parameter Code | Parameter Description | Value | Unit |
|---|---|---|---|
| DRNAREA | Area that drains to a point on a stream | 0.81 | square miles |
| FLC11DVLMH | Fraction of drainage area that is in low to high developed land-use classes 22-24 from NLCD 2011 | 0.605 | decimal fraction |
| FSSURGDC78 | Fraction of land area that is in very poorly drained and unknown likely water drainage classes 7 and 8 from SSURGO | 0.214 | decimal fraction |
| RELRELF | Basin relief divided by basin perimeter | 10.06 | feet per mi |

Peak-Flow Statistics Parameters [Region 2 Peak Rural and Urban 2016 5050]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 0.81 | square miles | 0.078 | 1351 |
| FLC11DVLMH | Frac_Lo_Med_Hi_Developed_from_NLCD2011 | 0.605 | decimal fraction | 0.0022 | 0.979 |
| FSSURGDC78 | Fraction_SSURGO_Drainage_Classes_7_and_8 | 0.214 | decimal fraction | 0 | 0.256 |
| RELRELF | Relative Relief | 10.06 | feet per mi | 0.821 | 37.3 |

Peak-Flow Statistics Flow Report [Region 2 Peak Rural and Urban 2016 5050]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

| Statistic | Value | Unit | PII | PIu | SEp |
|---|---|---|---|---|---|
| Urban 2 Year Peak Flood | 37.2 | ft^3/s | 17.5 | 79.3 | 46 |
| Urban 5 Year Peak Flood | 56.6 | ft^3/s | 26.1 | 123 | 47.1 |
| Urban 10 Year Peak Flood | 72 | ft^3/s | 32.2 | 161 | 49.6 |
| Urban 25 Year Peak Flood | 94.3 | ft^3/s | 39.9 | 223 | 52.9 |
| Urban 50 Year Peak Flood | 113 | ft^3/s | 45.9 | 280 | 55.9 |
| Urban 100 Year Peak Flood | 135 | ft^3/s | 51.9 | 349 | 59.4 |
| Urban 500 Year Peak Flood | 193 | ft^3/s | 67.2 | 556 | 66.9 |

*Peak-Flow Statistics Citations*

**Over, T.M. , Saito, R.J., Veilleux, A.G., Sharpe, J.B., Soong, D.T., and Ishii, A.L.,2016, Estimation of peak discharge quantiles for selected annual exceedance probabilities in northeastern Illinois: U.S. Geological Survey Scientific Investigations Report 2016-5050, 50 p. (http://dx.doi.org/10.3133/sir20165050)**

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Application Version: 4.2.1

# *Appendix 3*

# *FEMA FIS Information*

## Table 14 – Summary of Discharges (Continued) ANNOTATED

| Flooding Source and Location | Drainage Area (square miles) | Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance | 2-Percent-Annual-Chance | 1-Percent-Annual-Chance | 0.2-Percent-Annual-Chance |
|---|---|---|---|---|---|
| **Silver Creek** | | | | | |
| At mouth at Des Plaines River | 11.6 | 465 | 712 | 842 | 1,125 |
| At North Avenue | 10.3 | 443 | 680 | 802 | 1,075 |
| At Armitage Avenue | 9.1 | 351 | 620 | 768 | 1,145 |
| Approximately 800 feet upstream of Fullerton Avenue | 9.1 | 425 | 645 | 770 | 1,010 |
| Just upstream of Scott Street | 8.7 | 420 | 640 | 760 | 1,000 |
| At Grand Avenue | 7.4 | 303 | 545 | 669 | 1,015 |
| Approximately 1,800 feet upstream of Grand Avenue | 6.8 | 370 | 570 | 670 | 890 |
| Approximately 800 feet upstream of Belmont Avenue | 6.6 | 360 | 560 | 660 | 880 |
| At Franklin Avenue | 6.4 | 355 | 550 | 655 | 875 |
| At Railroad yard | 6.1 | 350 | 535 | 640 | 850 |
| **Skokie River** (See entry following Chicago River, North Branch) | | | | | |
| **Skokie River, Botanical Garden Diversion** | | | | | |
| At confluence with Skokie River | *[3] | 54 | 388 | 543 | 690 |
| **Skokie River, West Ditch** | | | | | |
| At confluence with Skokie River | 1.2 | 72 | 333 | 638 | 1,141 |
| At Tower Road | 0.8 | 54 | 67 | 73 | 74 |
| **South Navy Ditch** | | | | | |
| Just downstream from Soo Line Railroad | 1.9 | 217 | 351 | 410 | 527 |
| **South Tributary to Tinley Creek** | | | | | |
| At 88th Avenue | 0.4 | * | * | 51 | * |
| **Spring Creek** | | | | | |
| At 118th Avenue | 2.3 **2.3** | 108 **157** | 205 **244** | 259 **304** | 396 **484** |
| At 159th Street | 1.6 **1.6** | 61 **80** | 90 **107** | 97 **117** | 117 **145** |
| At 151st Street and Wolf Road | 0.8 **0.8** | 64 **81** | 112 **129** | 139 **153** | 195 **235** |
| **Stony Creek (East)** | | | | | |
| At confluence with Calumet-Sag Channel | 4.5 | 260 | 395 | 459 | 620 |
| At Sacramento Avenue | 4.3 | 255 | 390 | 454 | 615 |
| At Central Park Avenue | 3.6 | 205 | 315 | 365 | 495 |
| At Crawford Avenue | 2.4 | 158 | 239 | 277 | 372 |
| At Cicero Avenue | 0.2 | 50 | 75 | 100 | 150 |

* Data not available

[3] Includes split flow from Skokie River downstream of Lake Cook Road plus local drainage

**Table 17 - Manning's "n" Values (Continued)**

| Stream | Channel "n" | Overbank "n" |
|---|---|---|
| Poplar Creek South Branch | 0.06-0.080 | 0.04 |
| Poplar Creek Tributary A | 0.04-0.08 | 0.014-0.08 |
| Prairie Creek | 0.020.150 | 0.035-1.0 |
| Salt Creek | 0.03-0.100 | 0.023-0.080 |
| Salt Creek, Arlington Heights Branch | 0.040-0.070 | 0.060-0.090 |
| Salt Creek, Arlington Heights Branch, Anderson Drive Tributary | 0.05 | 0.060-0.080 |
| Salt Creek Middle Fork | 0.09 | 0.09 |
| Salt Creek South Fork | 0.080-0.095 | 0.065-0.095 |
| Salt Creek Tributary | 0.050-0.080 | 0.03 |
| Salt Creek Tributary A | 0.050-0.060 | 0.060-0.080 |
| Salt Creek Tributary B | 0.050-0.060 | 0.060-0.080 |
| Salt Creek Tributary C | 0.050-0.060 | 0.060-0.080 |
| Salt Creek Tributary D | 0.050-0.060 | 0.060-0.080 |
| Salt Creek (Upper Reach) | 0.050-0.060 | 0.060-0.080 |
| Salt Creek West Branch | 0.040-0.070 | 0.060-0.080 |
| Salt Creek West Branch Tributary A | 0.040-0.070 | 0.060-0.080 |
| Salt Creek West Branch Tributary #3 | 0.040-0.070 | 0.060-0.080 |
| Salt Creek West Branch Tributary #4 | 0.040-0.070 | 0.060-0.080 |
| Salt Creek West Branch Tributary #5 | 0.040-0.070 | 0.060-0.080 |
| Salt Creek West Branch Tributary #6 | 0.040-0.070 | 0.060-0.080 |
| Salt Creek West Branch Tributary #7 | 0.040-0.070 | 0.060-0.080 |
| Sexton Ditch | 0.04-0.05 | 0.04-0.05 |
| Silver Creek | 0.030-0.1 | 0.030-0.085 |
| Skokie River | 0.022-0.035 | 0.06-0.08 |
| Skokie River West Ditch | 0.035 | 0.06 |
| Skokie River Botanical Garden Diversion | 0.022-0.035 | 0.06-0.08 |
| South Navy Ditch | 0.045 | 0.08 |
| Spring Creek | 0.035-0.080 | 0.030-0.040 |
| Stony Creek (East) | 0.048-0.098 | 0.014-0.050 |
| Stony Creek (West) | 0.050-0.14 | 0.030-0.045 |
| Techny Drain | 0.040-0.080 | 0.040-0.065 |
| Techny Drain South Fork | 0.040-0.080 | 0.040-0.065 |
| Third Creek | 0.045-0.060 | 0.047-0.070 |
| Thorn Creek | 0.055-0.085 | 0.046-0.18 |

0.035 - 0.09

0.025 - 0.2

| FLOODING SOURCE | | FLOODWAY | | | 1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD) | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE (FEET) |
| Spring Creek | | | | | | | | |
| A | 0[95] 482 | 490 678 | 951 1314 | 0.8 0.3 | 682.9 684.7 | 682.9 684.7 | 683.0 684.7 | 0.1 0.0 |
| B | 1,280[95] 1,187 | 35 29 | 70 108 | 3.7 2.9 | 685.2 687.0 | 685.2 687.0 | 685.2 687.0 | 0.0 0.0 |
| C | 1,400[95] 1,800 | 29 33 | 108 131 | 2.4 2.3 | 686.7 687.6 | 686.7 687.6 | 686.8 687.6 | 0.1 0.0 |
| D | 2,200[95] 2,582 | 13 15 | 45 44 | 2.4 2.3 | 688.4 687.8 | 688.4 687.8 | 688.5 687.8 | 0.1 0.0 |
| E | 2,720[95] 3,197 | 15 21 | 55 62 | 1.9 1.9 | 689.4 688.7 | 689.4 688.7 | 689.5 688.7 | 0.1 0.0 |
| F | 2,820[95] 3,331 | 32 60 | 116 179 | 0.9 0.7 | 690.8 691.2 | 690.8 691.2 | 690.8 691.2 | 0.0 0.0 |
| G | 3,770[95] 4,347 | 44 30 | 112 117 | 0.9 1.0 | 690.9 691.3 | 690.9 691.3 | 690.9 691.3 | 0.0 0.0 |
| H | 4,820[95] 5,490 | 440 330 | 866 305 | 0.1 0.9 | 691.1 691.6 | 691.1 691.6 | 691.2 691.6 | 0.1 0.0 |
| I | 6,400[95] 7,194 | 236 535 | 637 1594 | 0.2 0.1 | 691.3 691.8 | 691.3 691.8 | 691.3 691.8 | 0.0 0.0 |
| J | 8,001[95] 8,723 | 50 514 | 115 677 | 1.3 0.3 | 691.4 691.8 | 691.4 691.8 | 691.4 691.8 | 0.0 0.0 |
| K | 10,651[95] 11,831 | 38 69 | 141 92 | 1.4 2.3 | 692.8 692.6 | 692.8 692.6 | 692.8 692.6 | 0.0 0.0 |
| L | 10,871[95] 12,020 | 21 23 | 79 63 | 2.3 2.9 | 693.1 692.8 | 693.1 692.8 | 693.2 692.8 | 0.1 0.0 |
| M | 12,171[95] 13,454 | 37 273 | 107 361 | 1.4 1.1 | 693.6 694.6 | 693.6 694.6 | 693.6 694.6 | 0.0 0.0 |
| N | 12,791[95] 13,981 | 34 33 | 142 155 | 1.1 1.0 | 693.9 694.8 | 693.9 694.8 | 694.0 694.8 | 0.1 0.0 |
| O | 13,392[95] 14,457 | 117 176 | 127 291 | 1.1 0.6 | 694.7 694.9 | 694.7 694.9 | 694.7 694.9 | 0.0 0.0 |
| P | 14,022[95] 15,213 | 30 21 | 34 62 | 2.8 1.4 | 695.3 694.9 | 695.3 694.9 | 695.3 694.9 | 0.0 0.0 |
| Q | 14,642[95] 15,850 | 565 540 | 433 583 | 0.2 0.2 | 695.8 695.1 | 695.8 695.1 | 695.8 695.1 | 0.0 0.0 |
| R | 14,877[95] 16,024 | 397 465 | 339 401 | 0.3 0.2 | 695.8 695.1 | 695.8 695.1 | 695.9 695.1 | 0.1 0.0 |
| S | 15,732[95] 16,983 | 35 17 | 23 18 | 3.0 3.8 | 700.7 699.0 | 700.7 699.0 | 700.7 699.0 | 0.0 0.0 |

[95] Feet above Will-Cook county boundary

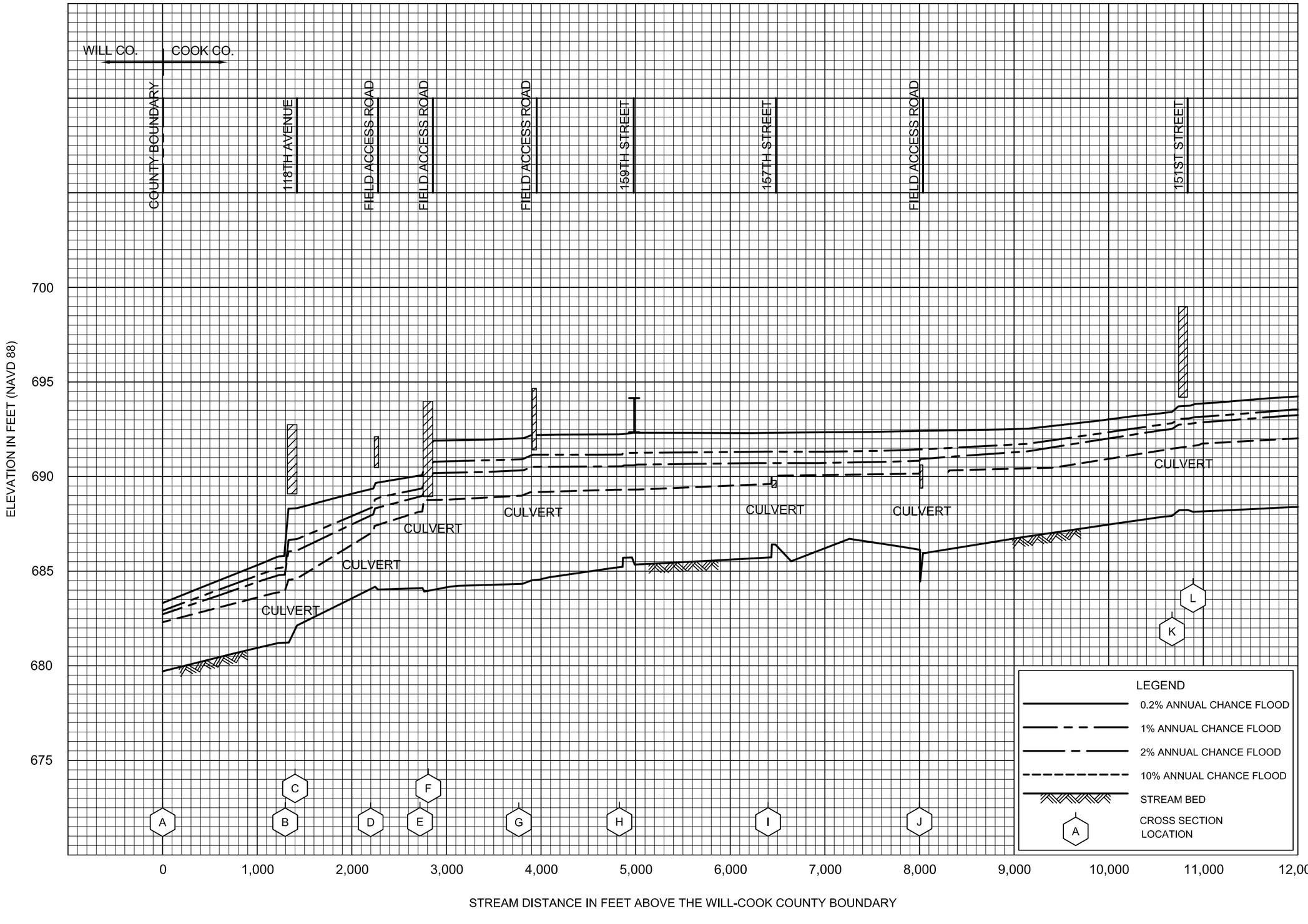
TABLE 19

FEDERAL EMERGENCY MANAGEMENT AGENCY

**COOK COUNTY, IL AND INCORPORATED AREAS**

**FLOODWAY DATA**

**SPRING CREEK**




# FLOOD PROFILES

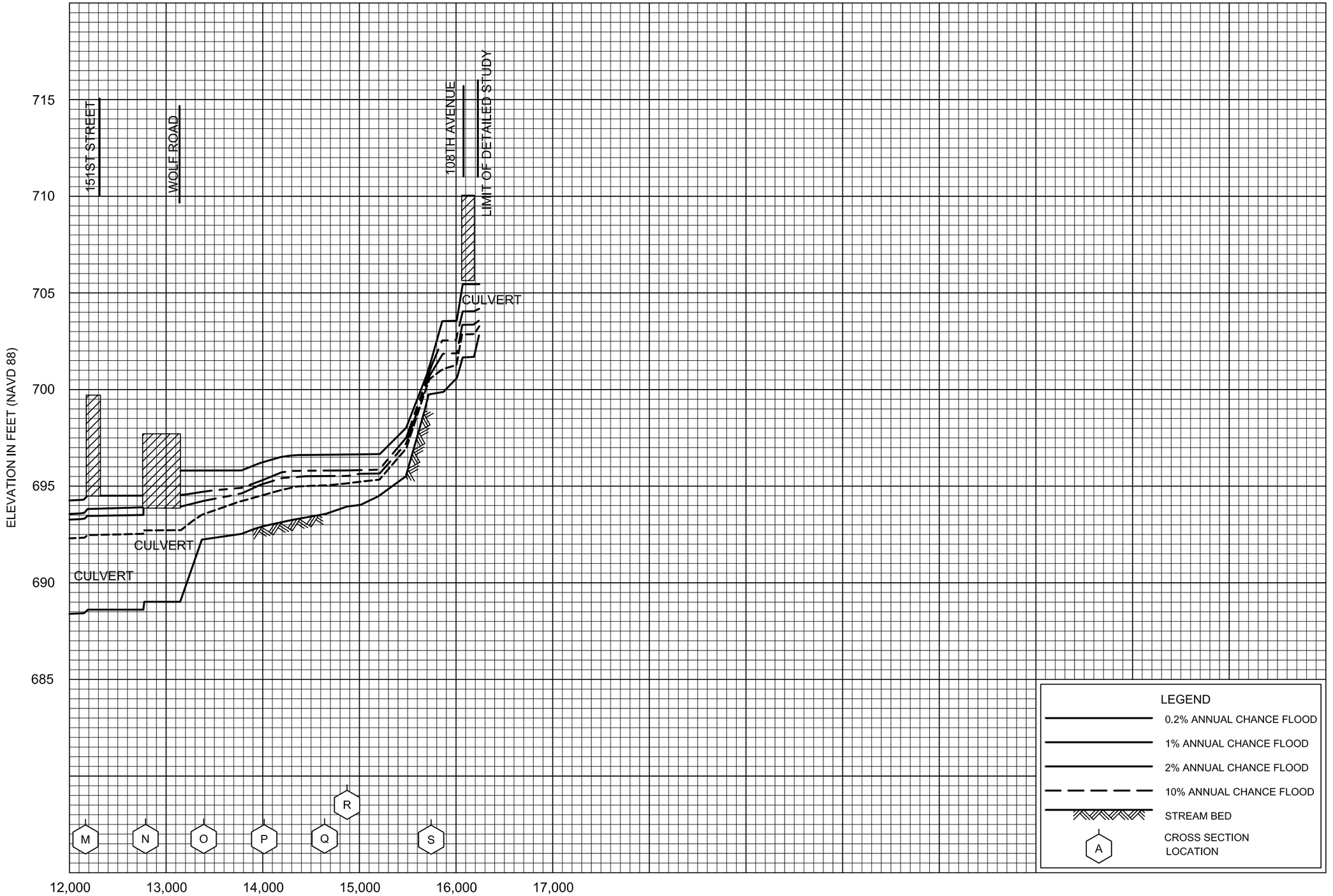
## SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COOK COUNTY, IL

AND INCORPORATED AREAS

340P




FLOOD PROFILES

SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COOK COUNTY, IL

AND INCORPORATED AREAS

341P

# *Appendix 4*

# *FEMA MT-2 Forms*

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

# OVERVIEW & CONCURRENCE FORM

*O.M.B No. 1660-0016*
*Expires February 28, 2014*

## PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

## PRIVACY ACT STATEMENT

**AUTHORITY:** The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

## A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

## B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

| Community No. | Community Name | State | Map No. | Panel No. | Effective Date |
|---|---|---|---|---|---|
| Example: 480301 | City of Katy | TX | 48473C | 0005D | 02/08/83 |
| 480287 | Harris County | TX | 48201C | 0220G | 09/28/90 |
| 170140 | Village of Orland Park | IL | 17031C | 682J | 08/19/08 |
| 170054 | Cook County | IL | 17031C | 684J | 08/19/08 |
| | | | | | |

2. a. Flooding Source: Spring Creek

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
   ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Spring Creek Restudy

4. FEMA zone designations affected: AE (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

   a. The basis for this revision request is (check all that apply)

   ☐ Physical Change ☒ Improved Methodology/Data ☒ Regulatory Floodway Revision ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☒ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☒ New Topographic Data ☐ Other (Attach Description)

   Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

## C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: $0

☐ No, Attach Explanation

**Please see the DHS-FEMA Web site at** http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **for Fee Amounts and Exemptions.**

## D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

| | | |
|---|---|---|
| Name: Jeff Julkowski, PE | Company: Christopher B. Burke Engineering, Ltd | |
| Mailing Address:<br>9575 W Higgins Road, Suite 600<br>Rosemont, IL 60018 | Daytime Telephone No.: 847-823-0500 | Fax No.: 847-823-0520 |
| | E-Mail Address: jjulkowski@CBBEL.com | |
| Signature of Requester (required): | Date: 5/18/16 | |

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

| | | |
|---|---|---|
| Community Official's Name and Title: Kurt Corrigan - Transportation & Engineering Manager | Community Name: Village of Orland Park | |
| Mailing Address: 14700 S. Ravinia Ave.<br>Orland Park, IL 60462 | Daytime Telephone No.: (708)403-6140 | Fax No.: 708-349-4859 |
| | E-Mail Address: kcorrigan@orlandpark.org | |
| Community Official's Signature (required): | Date: | |

## CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

| | | | |
|---|---|---|---|
| Certifier's Name: Jeff Julkowski, PE | License No.: 062-057976 | | Expiration Date: 11/30/2017 |
| Company Name: Christopher B. Burke Engineering, Ltd | Telephone No.: 847-823-0500 | | Fax No.: 847-823-0520 |
| Signature: | Date: | E-Mail Address: jjulkowski@cbbel.com | |

**Ensure the forms that are appropriate to your revision request are included in your submittal.**

| Form Name and (Number) | Required if … |
|---|---|
| ☒ Riverine Hydrology and Hydraulics Form (Form 2) | New or revised discharges or water-surface elevations |
| ☐ Riverine Structures Form (Form 3) | Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam |
| ☐ Coastal Analysis Form (Form 4) | New or revised coastal elevations |
| ☐ Coastal Structures Form (Form 5) | Addition/revision of coastal structure |
| ☐ Alluvial Fan Flooding Form (Form 6) | Flood control measures on alluvial fans |

Seal (Optional)

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

# RIVERINE HYDROLOGY & HYDRAULICS FORM

*O.M.B No. 1660-0016*
*Expires February 28, 2014*

## PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

## PRIVACY ACT STATEMENT

**AUTHORITY:** The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Spring Creek

**Note:** Fill out one form for each flooding source studied

## A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section B) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

| Location | Drainage Area (Sq. Mi.) | Effective/FIS (cfs) | Revised (cfs) |
|---|---|---|---|
| At 118th Avenue | 2.3 | 259 | 304 |
| At 159th Street | 1.6 | 97 | 118 |
| At 151st Street and Wolf | 0.8 | 139 | 153 |

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model → Specify Model: HEC-HMS
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

## B. HYDRAULICS

1. Reach to be Revised

| | Description | Cross Section | Water-Surface Elevations (ft.) | |
|---|---|---|---|---|
| | | | Effective | Proposed/Revised |
| Downstream Limit* | Appox 320 Feet D/S of 108th Ave | FIS S (17035.08) | 700.7 (NAVD 88) | 699.3 (NAVD 88) |
| Upstream Limit* | Aprox 1650 Feet D/S of Will Cook Rd | FIS A (35.4611) | 682.9 (NAVD 88) | 682.3 (NAVD 88) |

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

| Models Submitted | Natural Run | | Floodway Run | | Datum |
|---|---|---|---|---|---|
| Duplicate Effective Model* | File Name: | Plan Name: | File Name: | Plan Name: | |
| Corrected Effective Model* | File Name: | Plan Name: | File Name: | Plan Name: | |
| Existing or Pre-Project Conditions Model | File Name: SPCR_Design | Plan Name: Existing - 100yr12h | File Name: SPCR_Design | Plan Name: Existing - 100yr12h | NAVD 88 |
| Revised or Post-Project Conditions Model | File Name: | Plan Name: | File Name: | Plan Name: | |
| Other - (attach description) | File Name: | Plan Name: | File Name: | Plan Name: | |

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

## C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☒ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Cook County 2-foot aerial topography (NAVD88)

Source: Cook County Date: 2008

Accuracy:

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

## D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:

   - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
   - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☐ Yes ☒ No

   If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill? ☒ Yes ☐ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☒ Yes ☐ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

# *Appendix 5*

# *Digital Deliverables*

# *Appendix 6*

# *MWRD Detailed Watershed Plan for the Calumet-Sag Watershed*

*Final Report*

# Detailed Watershed Plan for the Calumet-Sag Channel Watershed: Volume 1

Prepared for

**Metropolitan Water Reclamation District of Greater Chicago**

August 2009

CH2MHILL

## 1.3.2 Model Setup and Unit Numbering

### 1.3.2.1 Hydrologic Model Setup

Hydrologic model data was primarily developed within the GeoHMS extension to Arc GIS Version 9.2. The extension provides an interface to geoprocessing functions used to characterize subbasin parameters within the hydrologic model. GeoHMS was used to calculate the CN for each basin; to define the longest flow path, basin slope, and longest flow path slope; and to establish a network connecting hydrologic elements (e.g., subbasins, reservoirs, reaches, and inflow locations) to the outlet of the system. HEC-HMS was used to create and sometimes route stormwater runoff hydrographs to the upstream extent of hydraulic models developed within HEC-RAS. Hydrologic model data was transferred between HEC-HMS and HEC-RAS through HEC-DSS files.

**Subbasin Delineation.** Each major tributary model (Tinley Creek, Melvina Ditch, etc.) was subdivided into subbasins roughly 100 acres in size to form the basis of the hydrologic model and modeled assuming a unified response to rainfall based on land use characteristics and soil type. Elevation data provided by Cook County, described in Section 2.3.4, was the principal data source used for subbasin delineation. Drainage divides were established based upon consideration of the direction of steepest descent from local elevation maxima, and refined in some instances to reflect modifications to topographic drainage patterns caused by stormwater management infrastructure (storm sewer systems, culverts, etc.). Subbasin boundaries were modified to encompass areas with similar development patterns. Finally, boundaries were defined to most accurately represent the area tributary to specific modeled elements, such as constrictions caused by crossings, and reservoirs. GIS data was developed for all subbasins delineated and used for hydrologic model data development.

**Runoff Volume Calculation.** The SCS CN loss model uses the empirical CN parameter to calculate runoff volumes based on landscape characteristics such as soil type, land cover, imperviousness, and land use development. Areas characterized by saturated or poorly infiltrating soils, or impervious development, have higher CN values, converting a greater portion of rainfall volume into runoff. The SCS methodology uses Equation 1.1 to compute stormwater runoff volume for each time step:

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad (1.1)$$

Where:

| | | |
|---|---|---|
| Q | = | runoff volume (in.) |
| P | = | precipitation (in.) |
| S | = | storage coefficient (in.) |
| $I_a$ | = | initial abstractions (in.) |

Rainfall abstractions due to ponding and evapotranspiration can be simulated using an initial abstractions ($I_a$) parameter. In the Calumet-Sag Channel DWP, the commonly used default value of $I_a$, estimated as 0.2 × S, where S is the storage coefficient for soil in the subbasin. S is related to CN through Equation 1.2:

$$S = \frac{1000}{CN} - 10 \qquad (1.2)$$

where:

CN = curve number (dimensionless)
S = storage coefficient (in,)

Table 1.3.2 describes the input data used to develop the CN values throughout the watershed.

TABLE 1.3.2
Description of Curve Number Input Data

| Variable Used to Determine CN | Approach for Definition of Variable for Calumet-Sag Channel Watershed Hydrologic Modeling |
|---|---|
| Ground cover | Chicago Metropolitan Agency for Planning (CMAP) 2001 land use inventory (v.1.2 2006) is used to define land use. A lookup table was developed to link CMAP categories to categories for which CN values have been estimated. |
| Soil type | The Natural Resources Conservation Service (NRCS) publishes county soil surveys that include a hydrologic classification of A, B, C, or D. If a soil group's infiltration capacity is affected by a high water table, it is classified as, for instance, "A/D," meaning the drained soil has "A" infiltration characteristics, undrained "D." It was assumed that half of these soil groups (by area) are drained. |
| Antecedent moisture condition | Antecedent Moisture Conditions (AMC) reflect the initial soil storage capacity available for rainfall. For areas within Northeastern Illinois, it is typical to assume an AMC of II. |

Specific combinations of land use and soil type were linked to CN values using a lookup table based on values recommended in Table 1.3.3 excerpted from *TR-55: Urban Hydrology for Small Watersheds* (U.S. Department of Agriculture [USDA], 1986). The CN matrix includes assumptions about the imperviousness of land use classes, and therefore, percent impervious does not need to be explicitly considered as the SCS runoff volume calculation. Since the CMAP land-use data does not correspond to the categories in Table 1.3.3, a mapping between TR-55 land use categories and CMAP land use categories was necessary. This process is detailed in Appendix C, which includes a technical memorandum detailing the process used to develop CN values for the Calumet-Sag Channel Watershed.

The GeoHMS tool was used to develop an area-weighted average CN for each subbasin.

**Runoff Hydrograph Production.** The runoff volume produced for a subbasin is converted into a basin-specific hydrograph by using a standard unit hydrograph and an estimate of basin lag time. The lag time is defined as the time elapsed between the centroid, by mass, of the precipitation event and the peak of the runoff hydrograph at the outlet of the subbasin. The lag time was estimated according to Equation 1.3, provided in the HEC-HMS Technical Reference Manual (USACE, 2006):

$$T_{lag} = 0.6T_c \qquad (1.3)$$

where:

$T_{lag}$ = Lag time
$T_c$ = Time of Concentration

TABLE 1.3.3
Runoff Curve Numbers for Urban Areas

| Cover Type and Hydrologic Condition | Avg. % Impervious Area | A | B | C | D |
|---|---|---|---|---|---|
| **Fully developed urban areas (vegetation established)** | | | | | |
| **Open Space (lawns, parks, golf courses, cemeteries, etc.)** | | | | | |
| Poor condition (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair condition (grass cover 50 to 75%) | | 49 | 69 | 79 | 84 |
| Good condition (grass cover > 75%) | | 39 | 61 | 74 | 80 |
| **Impervious Areas** | | | | | |
| Paved parking lots, roofs, driveways, etc. (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads | | | | | |
| Paved; curbs and storm sewers (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved; open ditches (including right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (including right-of-way) | | 76 | 85 | 89 | 91 |
| Dirt (including right-of-way) | | 72 | 82 | 87 | 89 |
| **Western Desert Urban Areas** | | | | | |
| Natural desert landscaping (pervious areas only) | | 63 | 77 | 85 | 88 |
| Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin barriers | | 96 | 96 | 96 | 96 |
| **Urban Districts** | | | | | |
| Commercial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| **Residential Districts by Average Lot Size** | | | | | |
| 1/8 acre or less | 65 | 77 | 85 | 90 | 92 |
| 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| 1/2 acre | 25 | 54 | 70 | 80 | 85 |
| 1 acre | 20 | 51 | 68 | 79 | 84 |
| 2 acres | 12 | 46 | 65 | 77 | 82 |
| **Developing Urban Areas** | | | | | |
| Newly Graded Areas (pervious areas only, no vegetation) | | 77 | 86 | 91 | 94 |

*Note:* Average runoff condition, and $I_a = 0.2S$.

*Note*: Table Source is *TR-55: Urban Hydrology for Small Watersheds* (U.S. Department of Agriculture, 1986)

The time of concentration is the time it takes for a drop of water to travel from the hydraulically furthest point in a watershed to the outlet. The time of concentration is estimated as the

sum of the travel time for three different segments of flow, split-up by flow type in each subbasin.

Thus Equation 1.4:

$$T_c = T_{sheet} + T_{shallow} + T_{channel} \qquad (1.4)$$

Where:

$T_{sheet}$ = sheet flow; flow occurring across the land area headwater areas prior to flow accumulation

$T_{shallow}$ = shallow flow; occurs where sheet flow begins to accumulate into more concentrated patterns, but prior to transitioning into open channel flow

$T_{channel}$ = flow within natural or manmade drainage facilities within each subwatershed prior to the point of discharge

GeoHMS-derived $T_c$ estimates were not considered accurate; however, GeoHMS also produced a definition of the longest flow path, its length, and slope. The basin parameter estimates were exported to a spreadsheet to support calculation of $T_c$.

An alternative method of lag time calculations is the CN-based method, characterized in Equation 1.5 (SCS, 1978):

$$T_{lag} = L^{.8} \frac{(S+1)^{.7}}{(1900Y^{.5})} \qquad (1.5)$$

Where:

L = hydraulic length of the subbasin
Y = subbasin slope
S = storage coefficient (in.)

These two approaches to calculation of lag time were performed for each subbasin and reviewed. The quasi-physical estimate of lag time described in Equation 1.4 was generally used for most subbasins. For some subbasins with very low relief, the CN-based method was used as it was considered most representative of the runoff response of the watershed.

**Rainfall Data.** Observed and design event rainfall data was used to support modeling evaluations for the DWP. Monitored rainfall data is described in Section 2.3.1. Design event rainfall data was obtained from Bulletin 71, *Rainfall Frequency Atlas of the Midwest* (Huff, 1992). Design event rainfall depths obtained from Bulletin 71 were used to support design event modeling performed for existing and proposed conditions assessment.

### 1.3.3 Storm Duration

A critical-duration analysis was performed to determine the storm duration that generally results in higher water surface estimates for a range of tributary sizes within the Calumet-Sag Channel Watershed. The 12-hour duration storm was identified as the critical duration for streams within the Calumet-Sag Channel Watershed. A second quartile storm is recommended for storms of this duration (Huff, 1992). Table 1.3.4 summarizes rainfall depths for the 12-hour duration storm.

### 1.3.4 Areal Reduction Factor

The rainfall depths presented in Table 1.3.4 summarize expected point rainfall accumulation for modeled recurrence intervals. The probability of uniform rainfall across a subwatershed decreases with increasing watershed size. Table 21 in Bulletin 71 relates areal mean rainfall depth to rainfall depth at a point (Huff, 1992). Subwatersheds in the Calumet-Sag Channel watershed that were large enough to warrant use of an areal reduction factor are Tinley, Long Run, and Stony Creeks. Modeled rainfall depths were multiplied by approximately 0.98 to account for the expected decrease in probability of uniform rainfall. In addition, the rainfall distribution was modified to the Quartile II distribution for basins 10 to 50 square miles in area, as recommended in Bulletin 71 (Huff, 1992).

TABLE 1.3.4
Rainfall Depths

| Recurrence Interval | 12-hr Duration Rainfall Depth |
|---|---|
| 2-year | 2.64 |
| 5-year | 3.31 |
| 10-year | 3.89 |
| 25- year | 4.79 |
| 50- year | 5.62 |
| 100-year | 6.59 |
| 500-year | 8.96[a] |

[a]500-year rainfall depth was determined based on a logarithmic relationship between rainfall depth and recurrence interval.

### 1.3.5 Hydrologic Routing

Stormwater runoff hydrographs were sometimes routed within HEC-HMS in upstream areas where the resolution of subbasins defined was greater than the hydraulic model extent. In areas where a channel cross section could be identified from topographic data, Muskingum-Cunge routing was performed using the approximate channel geometry from a representative cross section of the modeled hydrologic reach. In most of the watershed, it was impossible to identify channel cross sections in upstream areas. In those cases, a kinematic wave routing approximation was performed.

### 1.3.6 Hydraulic Model Setup

Hydraulic model data typically was developed through field surveys with some additional definition of channel overbank areas and roadway crests defined using Cook County topographic data. Cross section locations were developed in HEC GeoRAS, and surveyed channel geometry were inserted into topographically generated cross-sectional data. Cross sections were generally surveyed at intervals of 500 to 1,000 feet. Interpolated cross sections were added at many locations to the models to increase stability and reduce errors. Bridges, culverts, and other major hydraulic structures were surveyed within the hydraulic model extent. The locations of all surveyed and modeled cross sections, bridges, culverts, and other structures are shown in a figure within Appendix D.

The Stony Creek hydraulic model was developed using data from a model developed by the USACE in 2001. USACE calibrated the model, which is considered representative of existing conditions along Stony Creek. As part of the DWP, several cross sections were surveyed at locations where the USACE model had cross sections to compare and confirm that the model data reflected current conditions. This comparison concluded that the survey data in the USACE model of Stony Creek was generally consistent, and that the USACE model was valid for defining inundation areas and evaluation of alternative improvement projects.

#### 1.3.6.1 Bridges, Culverts, and Hydraulic Structures

Bridges, culverts, and hydraulic structures were surveyed consistent with FEMA mapping protocol as identified in *Guidelines and Specifications for Flood Hazard Mapping Partners*, "Guidance for Aerial Mapping and Surveying" (FEMA 2003). A State of Illinois licensed professional land surveyor certified each location as FEMA compliant. Documentation of certifications is provided in Appendix D. Bridges, culverts, and hydraulic structures were surveyed consistent with the NAVD 1988 datum using 5-centimeter or better GPS procedures (as specified in NGS-58 for local network accuracy) or third-order (or better) differential leveling, or trigonometric leveling for short distances. In a few cases, information from construction plans was used for recently constructed bridges in lieu of surveying. Ineffective flow areas were placed at cross sections upstream and downstream of crossings, generally assuming a contraction ratio of 1:1 and an expansion ratio of 2:1. Contraction and expansion coefficients generally were increased to 0.3 and 0.5, respectively, at cross sections adjacent to crossings.

#### 1.3.6.2 Cross-Sectional Data

Cross-sectional data was surveyed consistent with FEMA mapping protocol as identified in *Guidelines and Specifications for Flood Hazard Mapping Partners*, "Guidance for Aerial Mapping and Surveying" (FEMA 2003).

All survey work, including survey of cross sections, was certified as compliant to FEMA mapping protocol by a State of Illinois licensed professional land surveyor. Documentation of certifications is provided in Appendix D. Cross sections were surveyed consistent with the North American Vertical Datum, 1988 (NAVD 1988) using 5-centimeter or better GPS procedures (as specified in NGS-58 for local network accuracy) or third-order (or better) differential leveling, or trigonometric leveling for short distances. Cross sections were interpolated at many locations within the hydraulic models, to aid model stability and reduce errors.

#### 1.3.6.3 Boundary Conditions

Estimated water surface elevations along the major receiving systems were compared to normal depth of tributaries at the confluence. In most instances, normal depth estimates exceeded the elevation of the receiving system (i.e., Calumet-Sag Channel or Chicago Sanitary Ship Canal). This indicates that the downstream water surface elevation for the waterways is not controlled by the receiving system, as often occurs at stream confluences, but by the ability of the tributary to convey the flows produced in the upstream tributary area. The fact that both the Chicago Sanitary Ship Canal (CSSC) and the Calumet-Sag Channel are manmade, controlled waterways likely contributes to their relatively lower stage compared to their tributaries. Levels of the CSSC and the Calumet-Sag Channel are controlled by the District as required to support navigation and control flooding through operation of the Lockport Lock and Dam.

In cases where the estimated water surface elevation of a channel was required, this data was taken from the Chicago Waterway System (CWS) UNET model, which was obtained from the USACE and converted to HEC-RAS to support DWP development. The I&M Canal was assumed to be represented by water surface elevations along the CSSC as the two water bodies are parallel and directly connected. The specific boundary conditions used for each model

are summarized in the tributary sections. Appendix E contains a detailed summary of the Calumet-Sag Channel hydraulic conditions and methods used to estimate water surface elevation along the CSSC and Calumet-Sag Channel.

### 1.3.7 Model Run Settings

All hydraulic model simulations were carried out using the fully dynamic, unsteady flow simulation settings within HEC-RAS. The Saint-Venant equations, or the continuity and momentum balance equations for open channel flow, were solved using implicit finite difference scheme. HEC-RAS has the ability to model storage areas and hydraulic connections between storage areas and between stream reaches. The computational time step for model runs varied between 10 and 60 seconds, as necessary for model stability.

### 1.3.8 Model Calibration and Verification

Model calibration and verifications were performed for tributaries where monitoring data was available to ensure that the hydrologic and hydraulic models accurately predict stormwater runoff response for a range of storm magnitudes. Available monitoring data used for calibration is described in Section 2.3.1. Initial model runs were performed for Tinley Creek, Stony Creek, Mill Creek, Calumet-Sag Tributary B, and Navajo Creek subwatersheds using hydrologic and hydraulic parameters estimated from available GIS data (land-use, soils, topography) and field reconnaissance. Stages (or peak water surface elevation) and runoff volumes were compared to modeled values for a variety of storms. Then, hydrologic and hydraulic parameters with uncertainty were modified within a reasonable range to better represent monitored parameters. Stage was used as the primary calibration variable, since stage directly impacts stormwater damages due to flooding. Stage is also the measured value, both for high-water marks and the USGS gage, which uses a field-measured stage-flow relationship to calculate flow. Runoff volume was also considered, where monitoring data was available.

Initial calibration model results generally over-predicted stage, volume and peak flow rates for Stony Creek and Tinley Creek. Modification to lag time and curve number estimates, in the hydrologic model, and the roughness coefficient in the hydraulic model, were considered to address observed differences. Modification of the lag time was observed to have a minor impact on model results. While discrepancies in stage could be addressed by lowering the roughness coefficient on Tinley Creek, this would increase the over-prediction of peak flow, and would not address the over-prediction of runoff volume. Furthermore, stage was also over-predicted on Stony Creek for its initial calibration runs, and the Stony Creek roughness coefficients were already at the lower end of the acceptable range of values. Although no flow data was available, initial roughness coefficients were considered relatively low. For these reasons, the reduction of curve number values was considered the best method of achieving better correspondence between observed and modeled parameters. A 10 percent curve number reduction from the originally calculated values resulted in the best fit with monitored values for the storms considered.

Detailed calibration results are presented in subwatershed subsections, including hydrographs and comparisons of stage and, where available, runoff volume. Subwatersheds with available calibration data represent a subset of the Calumet-Sag Channel Watershed. Calibration data was available for both the northern part of the watershed, with its flatter topog-

raphy and higher-density development, and the southern part of the watershed with more varied topography and less dense suburban development. The 10 percent reduction of curve number was applied to un-gaged subwatersheds since it was found to be necessary for similar gaged areas of the watershed.

### 1.3.9 Flood Inundation Mapping

Flood inundation maps were produced to display the inundation areas associated with the 100-year event. The flood inundation maps were produced by overlaying the results of the hydraulic modeling on the ground elevation model of the watershed, which was derived from Cook County LiDAR data.

### 1.3.10 Discrepancies Between Inundation Mapping and Regulatory Flood Maps

Discrepancies may exist between inundation mapping produced under this DWP and regulatory flood maps. Discrepancies may be the result of updated rainfall data, more detailed topographic information, updated land use data, and differences in modeling methodology. A discussion of discrepancies is included in Appendix A.

### 1.3.11 Model Review

The hydrologic and hydraulic models developed under this DWP were independently reviewed by Christopher B. Burke Engineering, Ltd (CBBEL). CBBEL's review of the hydrologic models included a general verification of drainage areas, sub-basin divides, and hydrologic model parameters such as Curve Number and Time of Concentration. CBBEL's review of the hydraulic models included a general verification of roughness values, bank stations, ineffective flow areas, hydraulic structures, boundary conditions and connectivity with the hydrologic model output files. A significant recommendation from the independent review was to calibrate the models to a large storm event which occurred in the Calumet-Sag Channel watershed over the period September 13th to 14th, 2008. This and other recommendations from the independent review have been addressed in the hydrologic and hydraulic models developed to support the Calumet-Sag Channel DWP.

## 1.4 Development and Evaluation of Alternatives

### 1.4.1 Problem Area Identification

Problem area data for the Calumet-Sag Channel Watershed was generated from two sources. The first was community response data that identified flooding, erosion, water quality, and maintenance problems recognized by the communities to be problems. In addition, problem areas were identified by overlaying the results of H&H modeling on the ground elevation model of the watershed to identify structures at risk of flooding along regional waterways. Modeled flood problems generally corroborated the communities' reported problems; however, in many instances, the model results also showed additional areas at risk of flooding for larger magnitude events. A secondary source of problem area identification was the existing FEMA FIRM panel maps. Areas shown within FEMA floodplain were carefully considered in H&H modeling and communication with communities in order to identify problem areas.

# 3.27 Spring Creek

Spring Creek is a regional waterway located in southwestern Cook County, in the southern part of the Calumet-Sag Channel Watershed. The total drainage area of the Spring Creek subwatershed is 2.6 square miles, which includes some drainage area from Will County. Table 3.27.1 summarizes the communities within Cook County that drain to Spring Creek. Figure 3.27.1 is an overview of the tributary area of the subwatershed. Reported stormwater problem areas, flood inundation areas, and proposed alternative projects are also shown and discussed in the following subsections.

TABLE 3.27.1
Communities Draining to Spring Creek

| Community | Tributary Area ($mi^2$) |
|---|---|
| Orland Park | 1.75 |
| Unincorporated/Forest Preserve | 0.85 |

The Spring Creek subwatershed contains a mix of suburban development with some open space. Table 3.27.2 summarizes the land use distribution within the Spring Creek subwatershed.

TABLE 3.27.2
Land Use Distribution for Spring Creek

| Land Use Category | Area (acres) | % |
|---|---|---|
| Agricultural | 651 | 32.6 |
| Commercial/Industrial | 90 | 4.5 |
| Forest/Open Land | 453 | 22.7 |
| Institutional | 44 | 2.2 |
| Residential | 612 | 30.6 |
| Water/Wetland | 147 | 7.4 |

## 3.27.1 Sources of Data

### 3.27.1.1 Previous Studies

Will County recently created H&H models of existing conditions in Spring Creek to examine floodplain areas and channel improvements for part of Spring Creek in Will County. The model extent does not contain the part of Spring Creek in Cook County and does not begin at the county line, and therefore, did not contribute directly to the development of the Calumet-Sag Channel DWP.

### 3.27.1.2 Water Quality Data

The IEPA does not have any sites in the Ambient Water Quality Monitoring Network on Spring Creek. Spring Creek is identified as impaired in the IEPA's 2008 *Integrated Water Quality Report*, which includes the 303(d) and 305(b) lists. Spring Creek is on the IEPA's 303(d) list due to total manganese, total phosphorous, sedimentation and siltation. No TMDLs have been established for Spring Creek. According to a USEPA water permit discharge query, there is one NPDES permit issued by IEPA to the Andrew Corporation in Orland Park for discharges to Spring Creek. Municipalities discharging to Spring Creek are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was created to improve the water quality of stormwater runoff from urban areas, and requires that municipalities obtain permits for discharging stormwater and implement the six minimum control measures for limiting runoff pollution to receiving systems.

### 3.27.1.3 Wetland and Riparian Areas

Figures 2.3.6 and 2.3.7 contain mapping of wetland and riparian areas in the Calumet-Sag Channel Watershed. Wetland areas were identified using National Wetlands Inventory (NWI)

mapping. NWI data for 2001 identify 181.6 acres of wetland areas in the Spring Creek Tributary area. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

#### 3.27.1.4 Floodplain Mapping

Flood inundation areas supporting the NFIP were revised in 2008 as a part of FEMA's Map Modernization Program. Floodplain boundaries were revised based upon updated Cook County topographic information, but the effective models used to estimate flood levels generally were not updated. LOMRs were incorporated into revised floodplain areas.

Spring Creek is mapped in detail in the DFIRM mapping update, with Zone AE floodplain shown across the length of Spring Creek. The original hydrologic and hydraulic analyses were performed in 1976. The hydrologic modeling used Regression Equations 73 and 75. The hydraulic routing was steady state and used the WSP-2 modeling application.

Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels with inundation areas developed for the DWP.

#### 3.27.1.5 Stormwater Problem Data

Communities, agencies (e.g., IDOT, CCHD), and stakeholders submitted Form B questionnaire response data to the District summarizing known stormwater problems within their jurisdictions. Stormwater problems were classified as regional or local based upon the criteria described in Section 1 of the report. Table 3.27.3 summarizes the Form B data for Spring Creek.

TABLE 3.27.3
Community Response Data for Spring Creek

| Problem ID | Municipality | Problems as Reported by Local Agency | Location | Problem Description | Local/ Regional | Resolution in DWP |
|---|---|---|---|---|---|---|
| OT1 | Orland Township | Overbank flooding, ponding | 114th Court and 157th Street | Heavy rains cause overflow of Spring Creek into adjacent subdivision | Regional | Project SPCR-1 will raise 157th Street to reduce frequency of transportation damage |
| OP10 | Orland Park | Maintenance, overbank flooding | Deluga Woods subdivision between 155th and 159th Streets | Lack of maintenance in unincorporated area results in overbank flooding | Regional | Model results did not show property damage due to flooding from a regional waterway in this area. Stream maintenance is recommended. |
| OP4 | Orland Park | Pavement flooding | Southwest Highway at 151st Street | IDOT reported pavement flooding | Local | Problem not located along a regional waterway. This is a local problem |

#### 3.27.1.6 Near-Term Planned Projects

Watershed communities, agencies, and stakeholders were asked about near-term planned projects so that the implementation of near-term flood control projects by others is considered in development of the DWP. No near-term planned projects by others have been identified for the Spring Creek subwatershed.

### 3.27.2 Watershed Analysis

#### 3.27.2.1 Hydrologic Model Development

**Subbasin Delineation.** The Spring Creek subwatershed was delineated based upon LiDAR topographic data developed by Cook County in 2003. The subwatershed drainage area includes 0.07 square mile of area in Will County that drain into Cook County. This area had available LiDAR topographic data and was delineated in the same manner as the drainage area within Cook County.

Fifteen subbasins were delineated for the Spring Creek Tributary area, with an average area of 111 acres and a total drainage area of 2.6 square miles.

**Hydrologic Parameter Calculations.** CNs were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in Section 1.3.2, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

The lag time, used to convert excess precipitation into a runoff hydrograph, was assumed to be 0.6 times the time of concentration for all subbasins. The time of concentration, or time of travel from the hydrologically most distant part of the subbasin, was estimated by using standard procedures assuming a length of sheet flow, shallow concentrated flow, and channel flow. In some instances, modification to parameter estimates was necessary to more accurately characterize very flat or heavily sewered subwatersheds. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

#### 3.27.2.2 Hydraulic Model Development

**Field Data, Investigation, and Existing Model Data.** No hydraulic models that met District criteria, as identified in Section 6.3.3.2 of the CCSMP, were available for DWP development. The open channel of Spring Creek and all crossings were surveyed to characterize the channel and near overbank geometry. Cross-sectional geometry in the non-surveyed overbank area was obtained from Cook County topographic data and combined with the surveyed channel cross section. Field visits were performed to assess channel and overbank roughness characteristics, which were combined with information from photographs and aerial photography to assign modeled Manning's *n* roughness coefficient to the stream. Appendix D contains field survey information in digital form.

**Boundary Conditions.** The downstream extent of the Spring Creek model is the point at which Spring Creek drains into Will County. The slope of the main channel there is 0.00083. Normal depth based on this slope was set as the boundary condition for Spring Creek at the point of discharge into Will County.

#### 3.27.2.3 Calibration and Verification

No measured or observed stages were available for Spring Creek to compare model results. Curve numbers were reduced by 10 percent for existing and alternative conditions analysis based upon the calibration of streams with monitoring data as described in Section 1.3.8.

#### 3.27.2.4 Existing Conditions Evaluation

Flood Inundation Areas. Flood inundation areas were developed based on HEC-RAS water surface elevations and Cook County topographic data. Figure 3.27.1 shows inundation areas for the 100-year, 12-hour duration design storm.

Hydraulic Profiles. Appendix H contains hydraulic profiles of existing conditions in the Spring Creek system. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval design storms.

### 3.27.3 Development and Evaluation of Alternatives

#### 3.27.3.1 Model Problem Definition

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. No property damage due to flooding was identified in the Spring Creek subwatershed. Overtopping of 157th Street, which provides the only means of access to a subdivision west of Spring Creek, was identified as a modeled problem area, as shown in Table 3.27.4. The overtopping of this local road was considered a regional problem because as the only means of access to a subdivision, overtopping of this road by flooding would cut off emergency access to the entire subdivision.

TABLE 3.27.4
Modeled Problem Definition for Spring Creek

| Problem ID | Location | Recurrence Interval of Flooding (yr) | Associated Form B | Resolution in DWP |
|---|---|---|---|---|
| MPA33 | 157th Street crossing of Spring Creek | 10, 25, 50, 100 | OT1 | Project SPCR-1 will raise 157th Street to reduce frequency of transportation damage |

#### 3.27.3.2 Damage Assessment

Economic damages were defined following the protocol defined in Chapter 6.6 of the CCSMP. No property damage due to flooding is predicted based upon existing conditions H&H modeling analysis. No erosion or recreation damages were identified for Spring Creek. Transportation damages were explicitly calculated for Spring Creek as the crossing of 157th Street was identified by modeling and WPC members as a frequent flooding issue preventing the only means of access to a subdivision west of Spring Creek. Transportation damages were calculated using the method outlined in "What is a Benefit?" was used (FEMA 2001), using the same period of analysis and discount rate used for property damage due to flooding calculations. Table 3.27.5 lists the existing conditions damages for Spring Creek.

### 3.27.3.3 Technology Screening

Flood control technologies were screened to identify those most appropriate to address the flooding problems in the Spring Creek subwatershed. Conveyance improvements, increased storage, and levees were considered to address the MPA33 problem at the 157th Street crossing.

TABLE 3.27.5
Estimated Damages for Spring Creek

| Damage Category | Estimated Damage ($) | Note |
|---|---|---|
| Property | 0 | |
| Erosion | 0 | |
| Transportation | 24,100 | Specific transportation damages calculated for emergency access restrictions at 157th Street. |
| Recreation | 0 | |

### 3.27.3.4 Alternative Development

**Flood Control Alternatives.** Alternative solutions to regional flooding were developed and evaluated to address the damages estimated in Table 3.27.5 consistent with the methodology described in Section 1.4 of this report. Table 3.27.6 summarizes the flood control alternatives developed for Spring Creek.

TABLE 3.27.6
Flood Control Alternatives for Spring Creek

| Alternative | Location | Description |
|---|---|---|
| SPCR-1 | Spring Creek at 157th Street | Raise 157th Street to prevent overtopping, replace culvert with larger culvert, and construct upstream restrictor and weir with same hydraulics as existing conditions. |
| SPCR-2 | Spring Creek from 157th Street to 159th Street | Dredge Spring Creek to increase conveyance. This alternative did not effectively reduce water surface elevations in the flooding problem area, thus benefits and costs were not developed. |
| SPCR-3 | Spring Creek at 157th Street | Raise Road and provide in-line storage to lower downstream WSEL and prevent 157th Street from flooding. This alternative caused an increase in upstream water surface elevations, thus benefits and costs were not developed. |

**Erosion Control Alternatives.** No erosion control alternatives were developed for Spring Creek.

### 3.27.3.5 Alternative Evaluation and Selection

Alternative SPCR-1 addresses transportation damages associated with the overtopping of 157th Street by raising the road. The hydraulic structure at the crossing would be designed to maintain existing hydraulic conditions upstream and downstream of 157th Street. The culvert would be replaced with two large box culverts with capacity to convey the 100-year design storm. Upstream of the road, a weir is proposed to be built to the existing elevation of the road, with a low flow pipe equal in size to the existing culvert. Noneconomic criteria is a significant factor in development and consideration of this alternative for recommendation as community feedback from Orland Township indicated that frequent flooding of 157th Street cuts off emergency access to an Orland Township neighborhood.

SPCR-2 involves dredging parts of Spring Creek, as suggested by WPC members. This alternative had little impact on modeled WSELs because downstream restrictions limited conveyance capacity. Damages and a cost estimate were not defined for this alternative.

Model results determined that SPCR-3 increased upstream stage, and therefore cannot be recommended in the DWP.

Alternatives included in Table 3.27.6 were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. Table 3.27.8 provides a summary B/C ratio, net benefits, total project costs, number of structures protected, and other relevant alternative data. Alternatives that did not produce a significant change in inundation areas are not listed, as benefits were negligible, and so costs were not calculated for these alternatives.

Table 3.27.7 below provides a summary of the depth of road flooding for the 157th Street crossing for existing conditions and with recommended alternatives.

TABLE 3.27.7
Spring Creek Road Overtopping Summary

| Road Crossing | Road Elevation | 25-yr Depth of Flooding | 50-yr Depth of Flooding | 100-yr Depth of Flooding |
|---|---|---|---|---|
| 157th Street | 690.1 | 0.6 | 1.2 | 1.6 |
| 157th Street (with alternative SPCR-1) | 693.1 | | | |

Note: Blank entry indicates that road crossing does not overtop for that particular storm event.

### 3.27.3.6 Data Required for Countywide Prioritization of Watershed Projects

Appendix I presents conceptual level cost estimates for the recommended alternatives. Table 3.27.8 lists alternatives analyzed in detail. Alternative SPCR-1 is recommended to address transportation damages. Figure 3.27.2 shows the location of recommended alternative SPCR-1 and a comparison of the inundation mapping for existing conditions and with the recommended alternative.

TABLE 3.27.8
Spring Creek Project Alternative Matrix to Support District CIP Prioritization

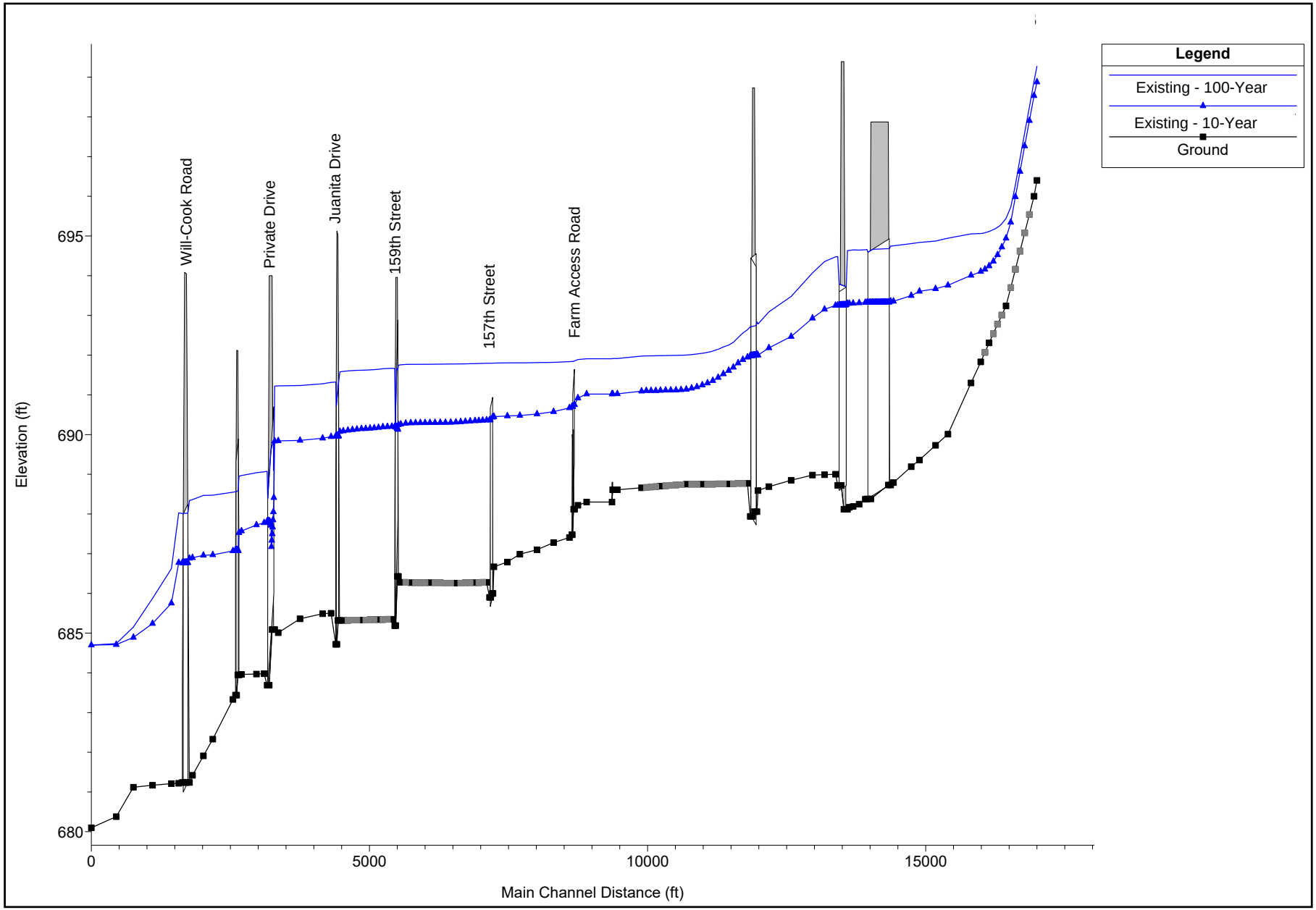
| Project | Description | B/C Ratio | Net Benefits ($) | Total Project Cost ($) | Cumulative Structures Protected | Funding Possibilities | Water Quality Benefit | Recommended | Communities Involved |
|---|---|---|---|---|---|---|---|---|---|
| SPCR-1 | Raise 157th street | 0.02 | 24,100 | 1,053,800 | 0 | Orland Township | No Impact | Yes | Orland Township |

Note: Net Benefits values do not include local benefits or non-economic benefits.

# APPENDIX 3

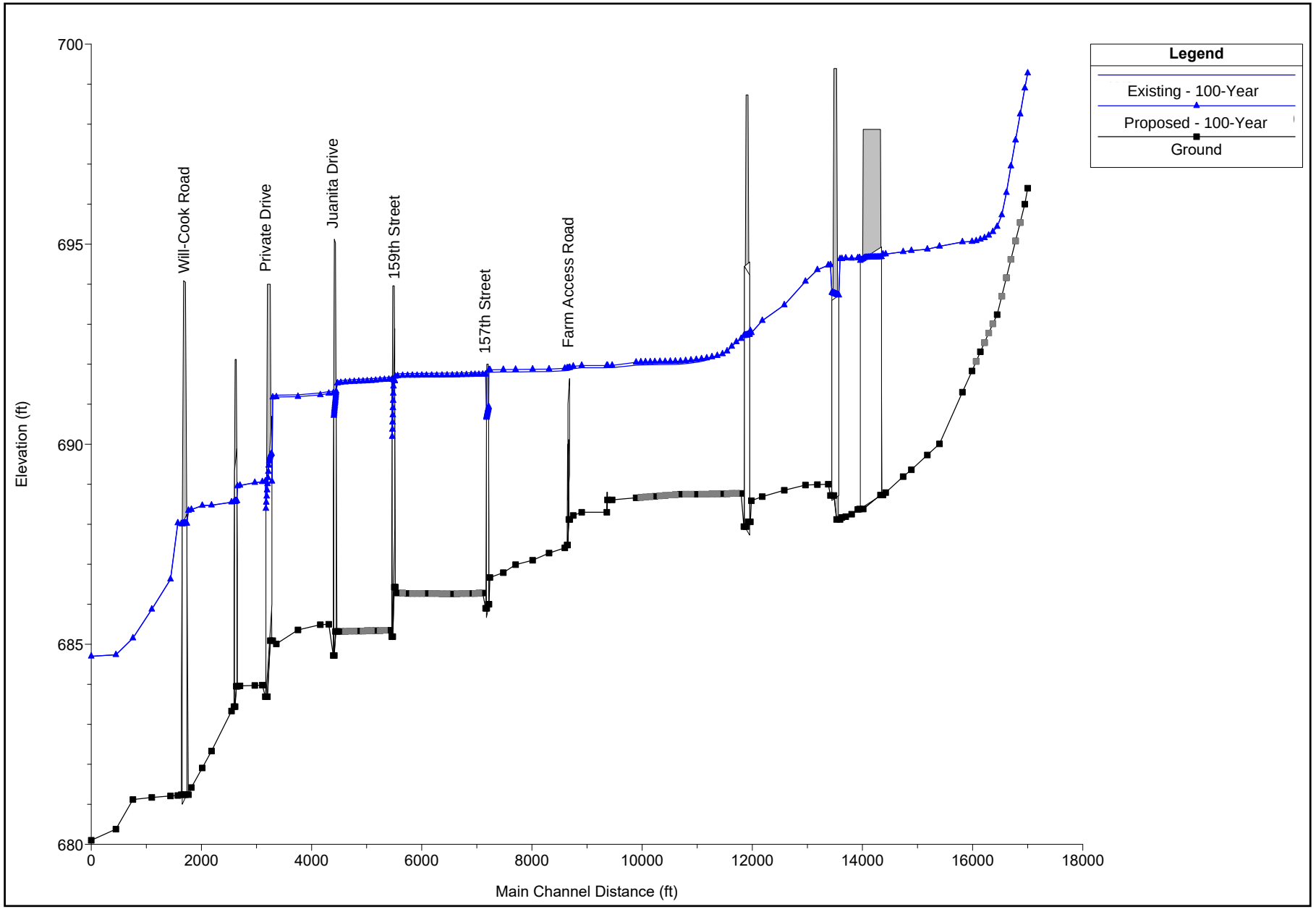
# HEC-RAS PROFILES

# EXISTING CONDITIONS PROFILE




1 in Horiz. = 2500 ft  1 in Vert. = 3.5 ft

# PROPOSED CONDITIONS PROFILE



| | 100-Year | | | 10-Year | | |
|---|---|---|---|---|---|---|
| River Station | Existing Conditions | Proposed Conditions | Change (FT) | Existing Conditions | Proposed Conditions | Change (FT) |
| 17035.08 | 699.27 | 699.27 | 0 | 698.88 | 698.88 | 0 |
| 16983.37 | 698.9 | 698.9 | 0 | 698.53 | 698.53 | 0 |
| 16479.65 | 695.44 | 695.44 | 0 | 694.94 | 694.94 | 0 |
| 16175.84 | 695.12 | 695.12 | 0 | 694.24 | 694.24 | 0 |
| 16024.4 | 695.06 | 695.06 | 0 | 694.1 | 694.1 | 0 |
| 15850.19 | 695.05 | 695.05 | 0 | 694.01 | 694.01 | 0 |
| 15434.41 | 694.95 | 694.95 | 0 | 693.76 | 693.76 | 0 |
| 15212.53 | 694.87 | 694.87 | 0 | 693.67 | 693.67 | 0 |
| 14922.76 | 694.84 | 694.84 | 0 | 693.61 | 693.61 | 0 |
| 14774.58 | 694.81 | 694.81 | 0 | 693.5 | 693.5 | 0 |
| 14457.09 | 694.75 | 694.75 | 0 | 693.36 | 693.36 | 0 |
| 14406.13 | 694.75 | 694.75 | 0 | 693.36 | 693.36 | 0 |
| | | | **Wolf Road** | | | |
| 13981.41 | 694.66 | 694.66 | 0 | 693.33 | 693.33 | 0 |
| 13949.59 | 694.65 | 694.65 | 0 | 693.32 | 693.32 | 0 |
| 13839.56 | 694.64 | 694.64 | 0 | 693.32 | 693.32 | 0 |
| 13732.13 | 694.65 | 694.65 | 0 | 693.31 | 693.31 | 0 |
| 13662.15 | 694.64 | 694.64 | 0 | 693.3 | 693.3 | 0 |
| 13628.36 | 694.63 | 694.63 | 0 | 693.3 | 693.3 | 0 |
| | | | **151st Street. (US)** | | | |
| 13453.85 | 694.48 | 694.48 | 0 | 693.26 | 693.26 | 0 |
| 13414.2 | 694.48 | 694.48 | 0 | 693.25 | 693.25 | 0 |
| 13217.08 | 694.36 | 694.36 | 0 | 693.16 | 693.16 | 0 |
| 13001.02 | 694.07 | 694.07 | 0 | 692.93 | 692.93 | 0 |
| 12615.85 | 693.48 | 693.48 | 0 | 692.47 | 692.47 | 0 |
| 12216.99 | 693.09 | 693.09 | 0 | 692.18 | 692.18 | 0 |
| 12019.91 | 692.78 | 692.78 | 0 | 692 | 692 | 0 |
| 12001.15 | 692.84 | 692.84 | 0 | 692.03 | 692.03 | 0 |
| | | | **151st Street (DS)** | | | |
| 11882.28 | 692.71 | 692.71 | 0 | 691.98 | 691.98 | 0 |
| 11831.4 | 692.64 | 692.64 | 0 | 691.95 | 691.95 | 0 |
| 11493.63 | 692.25 | 692.26 | -0.01 | 691.61 | 691.61 | 0 |
| 11018.49 | 692.05 | 692.12 | -0.07 | 691.25 | 691.24 | 0.01 |
| 10730.67 | 692 | 692.07 | -0.07 | 691.14 | 691.13 | 0.01 |
| 10267.74 | 691.99 | 692.06 | -0.07 | 691.11 | 691.1 | 0.01 |
| 9926.51 | 691.98 | 692.05 | -0.07 | 691.09 | 691.08 | 0.01 |
| 9491.793 | 691.91 | 691.97 | -0.06 | 691.03 | 691.01 | 0.02 |
| 8939.248 | 691.91 | 691.97 | -0.06 | 691.02 | 691 | 0.02 |
| 8784.397 | 691.89 | 691.95 | -0.06 | 690.92 | 690.9 | 0.02 |
| 8722.829 | 691.85 | 691.91 | -0.06 | 690.75 | 690.72 | 0.03 |
| | | | **Farm Access Road** | | | |
| 8674.268 | 691.84 | 691.9 | -0.06 | 690.7 | 690.67 | 0.03 |
| 8631.519 | 691.84 | 691.9 | -0.06 | 690.67 | 690.65 | 0.02 |
| 8345.665 | 691.82 | 691.88 | -0.06 | 690.58 | 690.55 | 0.03 |
| 8047.118 | 691.81 | 691.87 | -0.06 | 690.52 | 690.5 | 0.02 |
| 7739.449 | 691.81 | 691.87 | -0.06 | 690.48 | 690.46 | 0.02 |
| 7515.565 | 691.8 | 691.86 | -0.06 | 690.47 | 690.45 | 0.02 |
| 7272.821 | 691.8 | 691.86 | -0.06 | 690.45 | 690.43 | 0.02 |
| 7255.385 | 691.8 | 691.86 | -0.06 | 690.44 | 690.42 | 0.02 |
| | | | **157th Street** | | | |
| 7193.714 | 691.8 | 691.75 | 0.05 | 690.37 | 690.37 | 0 |
| 7141.58 | 691.79 | 691.74 | 0.05 | 690.36 | 690.36 | 0 |
| 6932.458 | 691.79 | 691.74 | 0.05 | 690.34 | 690.34 | 0 |
| 6588.943 | 691.78 | 691.72 | 0.06 | 690.31 | 690.31 | 0 |
| 6121.924 | 691.77 | 691.72 | 0.05 | 690.3 | 690.3 | 0 |
| 5778.104 | 691.77 | 691.72 | 0.05 | 690.29 | 690.29 | 0 |
| 5597.166 | 691.76 | 691.71 | 0.05 | 690.26 | 690.26 | 0 |
| 5556.618 | 691.75 | 691.69 | 0.06 | 690.25 | 690.25 | 0 |
| | | | **159th Street** | | | |
| 5490.413 | 691.67 | 691.61 | 0.06 | 690.2 | 690.2 | 0 |
| 5437.667 | 691.67 | 691.62 | 0.05 | 690.2 | 690.2 | 0 |
| 5198.254 | 691.64 | 691.59 | 0.05 | 690.18 | 690.18 | 0 |
| 4891.776 | 691.62 | 691.57 | 0.05 | 690.14 | 690.14 | 0 |
| 4565.488 | 691.59 | 691.54 | 0.05 | 690.09 | 690.09 | 0 |
| 4504.263 | 691.58 | 691.53 | 0.05 | 690.07 | 690.07 | 0 |
| | | | **Juanita Drive** | | | |
| 4430.212 | 691.32 | 691.28 | 0.04 | 689.96 | 689.96 | 0 |
| 4346.582 | 691.31 | 691.27 | 0.04 | 689.95 | 689.95 | 0 |
| 4194.408 | 691.28 | 691.23 | 0.05 | 689.91 | 689.91 | 0 |
| 3788.373 | 691.23 | 691.19 | 0.04 | 689.85 | 689.85 | 0 |
| 3395.646 | 691.23 | 691.18 | 0.05 | 689.84 | 689.84 | 0 |
| 3331.113 | 691.22 | 691.17 | 0.05 | 689.84 | 689.83 | 0.01 |
| | | | **Private Drive** | | | |
| 3196.567 | 689.08 | 689.07 | 0.01 | 687.82 | 687.83 | -0.01 |
| 3141.921 | 689.06 | 689.06 | 0 | 687.78 | 687.79 | -0.01 |
| 3004.055 | 689.04 | 689.04 | 0 | 687.72 | 687.73 | -0.01 |
| 2734.719 | 688.97 | 688.97 | 0 | 687.57 | 687.58 | -0.01 |
| 2688.915 | 688.95 | 688.95 | 0 | 687.53 | 687.53 | 0 |
| | | | **Field Access Road** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2626.817 | 688.56 | 688.56 | 0 | 687.09 | 687.09 | 0 |
| 2582.291 | 688.55 | 688.55 | 0 | 687.07 | 687.07 | 0 |
| 2218.895 | 688.47 | 688.48 | -0.01 | 686.97 | 686.97 | 0 |
| 2049.666 | 688.47 | 688.47 | 0 | 686.96 | 686.96 | 0 |
| 1853.478 | 688.36 | 688.36 | 0 | 686.9 | 686.9 | 0 |
| 1799.666 | 688.34 | 688.34 | 0 | 686.89 | 686.89 | 0 |
| **Will Cook Road** | | | | | | |
| 1670.018 | 688.01 | 688.01 | 0 | 686.77 | 686.77 | 0 |
| 1606.765 | 688.03 | 688.03 | 0 | 686.78 | 686.78 | 0 |
| 1475.852 | 686.62 | 686.62 | 0 | 685.76 | 685.76 | 0 |
| 1134.554 | 685.87 | 685.87 | 0 | 685.24 | 685.24 | 0 |
| 792.3003 | 685.15 | 685.15 | 0 | 684.89 | 684.89 | 0 |
| 482.8005 | 684.74 | 684.74 | 0 | 684.71 | 684.71 | 0 |
| 35.46111 | 684.7 | 684.7 | 0 | 684.7 | 684.7 | 0 |