# SUPPLEMENT TO QUICK CHECK GUIDEBOOK EXAMPLE CASES 

ILLINOIS DEPARTMENT OF TRANSPORTATION<br>BUREAU OF BRIDGES AND STRUCTURES<br>hYDRAULICS UNIT

Prepared By:
2IM Group, LLC and Hanson Professional Service Inc.

DATE: December 2021
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043-0040 - IL 78 over Plum River - District 2 - 2-span Bridge 155 feet

Date: 09/07/2021
County: Jo Daviess
Route: IL-78
Watercourse: Plum River
ESN: 043-0040 Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 13.95 Sq. Mi. (8,928 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\quad \square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: | 923 | 1,680 | 2,270 | 3,080 | 3,720 | 4,380 | 5,077 | 6,050 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\quad \square$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: QC_IL78_PlumRiver_Mesh Generator Mesh
Mesh Type: $\boxtimes$ Paving $\square$ Patching
Vertices Spacing: Max: 50 ft .; Min: 50 ft .
Mesh Density (Elements/ Acre): $3434 / 85.48=40.17$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 5 Number of Monitor Points: 0

## Materials Coverage:

Manning's " $n$ " Value used: 0.060
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | $\boxtimes$ Inlet-Q | $\square$ Exit-H | Location: NE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | ®Exit-H | Location: NW |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): 0.0042 Source: $\boxtimes$ DEM $\square$ FIS Profile
Model Control:
Time Step (sec.): $5 \quad$ Simulations Length (hrs.): 12
Output Method: $\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 1.5
Results:
$\boxtimes$ Roadway Overtopping occurs between the 200Y \& 500Y
Ghere Ratio (Mesh Density/ Time of Convergence): $40.17 / 1.5=27$
Notes:

## IL 78 Plum River SMS Quick Check Model

## 10-Year Storm - Velocity/Elevation Results



## IL 78 Plum River SMS Quick Check Model

## 10-Year Storm - Velocity/Depth Results



## IL 78 Plum River SMS Quick Check Model

50-Year Storm - Velocity/Elevation Results


## IL 78 Plum River SMS Quick Check Model

## 50-Year Storm - Velocity/Depth Results



## IL 78 Plum River SMS Quick Check Model

## 100-Year Storm - Velocity/Elevation Results



## IL 78 Plum River SMS Quick Check Model

## 100-Year Storm - Velocity/Depth Results



## IL 78 Plum River SMS Quick Check Model

## 200-Year Storm - Velocity/Elevation Results



## IL 78 Plum River SMS Quick Check Model

## 200-Year Storm - Velocity/Depth Results



## IL 78 Plum River SMS Quick Check Model

## 500-Year Storm - Velocity/Elevation Results



## IL 78 Plum River SMS Quick Check Model

## 500-Year Storm - Velocity/Depth Results



094-2004 - US 34 over Cedar Creek - District 4 - Twin Steel Arch Culvert

Quick Check Model

Date：11／8／2021
County：Warren
Route：US 34
Watercourse：Cedar Creek
ESN：094－2004 Structure Type：$\square$ Bridge $\boxtimes$ Culvert
Drainage Area：33．4 Sq．Mi．（21，376 acres）
Hydrology Method（check all that apply）：
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC－HMS $\square$ TR－20 $\square$ Rational Method $\square$ Other：

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID：1 | 1,757 | 2,856 | 3,705 | 4,761 | 5,514 | 6,319 | 7,098 | 8,310 |  |
| BC ID： 2 | 237 | 385 | 499 | 641 | 743 | 851 | 956 | 1,119 |  |
| BC ID： 3 | 36 | 59 | 76 | 98 | 114 | 130 | 146 | 171 |  |
| BC ID： |  |  |  |  |  |  |  |  |  |

Source of Topography／Surface Data（check all that apply）：
$\boxtimes$ SMS $\quad \square$ LiDAR $\quad \square$ Bathymetry $\square$ Cross Sections $\quad \square$ Text File $\square$ LandXML
Mesh Generator Coverage：
Mesh Name：Mesh Generator Mesh
Mesh Type：$\boxtimes$ Paving $\square$ Patching
Vertices Spacing：Max： 50 ft ．；Min： 50 ft ．
Mesh Density（Elements／Acre）：10，601／261．1 $=40.6$
Monitor Lines \＆Points Coverage：
Number of Monitor Lines： 5 Number of Monitor Points： 0

## Materials Coverage：

Manning＇s＂n＂Value used： 0.060

## Boundary Conditions Coverage：

Number of BC Arcs： 4

| BC ID： 1 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：NE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID： 2 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：SE |
| BC ID： 3 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：S |
| BC ID： 4 | Type： | $\square$ Inlet－Q | $\boxtimes$ Exit－H | Location：W |
| BC ID： | Type： | $\square$ Inlet－Q | $\square$ Exit－H | Location： |

Exit－H Channel Calculator Normal Depth Slope（ft／ft）：Source：$\square$ DEM $\square$ FIS Profile
Model Control：
Time Step（sec．）： 1 Simulations Length（hrs．）： 4
Output Method：$\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence：
Time of Convergence at（hrs．）： 4

## Results：

$\boxtimes$ Roadway Overtopping occurs between the $5 \mathrm{Y} \& 10 \mathrm{Y}$
Ghere Ratio（Mesh Density／Time of Convergence）：40．6／4＝10
Notes：Four streamstats runs were completed，three at inflow locations and one at the system outfall．The flow at the outfall was used for the model flows but it was reduced at each of the inflow locations by the ratio of the streamstats area tributary to the inflow location over the overall streamstats area tributary to the system outfall．

US 34 Over Cedar Creek SMS Quick Check Model

## 10-Year Storm - Velocity/Elevation Results



US 34 Over Cedar Creek SMS Quick Check Model
10-Year Storm - Velocity/Depth Results


US 34 Over Cedar Creek SMS Quick Check Model
50-Year Storm - Velocity/Elevation Results


US 34 Over Cedar Creek SMS Quick Check Model
50-Year Storm - Velocity/Depth Results


US 34 Over Cedar Creek SMS Quick Check Model
100-Year Storm - Velocity/Elevation Results


US 34 Over Cedar Creek SMS Quick Check Model
100-Year Storm - Velocity/Depth Results


US 34 Over Cedar Creek SMS Quick Check Model
200-Year Storm - Velocity/Elevation Results


US 34 Over Cedar Creek SMS Quick Check Model
200-Year Storm - Velocity/Depth Results


US 34 Over Cedar Creek SMS Quick Check Model
500-Year Storm - Velocity/Elevation Results


US 34 Over Cedar Creek SMS Quick Check Model
500-Year Storm - Velocity/Depth Results


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094-2004 - US 34 over Cedar Creek - District 4 - Twin Steel Arch Culvert

Detailed Model

US-34 Over Cedar Creek SMS Detailed Model 10-Year Storm - Velocity/Elevation Results





US-34 Over Cedar Creek SMS Detailed Model 100-Year Storm - Velocity/Elevation Results


US-34 Over Cedar Creek SMS Detailed Model 100-Year Storm - Velocity/Depth Results


US-34 Over Cedar Creek SMS Detailed Model 200-Year Storm - Velocity/Elevation Results



US-34 Over Cedar Creek SMS Detailed Model 500-Year Storm - Velocity/Elevation Results



095-0009 - IL 15 over Nashville Creek - District 8 - Single Span Bridge 24 feet

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SMS Quick Check Model for IL Hwy 15 Over Nashville Creek Near Nashville

| TO: | Neil Vanbebber, IDOT <br> Rich Guise, IDOT <br>  <br> Nicholas Jack, IDOT |
| :--- | :--- |
| From: | 2IM Group, LLC.; Hanson Professional Services Inc. |
| SUBJECT: | SMS Quick Check Model for IL Hwy 15 Over Nashville Creek Near Nashville |
| DATE: | September 17th, 2021 |

## Introduction

This crossing is located in Washington County on IL Hwy 15. It is west of Nashville, IL within city limits. Nashville Creek flows from the south towards IL Hwy 15. S Willowbrook Dr runs parallel to Nashville Creek and crosses the creek 300-ft upstream of IL Hwy 15. A tributary joins Nashville Creek 300-ft upstream of IL Hwy 15 near the Willowbrook Dr crossing. Separate flows are entered in for Nashville Creek and the tributary. The IL Hwy 15 and Willowbrook Dr crossings are modelled as openings in the 2D mesh terrain. The IL Hwy 15 opening is approximately 40 '. The quick check summary table and exhibits are attached. The following paragraph contains a brief description of the site hydrology.

## Hydrology

The hydrology for this site was developed from Streamstats. Streamstats queries were made for both Nashville Creek and the tributary upstream of IL Hwy 15. The 10-year, 50-year, 100-year, and the 500year storm events urban discharges reported in the Streamstats report were applied to the model boundary at Nashville Creek and the tributary. The total flow at the bridge was distributed between both streams by the ratio of each tributary drainage area to that of the total drainage area at the structure. A 200-year discharge was interpolated from the Streamstats output. See the summary table on the following page for the flow rates used.

Date: 9/17/2021
County: Washington
Route: IL Hwy 15
Watercourse: Nashville Creek
ESN: 095-0009 $\quad$ Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 2.1 Sq. Mi. (1325 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 70 | 131 | 179 | 242 | 294 | 345 | 400 | 476 |  |
| BC ID: 2 | 338 | 634 | 871 | 1178 | 1426 | 1675 | 1940 | 2314 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\square$ SMS $\quad$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: QC_IL15_Existing Conditions_Mesh Generator Mesh
Mesh Type: $\quad$ Paving $\quad \square$ Patching
Vertices Spacing: Max: 10 ft .; Min: 10 ft .
Mesh Density (Elements/ Acre): 51424 / 50.9 = 1010.3
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 3 Number of Monitor Points: 1

## Materials Coverage:

Manning's "n" Value used: 0.060

## Boundary Conditions Coverage:

Number of BC Arcs:

| BC ID: 1 | Type: | 凹Inlet-Q | $\square$ Exit-H |
| :--- | :--- | :--- | :--- | Location: Tributary US (southwest)

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.002 \quad$ Source: $\quad \boxtimes$ DEM $\quad \square$ FIS Profile
Model Control:
Time Step (sec.): $5 \quad$ Simulations Length (hrs.): 12
Output Method: $\boxtimes$ Specified Frequency $\square$ Specified Times $\square$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 3
Results:
$\boxtimes$ Roadway Overtopping occurs between the $<10 \mathrm{Y}$ \& Y
Ghere Ratio (Mesh Density/ Time of Convergence): 1010.3 / 3 = 337
Notes: Recommended element density reduced from $50-\mathrm{ft}$ to $10-\mathrm{ft}$ to capture bridge embankment opening and channel.











099-0005 (SB) and 099-0286 (NB) - I-55 over Grant Creek - District 1 Dual Bridges SB 3-span 177 feet NB 5-span 665 feet

Date：9／17／2021
County：Will
Route：I－55
Watercourse：Grant Creek
ESN：099－0005
Drainage Area： 13.58 Sq．Mi．（8，691 acres）
Structure Type：$\boxtimes$ Bridge $\square$ Culvert

Hydrology Method（check all that apply）：

| $\square$ FIS $\triangle$ StreamStats |  | $\square$ HEC－HMS |  | $\square$ TR－20 $\square$ Rational MethodDischarges／Flows |  |  | $\square$ Other： |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| Analyzed | $\square$ | $\square$ | 区 | $\square$ | 区 | 区 | 区 | 区 | $\square$ |
| BC ID： 1 | 312 | 496 | 630 | 812 | 951 | 1，090 | 1，240 | 1，440 |  |
| BC ID： 2 | 62 | 94 | 117 | 146 | 169 | 190 | 208 | 230 |  |
| BC ID： |  |  |  |  |  |  |  |  |  |
| BC ID： |  |  |  |  |  |  |  |  |  |

Source of Topography／Surface Data（check all that apply）：
$\square$ SMS $\quad$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage：
Mesh Name：QC＿I55＿GrantCreek＿Mesh
Mesh Type：$\boxtimes$ Paving $\quad \square$ Patching
Vertices Spacing：Max： 50 ft ．；Min： 25 ft ．
Mesh Density（Elements／Acre）： 7967 ／ $175.96=45.28$
Monitor Lines \＆Points Coverage：
Number of Monitor Lines： 9 Number of Monitor Points： 0

## Materials Coverage：

Manning＇s＂n＂Value used： 0.06
Boundary Conditions Coverage：
Number of BC Arcs： 3

| BC ID： 1 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：SE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID： 2 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：NW |
| BC ID： 3 | Type： | $\square$ Inlet－Q | 区Exit－H | Location：W |
| BC ID： | Type： | $\square$ Inlet－Q | $\square$ Exit－H | Location： |
| BC ID： | Type： | $\square$ Inlet－Q | $\square$ Exit－H | Location： |

Exit－H Channel Calculator Normal Depth Slope（ft／ft）： $0.003 \quad$ Source：$\quad \boxtimes$ DEM $\square$ FIS Profile
Model Control：
Time Step（sec．）： $5 \quad$ Simulations Length（hrs．）： 12
Output Method：$\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence：
Time of Convergence at（hrs．）： 10

## Results：

$\square$ Roadway Overtopping occurs between the $>500 \mathrm{Y}$ \＆ Y
Ghere Ratio（Mesh Density／Time of Convergence）：45．28／ $10=4.5$
Notes：An additional inflow location is added downstream of the I－55 bridge and comes from the Frontage Road Pond．The inflow amount from this location was calculated by subtracting the Grant Creek flow upstream of the pond from the Grant Creek flow downstream of the pond．

I-55 over Grant Creek SMS Quick Check Model
10-Year Storm - Velocity/Elevation Results


I-55 over Grant Creek SMS Quick Check Model
10-Year Storm - Velocity/Depth Results


I-55 over Grant Creek SMS Quick Check Model
50-Year Storm - Velocity/Elevation Results


I-55 over Grant Creek SMS Quick Check Model
50-Year Storm - Velocity/Depth Results


I-55 over Grant Creek SMS Quick Check Model 100-Year Storm - Velocity/Elevation Results


I-55 over Grant Creek SMS Quick Check Model
100-Year Storm - Velocity/Depth Results


I-55 over Grant Creek SMS Quick Check Model 200-Year Storm - Velocity/Elevation Results


I-55 over Grant Creek SMS Quick Check Model
200-Year Storm - Velocity/Depth Results


I-55 over Grant Creek SMS Quick Check Model
500-Year Storm - Velocity/Elevation Results


I-55 over Grant Creek SMS Quick Check Model
500-Year Storm - Velocity/Depth Results

$001-0016$ - IL 57 over Harkness Creek - District 6 - Single Span Bridge 32 feet

Date: 11/10/2021
County: Adams
Route: IL 57
Watercourse: Harkness Creek
ESN: 001-0016 $\quad$ Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 2.36 Sq. Mi. (1510 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 421 | 794 | 1090 | 1500 | 1820 | 2170 | 2523 | 3030 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\square$ SMS $\boxtimes$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\quad \square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: QC_IL57_Harkness_Mesg
Mesh Type: $\boxtimes$ Paving $\square$ Patching
Vertices Spacing: Max: 28 ft ; Min: 28 ft .
Mesh Density (Elements/ Acre): 39,489 / 307.8 = 128.3
Monitor Lines \& Points Coverage:
Number of Monitor Lines: $4 \quad$ Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.06

## Boundary Conditions Coverage:

Number of BC Arcs: 2

| BC ID: 1 | Type: | $\boxtimes$ Inlet-Q | $\square$ Exit-H | Location: NE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | Exit-H | Location: W |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.007 \quad$ Source: $\quad \boxtimes$ DEM $\square$ FIS Profile
Model Control:
Time Step (sec.): 1 Simulations Length (hrs.): 4
Output Method: $\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 1.5

## Results:

$\boxtimes$ Roadway Overtopping occurs between the $0 \mathrm{Y} \& 10 \mathrm{Y}$
Ghere Ratio (Mesh Density/ Time of Convergence): $128.3 / 1.5=85.5$
Notes: Area to the west of IL 57 is within the floodplain of the Mississippi River. Ground is lower on either side of the channel and without the influence of flooding from the Mississippi, flow from Harkness Creek appears to spread out in a seemingly unnatural way, even for smaller storms.



IL 57 Over Harkness Creek SMS Quick Check Model
50-Year Storm - Velocity/Elevation Results









## IL 57 Over Harkness Creek SMS Quick Check Model

100-Year Storm - Simulation Plot


$012-0018$ - US 40 over North Fork Embarras River - District 7 - 3-span Bridge 240 feet

Date: 6/25/2021
County: Clark
Route: US 40
Watercourse: North Branch Embarras River
ESN: 012-0018
Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 88.2 Sq. Mi. (56,448 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\quad \square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 3,320 | 5,960 | 7,910 | 10,500 | 12,600 | 14,600 | 16,825 | 19,800 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\quad \square$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: Mesh Generator Mesh
Mesh Type: $\boxtimes$ Paving $\square$ Patching
Vertices Spacing: Max: 50 ft .; Min: 50 ft .
Mesh Density (Elements/ Acre): 37,321 / $923=40.43$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 6 Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.06
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | 凹Inlet-Q | $\square$ Exit-H | Location: N |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | ®Exit-H | Location: S |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): 0.0005 Source: $\boxtimes D E M \quad \square$ FIS Profile
Model Control:
Time Step (sec.): 1 Simulations Length (hrs.): 6
Output Method: $\boxtimes$ Specified Frequency $\square$ Specified Times $\square$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 4
Results:
$\boxtimes$ Roadway Overtopping occurs between the $>500 \mathrm{Y}$ \& Y
Ghere Ratio (Mesh Density/ Time of Convergence): 40.43/4=10
Notes:



US-40 Over the North Branch Embarras River SMS Quick Check Model 50-Year Storm - Velocity/Elevation Results


US-40 Over the North Branch Embarras River SMS Quick Check Model 50-Year Storm - Velocity/Depth Results


US-40 Over the North Branch Embarras River SMS Quick Check Model 100-Year Storm - Velocity/Elevation Results



US-40 Over the North Branch Embarras River SMS Quick Check Model 200-Year Storm - Velocity/Elevation Results


US-40 Over the North Branch Embarras River SMS Quick Check Model 200-Year Storm - Velocity/Depth Results


US-40 Over the North Branch Embarras River SMS Quick Check Model 500-Year Storm - Velocity/Elevation Results


US-40 Over the North Branch Embarras River SMS Quick Check Model 500-Year Storm - Velocity/Depth Results

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019-0030 - IL 72 over Owens Creek - District 3 - 3-span Bridge 164 feet

# IL Hwy 72 Over Owens Creek <br> SMS Quick Check Model 

SMS Quick Check Model for IL Hwy 72 Over Owens Creek Near Kirkland
\(\left.$$
\begin{array}{ll}\text { TO: } & \begin{array}{l}\text { Neil Vanbebber, IDOT } \\
\\
\text { Rich Guise, IDOT }\end{array}
$$ <br>

\& Nicholas Jack, IDOT\end{array}\right]\)| From: | 2IM Group, LLC.; Hanson Professional Services Inc. |
| :--- | :--- |
| SUBJECT: | SMS Quick Check Model for IL Hwy 72 Over Owens Creek Near Kirkland |
| DATE: | November 5 th, 2021 |

## Introduction

This crossing is located in DeKalb County on IL Hwy 72, west of Kirkland, IL. Owens Creek flows from the south towards IL Hwy 72. Quarry Rd runs perpendicular to Owens Creek and intersects with Hwy 72 250-ft from Owens Creek crossing. The IL Hwy 72 crossing is modelled as an opening in the 2D mesh terrain. The IL Hwy 72 opening is approximately 170 '. The quick check summary table and exhibits are attached. The following paragraph contains a brief description of the site hydrology.

## Hydrology

The hydrology for this site was developed from Streamstats. Streamstats queries were made for Owens Creek upstream of IL Hwy 15. The 10-year, 50 -year, 100 -year, and the 500 -year storm events urban discharges reported in the Streamstats report were applied to the model boundary at Owens Creek. A 200-year discharge was interpolated from the Streamstats output. See the summary table on the following page for the flow rates used.

Date: 11/5/2021
County: DeKalb
Route: IL 72
Watercourse: Owens Creek
ESN: 019-0030 Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 45.2 Sq. Mi. (28928 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS
$\square$ TR-20 $\square$ Rational Method $\square$ Other:

Discharges/ Flows

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 2 | 814 | 1300 | 1640 | 2080 | 2400 | 2710 | 3042 | 3450 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\square$ SMS $\boxtimes$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: QC_IL72_Existing Conditions_Mesh
Mesh Type: $\boxtimes$ Paving $\square$ Patching
Vertices Spacing: Max: 50 ft .; Min: 50 ft .
Mesh Density (Elements/ Acre): 4827 / $117=41.3$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: $2 \quad$ Number of Monitor Points: 2
Materials Coverage:
Manning's " $n$ " Value used: 0.060
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 2 | Type: | 凹Inlet-Q | $\square$ Exit-H | Location: South (Upstream) |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 1 | Type: | $\square$ Inlet-Q | $\boxtimes$ Exit-H | Location: North (Downstream) |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.002 \quad$ Source: $\triangle$ DEM $\square$ FIS Profile

Model Control:
Time Step (sec.): 5 Simulations Length (hrs.): 12
Output Method: $\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 5
Results:
$\boxtimes$ Roadway Overtopping occurs between the $>500 \mathrm{Y} \& \quad \mathrm{Y}$
Ghere Ratio (Mesh Density/ Time of Convergence): $41.3 / 5=8.3$ Elements/Hour
Notes: Roadway overtops at an event greater than the 500 year flood.




## 50-Year Storm - Velocity/Depth Results









IL-72 Over Owens Creek SMS Quick Check Model

## 100-Year Storm - Simulation Plot




037-0107 (EB) and 037-0108 (WB) - I-80 over Mineral Creek - District 2 - 3-span Dual Bridges 151 feet

Date: 09/01/2021
County: Henry
Route: I-80
Watercourse: Mineral Creek
ESN: 037-0107, 037-0108
Structure Type: $\boxtimes$ BridgeCulvert
Drainage Area: 19.17 Sq. Mi. (12,269 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\quad \square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 1080 | 1880 | 2470 | 3260 | 3850 | 4490 | 5141 | 6000 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\quad \square$ LiDAR $\square$ Bathymetry $\square$ Cross SectionsText FileLandXML

Mesh Generator Coverage:
Mesh Name: QC_I-80_MineralCreek_Existing Conditions
Mesh Type: $\boxtimes$ Paving $\quad \square$ Patching
Vertices Spacing: Max: 50 ft ; Min: 50 ft .
Mesh Density (Elements/ Acre): 10,358 / 256.37 $=40.40$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 5 Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.06
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | $\boxtimes$ Inlet-Q | $\square$ Exit-H | Location: SE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | 区Exit-H | Location: NW |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.001 \quad$ Source: $\boxtimes D E M \quad \square$ FIS Profile
Model Control:
Time Step (sec.): 10 Simulations Length (hrs.): 12
Output Method: $\boxtimes$ Specified Frequency $\square$ Specified Times $\square$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 4
Results:
$\square$ Roadway Overtopping occurs between the N/A Y \& N/A Y
Ghere Ratio (Mesh Density/ Time of Convergence): $40.40 / 4=10.1$
Notes:

I-80 Over Mineral Creek SMS Quick Check Model
10-Year Storm - Velocity/Depth Results


I-80 Over Mineral Creek SMS Quick Check Model
10-Year Storm - Velocity/Elevation Results


I-80 Over Mineral Creek SMS Quick Check Model
50-Year Storm - Velocity/Depth Results


I-80 Over Mineral Creek SMS Quick Check Model
50-Year Storm - Velocity/Elevation Results


I-80 Over Mineral Creek SMS Quick Check Model

## 100-Year Storm - Velocity/Depth Results



I-80 Over Mineral Creek SMS Quick Check Model

## 100-Year Storm - Velocity/Elevation Results



I-80 Over Mineral Creek SMS Quick Check Model

## 200-Year Storm - Velocity/Depth Results



I-80 Over Mineral Creek SMS Quick Check Model
200-Year Storm - Velocity/Elevation Results


I-80 Over Mineral Creek SMS Quick Check Model
500-Year Storm - Velocity/Depth Results


I-80 Over Mineral Creek SMS Quick Check Model
500-Year Storm - Velocity/Elevation Results


038-0017 - IL 1 over Little Beaver Creek - District 3 - 2-span Bridge 63 feet

Date: 09/09/2021
County: Iroquois
Route: IL 1
Watercourse: Little Beaver Creek
ESN: 038-0017 $\quad$ Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 57.86 Sq. Mi. (37,030 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\quad \square$ HEC-HMS $\quad \square$ TR-20 $\quad \square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 795 | 1390 | 1820 | 2380 | 2810 | 3250 | 3706 | 4310 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\square$ SMS $\boxtimes$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: QC_IL1_LittleBeaverCreek_Mesh
Mesh Type: $\triangle$ Paving $\quad \square$ Patching
Vertices Spacing: Max: 50 ft .; Min: 10 ft .
Mesh Density (Elements/ Acre): 11,499 / 207 = 55.55
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 5 Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.06
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | 凹Inlet-Q | $\square$ Exit-H | Location: NE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | 区Exit-H | Location: SW |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.001013 \quad$ Source: $\boxtimes D E M \quad \square$ FIS Profile
Model Control:
Time Step (sec.): 10 Simulations Length (hrs.): 12
Output Method: $\boxtimes$ Specified Frequency $\square$ Specified Times $\square$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 4
Results:
$\boxtimes$ Roadway Overtopping occurs between the $0 \mathrm{Y} \& 10 \mathrm{Y}$
Ghere Ratio (Mesh Density/ Time of Convergence): 55.55 / 4 = 13.89
Notes:
Smaller vertice spacing was used through the 40 ' bridge opening because one element in the
opening is not sufficient for accurate results

IL 1 Over Little Beaver Creek SMS Quick Check Model

## 10-Year Storm - Velocity/Depth Results



IL 1 Over Little Beaver Creek SMS Quick Check Model

## 10-Year Storm - Velocity/Elevation Results



IL 1 Over Little Beaver Creek SMS Quick Check Model

## 50-Year Storm - Velocity/Depth Results



IL 1 Over Little Beaver Creek SMS Quick Check Model

## 50-Year Storm - Velocity/Elevation Results



IL 1 Over Little Beaver Creek SMS Quick Check Model 100-Year Storm - Velocity/Depth Results


IL 1 Over Little Beaver Creek SMS Quick Check Model

## 100-Year Storm - Velocity/Elevation Results



IL 1 Over Little Beaver Creek SMS Quick Check Model
200-Year Storm - Velocity/Depth Results


IL 1 Over Little Beaver Creek SMS Quick Check Model
200-Year Storm - Velocity/Elevation Results


## IL 1 Over Little Beaver Creek SMS Quick Check Model

## 500-Year Storm - Velocity/Depth Results



IL 1 Over Little Beaver Creek SMS Quick Check Model

## 500-Year Storm - Velocity/Elevation Results



050-0048 - IL 23 over Tributary to Covel Creek - District 3 - 3-span
Bridge 102 feet

Date: 9/17/2021
County: LaSalle
Route: IL 23
Watercourse: Tributary to Covel Creek
ESN: 050-0048
Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 8.68 Sq. Mi. (5,555 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 375 | 685 | 918 | 1,230 | 1,470 | 1,720 | 1,974 | 2,320 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\square$ SMS $\quad$ LiDAR $\square$ Bathymetry $\square$ Cross SectionsText FileLandXML

Mesh Generator Coverage:
Mesh Name: QC_IL23_TribToCovelCreek_Mesh
Mesh Type: $\triangle$ Paving $\quad \square$ Patching
Vertices Spacing: Max: 50 ft ; Min: 25 ft .
Mesh Density (Elements/ Acre): 16,966 / 5,555 = 3.1
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 4 Number of Monitor Points: 0
Materials Coverage:
Manning's "n" Value used: 0.06
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | $\boxtimes$ Inlet-Q | $\square$ Exit-H | Location: W |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | $\boxtimes$ Exit-H | Location: E |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.003 \quad$ Source: $\quad \boxtimes$ DEM $\square$ FIS Profile
Model Control:
Time Step (sec.): $1 \quad$ Simulations Length (hrs.): 7
Output Method: $\square$ Specified FrequencySpecified Times $\boxtimes$ Simulation EndUnsteady Output

Model Convergence:
Time of Convergence at (hrs.): 7

## Results:

$\square$ Roadway Overtopping occurs between the $>500 \mathrm{Y} \& \quad \mathrm{Y}$
Ghere Ratio (Mesh Density/ Time of Convergence): $3.1 / 7=0.44$
Notes:



IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 50-Year Storm - VelocityIElevation Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 50-Year Storm - Velocity/Depth Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 100-Year Storm - Velocity/Elevation Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 100-Year Storm - Velocity/Depth Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 200-Year Storm - Velocity/Elevation Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 200-Year Storm - Velocity/Depth Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 500-Year Storm - Velocity/Elevation Results


IL-23 Over the Tributary to Covel Creek SMS Quick Check Model 500-Year Storm - Velocity/Depth Results


069-0023 - IL 111 over Apple Creek - District 6 - Single Span Bridge 55 feet

Date：11／12／2021
County：Morgan
Route：IL－111
Watercourse：Apple Creek
ESN：069－0023 $\quad$ Structure Type：$\boxtimes$ Bridge $\square$ Culvert
Drainage Area：8．97 Sq．Mi．（5，741 acres）
Hydrology Method（check all that apply）：
$\square$ FIS $\boxtimes$ StreamStats $\quad \square$ HEC－HMS $\quad \square$ TR－20 $\quad \square$ Rational Method $\square$ Other：

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID： 1 |  |  | 1490 |  | 2370 | 2770 | 3180 | 3730 |  |
| BC ID： 2 |  |  | 30 |  | 50 | 50 | 59 | 70 |  |
| BC ID： 3 |  |  | 250 |  | 427 | 510 | 596 | 718 |  |
| BC ID： |  |  |  |  |  |  |  |  |  |

Source of Topography／Surface Data（check all that apply）：
$\square$ SMS $\boxtimes$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage：
Mesh Name：QC＿IL111＿AppleCreek＿Mesh
Mesh Type：$\quad \boxtimes$ Paving $\quad \square$ Patching
Vertices Spacing：Max： 50 ft ；Min： 25 ft ．
Mesh Density（Elements／Acre）： $5038 / 107.6=46.8$
Monitor Lines \＆Points Coverage：
Number of Monitor Lines： 6 Number of Monitor Points： 0

## Materials Coverage：

Manning＇s＂n＂Value used： 0.06
Boundary Conditions Coverage：
Number of BC Arcs： 3

| BC ID： 1 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：E |
| :--- | :--- | :--- | :--- | :--- |
| BC ID： 2 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：SE |
| BC ID： 3 | Type： | 凹Inlet－Q | $\square$ Exit－H | Location：S |
| BC ID： 4 | Type： | $\square$ Inlet－Q | Exit－H | Location：W |
| BC ID： | Type： | $\square$ Inlet－Q | $\square$ Exit－H | Location： |

Exit－H Channel Calculator Normal Depth Slope（ft／ft）： $0.002 \quad$ Source：$\triangle$ DEM $\square$ FIS Profile
Model Control：
Time Step（sec．）： 5 Simulations Length（hrs．）： 5
Output Method：$\boxtimes$ Specified FrequencySpecified Times $\square$ Simulation End $\qquad$ Unsteady Output

Model Convergence：
Time of Convergence at（hrs．）： 2

## Results：

$\boxtimes$ Roadway Overtopping occurs between the $0 \mathrm{Y} \& 10 \mathrm{Y}$
Ghere Ratio（Mesh Density／Time of Convergence）： $46.8 / 2=23.4$
Notes：Two tributaries bringing flow from south．Downstream tributary added to analyze impact on bridge backwater．Smaller vertice spacing used in bridge opening because only 1 element fits with 50 ft spacing．

IL 111 over Apple Creek SMS Quick Check Model 10-Year Storm - Velocity/Depth Results


IL 111 over Apple Creek SMS Quick Check Model 10-Year Storm - Velocity/Elevation Results


IL 111 over Apple Creek SMS Quick Check Model 50-Year Storm - Velocity/Depth Results


IL 111 over Apple Creek SMS Quick Check Model 50-Year Storm - Velocity/Elevation Results




IL 111 over Apple Creek SMS Quick Check Model 200-Year Storm - Velocity/Depth Results




IL 111 over Apple Creek SMS Quick Check Model 500-Year Storm - Velocity/Elevation Results



Monitor Line Plot - 10yr Event


Net Q Plot - 10yr Event




Monitor Plot - 50yr Event



Wet Elements Plot - 50yr Event



Monitor Plot - 100yr Event



Wet Elements Plot - 100yr Event



Monitor Plot - 200yr Event


Net Q Plot - 200yr Event


Wet Elements Plot - 200yr Event





Wet Elements Plot - 500yr Event


070-0002 - IL 121 over West Okaw River - District 7 - 6-span Bridge 461 feet

Date: 7/9/2021
County: Moultrie
Route: IL 121
Watercourse: West Okaw River
ESN: 070-0002 $\quad$ Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 168.7 Sq. Mi. (107,968 acres)
Hydrology Method (check all that apply):
$\square$ FIS $\boxtimes$ StreamStats $\square$ HEC-HMS $\quad \square$ TR-20 $\square$ Rational Method $\square$ Other:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 | 2,280 | 3,920 | 5,090 | 6,610 | 7,770 | 8,920 | 8,920 | 11,600 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\quad \square$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: Mesh Generator Mesh
Mesh Type: $\boxtimes$ Paving $\square$ Patching
Vertices Spacing: Max: 50 ft ; Min: 50 ft .
Mesh Density (Elements/ Acre): 9,879 / $242.67=40.71$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 5 Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.060
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | 凹Inlet-Q | $\square$ Exit-H | Location: N |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | ®Exit-H | Location: S |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.00007 \quad$ Source: $\boxtimes D E M \quad \square$ FIS Profile
Model Control:
Time Step (sec.): 1 Simulations Length (hrs.): 6
Output Method: $\boxtimes$ Specified Frequency $\square$ Specified Times $\square$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 3
Results:
$\boxtimes$ Roadway Overtopping occurs between the $>500 \mathrm{Y} \& \quad \mathrm{Y}$
Ghere Ratio (Mesh Density/ Time of Convergence): $40.71 / 3=14$
Notes:



IL-121 Over the West Okaw River SMS Quick Check Model 50-Year Storm - Velocity/Elevation Results


IL-121 Over the West Okaw River SMS Quick Check Model 50-Year Storm - Velocity/Depth Results


IL-121 Over the West Okaw River SMS Quick Check Model 100-Year Storm - Velocity/Elevation Results



IL-121 Over the West Okaw River SMS Quick Check Model 200-Year Storm - Velocity/Elevation Results



IL-121 Over the West Okaw River SMS Quick Check Model 500-Year Storm - Velocity/Elevation Results


IL-121 Over the West Okaw River SMS Quick Check Model 500-Year Storm - Velocity/Depth Results


081-0047 - 27 th Street over Rock River - District 2 - 9-span Bridge 919 feet - FIS Hydrology

# 27 ${ }^{\text {th }}$ Street Over Rock River <br> SMS Quick Check Model 

| TO: | Neil Vanbebber, IDOT <br> Rich Guise, IDOT <br> Nicholas Jack, IDOT |
| :--- | :--- |
| From: | 2IM Group, LLC.; Hanson Professional Services Inc. |
| SUBJECT: | SMS Quick Check Model for $27^{\text {th }}$ Street Over Rock River |
| DATE: | September $9^{\text {th }}, \mathbf{2 0 2 1}$ |

## Introduction

This crossing is located in Rock Island County on $27^{\text {th }}$ Street. It is 4.4 miles west of the Henry County line. Rock River flows from the east towards $27^{\text {th }}$ Street. The US 6 bridge crosses Rock River 1,100-ft upstream of $27^{\text {th }}$ Street. Both the $27^{\text {th }}$ Street and US 6 crossings are modelled as an opening in the 2D mesh. The $27^{\text {th }}$ Street opening is approximately 900 '. The quick check summary table and exhibits are attached. The following paragraph contains a brief description of the site hydrology.

## Hydrology

The hydrology for this site was developed from the FIS report for Rock Island County. The location of the flows reported in the FIS report is just downstream of US 6. The 10-year, 50-year, 100-year, and the 500-year storm events were taken from the FIS report and applied to the model boundary. A 200year discharge was interpolated from the Streamstats output. See the summary table on the following page for the flow rates used.

Date: 9/9/2021
County: Rock Island
Route: $27^{\text {th }}$ Street
Watercourse: Rock River
ESN: 081-0047 $\quad$ Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 10821 Sq. Mi. (6925440 acres)
Hydrology Method (check all that apply): $\boxtimes$ FIS $\quad \square$ StreamStats $\square$ HEC-HMS$\square$ TR-20Rational MethodOther:

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 |  |  | 43000 |  | 65000 | 76000 | 90000 | 108000 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\square$ LiDAR $\square$ Bathymetry $\square$ Cross SectionsText File $\qquad$
Mesh Generator Coverage:
Mesh Name: Mesh
Mesh Type: $\quad \boxtimes$ PavingPatching
Vertices Spacing: Max: 75 ft .; Min: 50 ft .
Mesh Density (Elements/ Acre): $165002 / 7809=21.1$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 5 Number of Monitor Points: 5

## Materials Coverage:

Manning's "n" Value used: 0.060
Boundary Conditions Coverage:
Number of BC Arcs:

| BC ID: 1 | Type: | 凹Inlet-Q | $\square$ Exit-H | Location: East |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | $\boxtimes$ Exit-H | Location: West |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.0001 \quad$ Source: $\square$ DEM $\boxtimes$ FIS Profile
Model Control:
Time Step (sec.): 1 Simulations Length (hrs.): 40
Output Method: $\boxtimes$ Specified Frequency $\square$ Specified Times $\square$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 27
Results:
$\boxtimes$ Roadway Overtopping occurs between the Y \& 10Y
Ghere Ratio (Mesh Density/ Time of Convergence): 21.1/27=1
Notes: The approach road is overtopped by a storm smaller than a $10 \%$ chance, while the bridge is still not overtopped by the $0.2-\%$ chance storm. However, water surface elevations may be significantly lower than predicted by this model due to the missing channel bed.

27th Street Over Rock River SMS Quick Check Model
10-yr Velocity/Elevation Results


27th Street Over Rock River SMS Quick Check Model
10-yr Velocity/Depth Results


27th Street Over Rock River SMS Quick Check Model
50-yr Velocity/Elevation Results


27th Street Over Rock River SMS Quick Check Model
50-yr Velocity/Depth Results


27th Street Over Rock River SMS Quick Check Model
100-yr Velocity/Elevation Results


27th Street Over Rock River SMS Quick Check Model
100-yr Velocity/Depth Results


27th Street Over Rock River SMS Quick Check Model
200-yr Velocity/Elevation Results


27th Street Over Rock River SMS Quick Check Model
200-yr Velocity/Depth Results


27th Street Over Rock River SMS Quick Check Model
500-yr Velocity/Elevation Results


27th Street Over Rock River SMS Quick Check Model
500-yr Velocity/Depth Results


099-0008 (SB) and 099-0009 (NB) - I-55 over Des Plaines River - District 1-7-span Dual Bridges 1,406 feet - FIS Hydrology

Date: 9/17/2021
County: Will
Route: I-55
Watercourse: DesPlaines River
ESN: 099-0005 $\quad$ Structure Type: $\boxtimes$ Bridge $\square$ Culvert
Drainage Area: 13.58 Sq. Mi. (8,691 acres)
Hydrology Method (check all that apply): $\boxtimes$ FIS $\quad \square$ StreamStats $\square$ HEC-HMS $\square$ TR-20 $\quad \square$ Rational Method $\square$ Other: Discharges/ Flows

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: 1 |  |  | 21000 |  | 27000 | 30000 | 32800 | 36000 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\quad \square$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: QC_I55_DesPlainesRiver_Mesh
Mesh Type: $\triangle$ Paving $\quad \square$ Patching
Vertices Spacing: Max: 50 ft ; Min: 25 ft .
Mesh Density (Elements/ Acre): 34626 / $8691=3.98$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 3 Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.06
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | 凹Inlet-Q | $\square$ Exit-H | Location: NE |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | ®Exit-H | Location: SW |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.00005 \quad$ Source: $\boxtimes D E M \quad \square$ FIS Profile
Model Control:
Time Step (sec.): $5 \quad$ Simulations Length (hrs.): 12
Output Method: $\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 10
Results:
$\square$ Roadway Overtopping occurs between the $>500 \mathrm{Y} \& \quad \mathrm{Y}$
Ghere Ratio (Mesh Density/ Time of Convergence): 3.98/10=0.40
Notes:

I-55 over Des Plaines River SMS Quick Check Model 10-Year Storm - Velocity/Elevation Results


I-55 over Des Plaines River SMS Quick Check Model
10-Year Storm - Velocity/Depth Results


I-55 over Des Plaines River SMS Quick Check Model 50-Year Storm - Velocity/Elevation Results


I-55 over Des Plaines River SMS Quick Check Model
50-Year Storm - Velocity/Depth Results


I-55 over Des Plaines River SMS Quick Check Model 100-Year Storm - Velocity/Elevation Results


I-55 over Des Plaines River SMS Quick Check Model 100-Year Storm - Velocity/Depth Results


I-55 over Des Plaines River SMS Quick Check Model
200-Year Storm - Velocity/Elevation Results


I-55 over Des Plaines River SMS Quick Check Model
200-Year Storm - Velocity/Depth Results


I-55 over Des Plaines River SMS Quick Check Model 500-Year Storm - Velocity/Elevation Results


I-55 over Des Plaines River SMS Quick Check Model 500-Year Storm - Velocity/Depth Results


099-0001 (NB) and 099-0002 (SB) - I-55 over Kankakee River - District 1 - 12-span Dual Bridges 1,000 feet - FIS Hydrology

Date: 7/9/2021
County: Will
Route: I-55
Watercourse: Kankakee River
ESN: 099-0001, 099-0002
Structure Type: $\boxtimes$ BridgeCulvert
Drainage Area: 5,150 Sq. Mi. (3,296,000 acres)
Hydrology Method (check all that apply):
$\boxtimes$ FIS $\quad \square$ StreamStats $\quad \square$ HEC-HMS $\quad \square$ TR-20 $\square$ Rational Method $\square$ Other:

Discharges/ Flows

| Y | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Analyzed | $\square$ | $\square$ | $\boxtimes$ | $\square$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\boxtimes$ | $\square$ |
| BC ID: | 29,840 | 39,999 | 42,500 | 57,845 | 71,000 | 78,000 | 80,902 | 86,000 |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |
| BC ID: |  |  |  |  |  |  |  |  |  |

Source of Topography/ Surface Data (check all that apply):
$\boxtimes$ SMS $\square$ LiDAR $\square$ Bathymetry $\square$ Cross Sections $\square$ Text File $\square$ LandXML
Mesh Generator Coverage:
Mesh Name: 50_ft_Paving
Mesh Type: $\triangle$ Paving $\quad \square$ Patching
Vertices Spacing: Max: 50 ft ; Min: 50 ft .
Mesh Density (Elements/ Acre): 62,496 / $1557=40.1$
Monitor Lines \& Points Coverage:
Number of Monitor Lines: 4 Number of Monitor Points: 0

## Materials Coverage:

Manning's "n" Value used: 0.06
Boundary Conditions Coverage:
Number of BC Arcs: 2

| BC ID: 1 | Type: | $\boxtimes$ Inlet-Q | $\square$ Exit-H | Location: S |
| :--- | :--- | :--- | :--- | :--- |
| BC ID: 2 | Type: | $\square$ Inlet-Q | $\boxtimes$ Exit-H | Location: NW |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |
| BC ID: | Type: | $\square$ Inlet-Q | $\square$ Exit-H | Location: |

Exit-H Channel Calculator Normal Depth Slope (ft/ft): $0.000513 \quad$ Source: $\square$ DEM $\boxtimes$ FIS Profile
Model Control:
Time Step (sec.): $5 \quad$ Simulations Length (hrs.): 8
Output Method: $\square$ Specified Frequency $\square$ Specified Times $\boxtimes$ Simulation End $\square$ Unsteady Output
Model Convergence:
Time of Convergence at (hrs.): 3
Results:
$\square$ Roadway Overtopping occurs between the Y\& Y
Ghere Ratio (Mesh Density/ Time of Convergence): 40.1/3=13
Notes:
No overtopping occurs. A small area within the mesh boundary overlaps with the Des Plaines River floodplain. The model is showing higher stages than FIS due to $n$ value assumptions and lack of channel bathymetry.

I-55 Over The Kankakee River SMS Quick Check Model
10-Year Storm - Velocity/Elevation Results


I-55 Over The Kankakee River SMS Quick Check Model
10-Year Storm - Velocity/Depth Results


I-55 Over The Kankakee River SMS Quick Check Model
50-Year Storm - Velocity/Elevation Results


I-55 Over The Kankakee River SMS Quick Check Model
50-Year Storm - Velocity/Depth Results


I-55 Over The Kankakee River SMS Quick Check Model
100-Year Storm - Velocity/Elevation Results


I-55 Over The Kankakee River SMS Quick Check Model
100-Year Storm - Velocity/Depth Results


I-55 Over The Kankakee River SMS Quick Check Model
200-Year Storm - Velocity/Elevation Results


I-55 Over The Kankakee River SMS Quick Check Model
200-Year Storm - Velocity/Depth Results


I-55 Over The Kankakee River SMS Quick Check Model
500-Year Storm - Velocity/Elevation Results


I-55 Over The Kankakee River SMS Quick Check Model
500-Year Storm - Velocity/Depth Results


